UNIVERSITY OF CAMBRIDGE
Faculty of Economics

Cambridge Working Papers in Economics

Cambridge Working Papers in Economics: 1905

OWNERSHIP UNBUNDLING OF ELECTRICITY DISTRIBUTION NETWORKS

Paul Nillesen Michael G. Pollitt

19 January 2018

Traditional restructuring of power markets has focused on legally separating monopolistic transmission and distribution infrastructure, with sufficient regulatory oversight to ensure non-discriminatory access to networks, and transparent and cost-reflective tariffs. There is consensus that ownership separation for transmission assets is beneficial for competition and transparency. However, at the distribution level the benefits are questionable. This paper reviews the theoretical arguments for ownership unbundling and summarises the findings from 23 academic papers and consulting reports. In addition, this paper empirically demonstrates that forced distribution ownership unbundling in New Zealand (from 1998) and the Netherlands (from 2009) did not increase retail competition (and reduced it in New Zealand), did not increase network quality, but did result in significant one-off and structural costs. The pros and cons of DSO ownership unbundling is topical given current policy discussions in Denmark and the more general changes to the operating environment of DSOs with increasingly active networks due to decentralised renewables production and bi-directional power flows. Policymakers should therefore consider alternative policy measures to increase retail competition and network quality.

UNIVERSITY OF CAMBRIDGE | Energy Policy Research Group

Ownership Unbundling of Electricity Distribution Networks

EPRG Working Paper 1905

Cambridge Working Paper in Economics 1905

Paul Nillesen

Michael G. Pollitt

Abstract

Traditional restructuring of power markets has focused on legally separating monopolistic transmission and distribution infrastructure, with sufficient regulatory oversight to ensure non-discriminatory access to networks, and transparent and cost-reflective tariffs. There is consensus that ownership separation for transmission assets is beneficial for competition and transparency. However, at the distribution level the benefits are questionable. This paper reviews the theoretical arguments for ownership unbundling and summarises the findings from 23 academic papers and consulting reports. In addition, this paper empirically demonstrates that forced distribution ownership unbundling in New Zealand (from 1998) and the Netherlands (from 2009) did not increase retail competition (and reduced it in New Zealand), did not increase network quality, but did result in significant one-off and structural costs. The pros and cons of DSO ownership unbundling is topical given current policy discussions in Denmark and the more general changes to the operating environment of DSOs with increasingly active networks due to decentralised renewables production and bi-directional power flows. Policymakers should therefore consider alternative policy measures to increase retail competition and network quality.

Keywords electricity distribution, ownership unbundling
JEL Classification L94

Contact paul.nillesen@pwc.com
Publication January 2019
Financial Support Dansk Energi

OWNERSHIP UNBUNDLING OF ELECTRICITY DISTRIBUTION NETWORKS

Dr. Paul Nillesen
Partner
Strategy& (part of PwC)[1]

&

Dr. Michael Pollitt
Professor of Business Economics
Energy Policy Research Group,
Judge Business School
University of Cambridge

Abstract

Traditional restructuring of power markets has focused on legally separating monopolistic transmission and distribution infrastructure, with sufficient regulatory oversight to ensure non-discriminatory access to networks, and transparent and cost-reflective tariffs. There is consensus that ownership separation for transmission assets is beneficial for competition and transparency. However, at the distribution level the benefits are questionable. This paper reviews the theoretical arguments for ownership unbundling and summarises the findings from 23 academic papers and consulting reports. In addition, this paper empirically demonstrates that forced distribution ownership unbundling in New Zealand (from 1998) and the Netherlands (from 2009) did not increase retail competition (and reduced it in New Zealand), did not increase network quality, but did result in significant one-off and structural costs. The pros and cons of DSO ownership unbundling is topical given current policy discussions in Denmark and the more general changes to the operating environment of DSOs with increasingly active networks due to decentralised renewables production and bi-directional power flows. Policymakers should therefore consider alternative policy measures to increase retail competition and network quality.

Keywords: electricity distribution, ownership unbundling
JEL classification: L94

Introduction and Background

[1] Corresponding author. Authors are grateful for valuable input from colleagues at Dansk Energi, PwC, Cambridge University. Authors are further grateful for excellent research support by Dr. Jun Hoo, Jos Borger and Mark Jonker. Any remaining errors or omissions are the responsibility of the authors. The views expressed here are those of the authors and do not necessarily reflect the views of PricewaterhouseCoopers Advisory N.V., any of the PricewaterhouseCoopers network of firms or any other individual with which they are associated.

In the past 30 years electricity markets around the world have been radically transformed. We can observe, *inter alia*, the following: markets opened, competitors emerged, businesses rationalized, incumbents combined, technologies advanced and customers experimented on. Power utilities have evolved into a dramatically divergent industry from their long-dated legacy as integrated monopoly utilities. Many of the changes have been initiated by significant institutional reforms, such as horizontal and vertical unbundling of integrated utilities, the introduction of independent incentive regulation, and the privatisation of publicly owned electricity assets. At the same time the way power is produced and consumed is changing, with increasing amounts of decentralised and distributed intermittent renewable sources. Traditionally passive uni-directional distribution networks are becoming increasingly active with bi-directional power flows.

Separating electricity distribution and transmission networks – considered to be the remaining natural monopolies – from those activities now considered to be competitive, such as generation, trading, and supply, has been a key component of these reforms.

The most common form of separation – in OECD countries - has been to create legally separate entities – within the original utility – that own and operate the networks with an external and independent regulator that ensures grid access is non-discriminatory, transparent, and tariffs are cost-reflective (see Kufeoglu et al., 2018). The more extreme form of separation is to require ownership unbundling and to prohibit the networks to be (majority) owned by players with competitive power market activities.

There is an emerging consensus that mandating ownership separation is preferable at the transmission level – either of both assets and operation (Transmission System Operators, TSO), or at least the operation of the assets (Independent System Operators, ISO) (see Chawla and Pollitt, 2013). The World Bank recommends that the system operator is independent and does not have financial interests in market participants and *vice versa*[2]. The European Commission states that transmission ownership separation is the preferred option[3]. FERC (US federal regulator) implemented open access to transmission facilities in 1996. In 1999 FERC encouraged the formation of Regional Transmission Operators (RTOs) that serve as regional system operators with Order 2000[4].

[2] World Bank (2002).

[3] European Commission (2009), *Third Energy Package*. The Third Energy Package includes rules on the unbundling of transmission system operators from energy suppliers and producers in order to ensure non-discriminatory access of all suppliers and producers to electricity and gas transmission networks.

[4] FERC Order No. 2000 requires that each public utility that owns, operates, or controls facilities for the transmission of electric energy in interstate commerce make certain filings with respect to forming and participating in a Regional Transmission Organization (RTO). Order No. 2000 also codifies minimum characteristics and functions that a transmission entity must satisfy to be considered an RTO.

At the distribution level, there has been a debate on the costs and benefits of ownership separation. Although there are several examples of voluntary ownership separation of distribution networks (e.g. Western Power Distribution, UK Power Networks and Northern Powergrid in the UK), there have only been two countries to have forced this in their markets. New Zealand introduced distribution network ownership unbundling in 1998 and the Netherlands in 2009. In both of these electricity markets the aim was to improve competition, increase quality, and reduce costs by increasing efficiency.

The discussion over the advantages and disadvantages of mandated ownership separation of distribution networks is topical given the changes to the role of distribution networks in the energy transition. According to a recent survey, 72 percent of European distribution executives think that their companies will become more service-focused than asset-oriented. They see their future role as data hubs to facilitate market access[5]. The emergence of "platforms", where distribution networks play a central role connecting and facilitating supply and demand, will require a different regulatory perspective on the DSO (Pollitt, 2008). In Denmark the government is considering ownership unbundling of DSOs and is currently examining its potential effects on retail competition (Danish Energy Agency, 2014)[6]. The sheer size of this part of the value chain and the number of companies involved, warrants a closer look at the pros and cons of forced ownership unbundling. Recent analysis shows there are approximately 7600 distribution system operators in 175 countries, but that only 41 of those countries have a legally separated the distribution company[7].

Ownership unbundling of the distribution network is a complicated and challenging process – especially when imposed (i.e. forced) simultaneously on all market players. Three aspects need to be taken into account: (i) the transaction costs of unbundling (e.g. direct or contract renegotiation costs), (ii) the dynamic efficiency effect on costs and quality (e.g. loss of vertical economies versus gain in management focus), and (iii) the effect on the degree of concentration in competitive segments (i.e. the reduction in the number of competitors versus the breaking up of incumbency).

Therefore, the question is whether ownership unbundling at distribution level is the right next step for those countries that have already legally separated their distribution networks. For those countries that have not yet legally separated their distribution networks, the question is whether forced ownership separation should be considered as opposed to legal separation.

---

[5] Vlerick Business School (2016).

[6] Danish Energy Agency (2014), pages 74-75: "*An analysis of disadvantages and benefits associated with ownership unbundling compared to current regulation should be prepared in good time before the next licence period. The analysis, which must be available in good time before deciding on new licences to the distribution companies for the period after 2021-2024, should take into account relevant academic and legal issues, including the relationship to the provision in the constitution regarding expropriation.*" [Translated from Danish by authors].

[7] Küfeoğlu *et al.* (2018).

This paper uses data from both markets to assess whether distribution network ownership unbundling achieved what proponents argued, and discusses whether alternative policy measures could have achieved similar results at lower costs.

Arguments *for* and *against* ownership unbundling of distribution networks

According to its proponents, distribution ownership unbundling leads to increased retail competition and hence to a greater economic welfare for consumers (e.g. lower prices, higher service quality, fair network access and more innovation). It improves the quality of networks and the security of supply, because of more managerial focus, independence and increased investments. It increases market transparency, and thus improves regulatory effectiveness. Finally, distribution ownership unbundling improves efficiency and reduces costs, due to more focus, alignment of managerial incentives and lower cost of capital for the network company.

According to opponents, distribution ownership unbundling increases the risk of consolidation among incumbents at the same horizontal level. It reduces coordination between networks and generation/ supply. It leads to the risk of less investment in generation and networks, due to a higher cost of capital and consequent reduced incentives to avoid grid failures. It results in high one-off transaction costs (financial and legal negotiations and settlements, i.e. reallocation of balance sheet, contractual obligations, roles and responsibilities, and organizational restructuring of the new separated entities) and increases structural costs due to loss of economies of scope. Finally, distribution ownership unbundling is not necessary, if effective competition policy and incentive based regulation is in place, which targets the promotion of competition, quality of service and lower network costs directly.

No clear theoretical guidance on optimal scale or scope of firms

The optimal scale and scope of a firm is highly firm specific, both the type of industry and history are significant in determining optimal scale and scope at any given time[8]. The wide range of scales and scopes observed in firms demonstrates this. Forcing simultaneous ownership unbundling of different activities can subsequently result in horizontal consolidation of separated activities, raising the possibility of increased concentration and reduced competition in the long run. There is very little evidence for the stability of forced separations lead to a reduction of long-run prices, in the presence of such horizontal mergers[9]. It is also not clear if ownership unbundling addresses the possible need to better align managerial incentives across the different activities[10].

[8] Hay & Liu (1997).

[9] See for example, Slade (1998).

[10] Jensen & Meckling (1976)

The theory supporting the positive impact of forced ownership unbundling is ambiguous and abstract: (i) optimal scale and scope is hard to identify and heavily dependent on market conditions and historical context, (ii) ownership unbundling might reduce the possibility of vertical restraints on competition, yet introduces the risk of horizontal foreclosure, and (iii) the existence of a smaller unbundled business might in principle sharpen managerial incentives, yet in practice subsequent mergers might lead to larger entities with greater principal agent problems.

Literature on ownership unbundling non-supportive

We have reviewed 60 papers relevant to ownership unbundling of electricity transmission and distribution over the period 1990 to today, of which 23 discuss the effects of (ownership) separation of distribution networks. We have developed a framework for assessing the degree of consensus on forced distribution ownership unbundling, looking at their overall ownership unbundling assessment and with respect to their assessment of the effect of unbundling following three indicators/ hypotheses:

Competition in retail and generation markets hypothesis

Ownership unbundling could increase competition among retailers and generators, resulting in lower retail margins, higher quality products and services, and more innovation.

Quality of network infrastructure hypothesis

Ownership unbundling could improve the quality of network infrastructure by increased investment and management focus, leading to an increase in security of supply and thus benefiting end-consumers.

Costs impact of unbundling hypothesis

Ownership unbundling could result in large one-off transaction costs, possible loss of synergies and higher cost of capital on one hand, but it could lead to increased cost efficiency of networks due to better management focus.

Table 1 provides an overview of the 23 papers that discuss distribution network unbundling, and how the papers assess the impact of ownership unbundling on competition, quality and costs (in favour, inconclusive, not in favour, and not assessed). Table 2 provides a summary of the results from the 23 papers.

Table 1: Distribution ownership unbundling papers

Author(s)	Country/Countries	Em-pirical	Type of data	Time Period	Comp-etition	Quality	Costs
Vagliasindi & Besant-Jones (World Bank) (2013)	Argentina, Brazil, Chile, Czech Republic, Egypt, Indonesia, South Korea, Peru, South Africa, Turkey, Botswana, India, Jordan, Vietnam, Zambia, Kenya, Tanzania, Uganda	Yes	Real/ Simulation	1989-2009	-	~	N/A
Growitsch *et al.* (2008)	Finland, Ireland, Italy, Netherlands, Norway, Spain, Sweden, UK	Yes	Real	2002	N/A	N/A	-
Mulder *et al.* (2005)	Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, UK, Argentina, Chile, New Zealand	No	Theoretical	1999-2005	+	~	-
Meyer (2011)	EU, USA, New Zealand	Yes	Real	1971-2011	~	N/A	-
Bertram & Twaddle (2005)	New Zealand	Yes	Real	1994-2003	-	N/A	N/A
Bertram (2006)	New Zealand	Yes	Real	1984-2005	-	-	-
Nillesen & Pollitt (2011)	New Zealand	Yes	Real	1991-2007	-	+	+
Shen & Yang (2012)	New Zealand	Yes	Real	1996-2011	-	-	~
Filippini & Wetzel (2014)	New Zealand	Yes	Real/ Simulation	1996-2011	+	N/A	+
Deloitte (2005)	Netherlands	No	Theoretical	1998-2004	N/A	N/A	-
CPB (2006)	Netherlands	No	Theoretical	1981-2005	N/A	N/A	~
Baarsma *et al.* (2007)	Netherlands	No	Theoretical	1998-2006	~	~	-
Kunneke & Fens (2007)	Netherlands	No	Theoretical	1998-2006	+	+	-
De Nooij & Baarsma (2009)	Netherlands	No	Theoretical	1998-2009	~	~	-
Mulder & Willems (2016)	Netherlands	Yes	Real	2004-2014	~	+	N/A
Greer (2008)	US	Yes	Real	1997	N/A	N/A	-
Meyer (2010)	US	Yes	Real	2001-2008	N/A	N/A	-

Kwoka *et al.* (2010)	US	Yes	Real	1994-2003	N/A	N/A	-
Filippini *et al.* (2008)	Switzerland	Yes	Real	1997-2005	N/A	N/A	-
Fetz & Filippini (2010)	Switzerland	Yes	Real	1997-2005	N/A	N/A	-
Jara-Diaz et al. (2004)	Spain	Yes	Real	1985-1996	N/A	N/A	-
Arocena (2008)	Spain	Yes	Real/ Simulation	1990-2006	N/A	N/A	-
Piacenza *et al.* (2005)	Italy	Yes	Real	1994-2000	N/A	N/A	-

+ In favour, - Not in favour, ~ Inconclusive

Table 2: Summary of findings based on 23 papers

Total	Competition	Quality	Costs
In favour	3	3	2
Inconclusive	4	4	2
Not in favour	5	2	16
Not examined	11	14	3
Total	23	23	23
Of which with empirical analysis			
In favour	1	2	2
Inconclusive	2	1	1
Not in favour	5	2	11
Not examined	9	12	3
Total	17	17	17

The majority of papers – both theoretical and empirical – we have reviewed are either not in favour or inconclusive on the benefits of distribution network ownership unbundling. Along the competition and quality dimensions, the papers are relatively equally spread between "in favour", "inconclusive", and "not in favour". However, with respect to costs, there are a significant number of papers "not in favour".

Nardi (2012, p.16) states that "*…it should be said that ownership unbundling, the core of the third package of reforms by the EC, does not show an incontrovertible evidence of better quality and capacity expansion…*".

Jara-Diaz *et al.* (2004, p.1009) conclude that "*The results obtained show that the market transaction costs are far from negligible and should be taken into account in the analysis of vertical disintegration.*"

In their discussion of the New Zealand reforms, Shen & Yang (2012, p.135) conclude that "*…unbundling does not seem to have facilitated greater competition in electricity generation sector, which has been the subject of several anti-competitive complaints since 2003. In the retail sector, the creation of vertically integrated gentailers*[11] *probably didn't improve the competition situation in retail.*"

What has been the New Zealand and Dutch experience?

New Zealand

The 1998 Electricity Industry Reform Act (EIRA) required, amongst other policy measures, the ownership unbundling of distribution networks from retail activities. The objective of the EIRA was to improve efficiency and consumer welfare through increased competition, and prevent cross-subsidization between retail and networks. Following the introduction of the EIRA, most electricity distribution companies quickly sold their retail businesses (by April 1999). The newly-formed retailers all merged with generators, forming so-called "gentailers". Together the five largest gentailers accounted for ~99% of the retail market in 2005.[12]

Following a Ministerial Review in 2009, after steady complaints about abuse of market power and high prices, the EIRA was repealed, the regulator was strengthened, and ownership separation rules were relaxed. One of the provisions was to allow network operators to re-enter the retail market under certain conditions, as they were seen as "natural" players, given existing relationships with customers, familiarity with the energy sector, local presence, and brand recognition.

Netherlands

The Network Management Act ('Splitsingswet') was passed in 2006 with the intention of improving retail competition and network quality. The Act prohibits distribution network companies from being in the same corporate group as companies engaged in the production, trade or supply of electricity or gas in the Netherlands. Further, the ownership of distribution networks and shares in distribution companies must be in the hands of the Dutch state or other state bodies (e.g. provinces, municipalities). The original deadline for Essent, Nuon, Eneco and Delta – the existing integrated large Dutch energy companies whose shares were held by municipalities and provinces – to comply with the ownership unbundling requirements was 1 January 2011.

Nuon and Essent sold their production and supply businesses in 2009 to Vattenfall and RWE respectively. The resulting provincial/municipal-owned network companies became Alliander (Nuon) and Enexis (Essent). Eneco and Delta (as well as Essent, regardless of its split up) undertook lengthy

[11] Gentailers refers to companies that merged generation and retail activities.

[12] Nillesen & Pollitt (2011).

legal proceedings – ultimately unsuccessful – against the Dutch state. Finally, in 2017 Eneco implemented the unbundling requirements in a manner whereby its shareholders have shares in two companies, Eneco and the distribution company Stedin. Delta sold its network group to Stedin.

Examining the impact

To examine the impact of ownership separation we collected data to test whether competition and quality improved, and whether costs fell. To examine the effects on retail competition we collected data on: (i) Retail market concentration (HHI index[13]), (ii) Concentration ratio of the top 3 retail players (CR3), (iii) Retail margins, and (iv) Switching rates between retailers. To examine the effects on network quality we collected data on: (i) Outage duration (SAIDI[14]), and (ii) Outage frequency (SAIFI[15]). To examine the effects on costs we collected data on (i) One-off costs, and (ii) structural costs/ efficiency.

Table 4. Competition, Quality and Cost data for New Zealand pre- and post-unbundling[16]

New Zealand		Pre 1998	Post 1998	Change	Stat. Sign.[17]
Competition	HHI (#)	667	2044	+1377	Y
	CR3 (%)	37.2%	69.8%	+32.6%	Y
	Gross retail profit margin (%)	21.1%	22.2%	+1.1%	N
	Change in switching rate (%)	0.0%	1.1%	+1.1%	N
Quality	SAIDI (minutes)	124.8	77.4	- 47.4	Y
	SAIFI (#)	6.1	7.3	+1.2	Y
Costs	Network Costs (NZ$/kWh, 2007 prices)	2.10	1.60	- 0.50	Y
	Distribution gross margin	48.9%	61.8%	+12.8%	Y

The data from New Zealand demonstrate that ownership unbundling did not have a positive effect on competition. In fact, competition decreased: the combined market share of the three largest retailers increased from 37 percent to 70 percent and the HHI tripled to 2044, because of the vertical integration between generators and the newly created independent retailers, creating so-called "gentailers".

The data show an increase in the gross profit margin of retailers and increase in the rate of switching, but the difference pre- and post-unbundling is not statistically significant. There was a large improvement in the average duration of outages (SAIDI) immediately following unbundling.

[13] Herfindahl-Hirschman Index, which measures the degree of concentration by calculating the square of the market share of each firm and then summing the resulting numbers. It can range from close to zero to 10,000.

[14] System Average Interruption Duration Index, which is the average outage duration per customer.

[15] System Average Interruption Frequency Index, which is the average number of interruptions per customer.

[16] Pre-1998 covers 1995-1998, and post-1998 covers 1999-2006.

[17] Student's t-test, 90% confidence interval.

At the same time the operational costs of the distribution companies decreased significantly by approximately 25% per kWh. However, these cost reductions were not passed on to consumers in the form of lower tariffs as demonstrated by the increase in distribution gross margins by almost 13 percent.

The one-off transaction costs associated with the ownership unbundling are estimated at EUR 130 per customer (today's prices), based on information from the three main players at the time in New Zealand (Powerco, Vector, and United Networks), which represented approximately half the total market[18]. In the case of Powerco there was a loss of approximately NZ$10mln on the disposal of generation assets. Vector incurred one off losses of approximately NZ$51mln on the sale of electricity contracts associated with the retail business. Finally, United Networks incurred one-off costs of approximately NZ$42mln due to restructuring costs and the loss on the sale of an electricity contract.

Our empirical evidence demonstrates that the benefits do not appear to outweigh the costs by a wide enough margin to justify interfering in the ownership structure of companies. On the positive side, ownership unbundling in New Zealand led to substantial cost reductions and increases in quality of service. On the negative side overall competition was reduced, prices rose as cost reductions were not passed on the end-users, and there were substantial one-off transactions costs involved. In recent years, the rules on ownership unbundling have been relaxed to allow distribution companies to own and operate generation and be active in retail – under certain conditions. The question for New Zealand remains whether a strict regulator enforcing a proven regulatory regime (such as the CPI-X price control regime that is practised in many other countries) could, in reality, have achieved more than the current results demonstrate.

Table 5. Competition, Quality and Cost data for the Netherlands pre- and post-unbundling[19]

Netherlands		Pre 2009	Post 2009	Delta	Stat. Sign.
Competition	HHI	2291	2268	-23	N
	CR3	81,1%	82,1%	1,0%	N
	Gross retail profit margin	9,9%	13,2%	3,2%	N
	Change in switching rate	1,5%	0,7%	-0,8%	N
Quality	SAIDI	25,1	21,8	-3,4	N
	SAIFI	0,4	0,3	-0,04	N
Costs	Network Costs	n/a	n/a	n/a	n/a
	Distribution gross margin	45,0%	46,4%	1,3%	N

The data from the Netherlands are inconclusive on the impact of ownership unbundling – the differences pre- and post-unbundling are not statistically significant. Ownership unbundling of the

[18] Nillesen & Pollitt (2011).

[19] Pre-2009 covers 2006-2009, and post-2009 covers 2009-2017.

distribution networks did not have the desired effects that were intended by the policy measure. We do not observe an increase in competition, although the data suggests it has deteriorated since 2009. The quality of the networks does seem to have improved, but statistically there is no difference pre- and post-unbundling. Finally, distribution costs (margins) have increased slightly, although – again – the change is not statistically significant.

The one-off transaction costs associated with the ownership unbundling are estimated at EUR 70 per customer (today's prices), based on the observed one-off cost of unbundling Alliander from Nuon (EUR 137 million between 2008-10). The unbundling also resulted in lower credit ratings, which impact borrowing costs and access to financing. The integrated Nuon had an A+ credit rating, but following unbundling in 2009, the rating for Alliander (the distribution company) was downgraded A, and the remaining generation and retail business was downgraded to BBB+. In the case of Essent (2009), the overall rating was A. Following unbundling Enexis (the distribution company) maintained this rating, whereas the generation and retail business was downgraded to A-. Eneco had an overall A- rating in 2017. Following unbundling Stedin (the distribution company) maintained this rating, whereas the generation and retail business was downgraded to BBB+. The cost of capital, as a result of lower credit ratings, will be higher for the two unbundled companies combined than for the previously integrated company, assuming equal borrowing behaviour – given the non-linear relationship between credit ratings and credit spreads. Based on Hennink (2016) we estimate that the average credit spread loss was approximately 15 basis points. This is equivalent to EUR 2 per customer per year in additional costs.[20]

The data for the Netherlands do not show a significant impact of ownership unbundling on quality or competition. There is no difference pre- and post-unbundling. However, there were clear one-off and structural costs involved with unbundling. Thus on balance, the expected, but disputed, benefits have largely not materialised, whereas the costs of unbundling, have materialised and are significant. Additionally, as the Netherlands implemented this form of unbundling unilaterally, many foreign players – with network assets – are active in retail and other commercial activities (approximately 60 percent of retail customers are served by a company that owns networks outside the Netherlands). Thus, creating an un-level playing field nationally as well as on a European level, rather than levelling the playing field. If network companies could have been sold, they too may well have passed into the foreign ownership of bundled international companies.

Overall conclusions

[20] Based on total loan portfolio of EUR 11bn at time of unbundling of Nuon, Essent, Eneco, and Delta, and based on total customer portfolio of 8mln.

The evidence from the Netherlands and New Zealand shows that it is highly questionable whether forced ownership unbundling of distribution networks is beneficial for quality and/ or retail competition, and could even be negative, whereas the associated one-off and structural costs are both significant and certain. The New Zealand experience demonstrates that a structural intervention can result in unintended side-effects –i.e. from one form of integration (distribution and retail) to another form of integration (generation and retail) and could actually reduce competition. The Netherlands on the other hand shows that unilateral structural interventions, without similar measures at a European level, where markets are integrated, leads to an un-level playing field and does not change the status quo in terms of competition and quality. Either way one-off and structural costs are passed on to consumers.

From a policy perspective, it is thus advisable to consider other policy measures to improve competition in retail, improve the quality of the network and drive down monopoly network costs. Measures that could be considered are (i) strengthening the regulatory framework and the regulator (e.g. extending the legal remit, increasing the budget), (ii) decreasing or removing barriers to entry for retail activities (e.g. permitting, contracting, financial requirements, arrears procedures, marketing rules, etc.), (iii) further ring-fencing of distribution activities (e.g. separate name and branding from holding company, financial and reporting requirements, independent decision-making and governance, etc.), and (iv) improving transparency for end-users (e.g. price comparison websites, data transparency on quality, competition, and financial metrics). The latter is one of the key focus areas for the European Commission and leading regulators, such as the UK's, Ofgem.

References

Arocena, P. (2008), *Cost and Quality Gains from Diversification and Vertical Integration in the Electricity Industry: A DEA Approach*, Energy Economics, 30, pp. 39-58.

Baarsma, B., Nooij, M., Koster, W. & van der Weijden, C. (2007), *Divide and rule. The economic and legal implications of the proposed ownership unbundling of distribution and supply companies in the Dutch electricity sector*, Energy Policy, 35, 1785-1794.

Bertram, G. & Twaddle, D. (2005), *Price-Cost Margins and Profit Rates in New Zealand Electricity Distribution Networks Since 1994: The Cost of Light Handed Regulation*, Journal of Regulatory Economics, 27, pp. 281-308.

Bertram, G. (2006), *Restructuring the New Zealand Electricity Sector 1984-2005. Electricity Market Reform-An International Perspective*, in Sioshansi, F.P. & Pfannenberger, W. (eds.), Electricity Market Reform: An International Perspective, Elsevier.

Chawla, M. and Pollitt, M. (2013), 'Global Trends in Electricity Transmission System Operation: where does the future lie?', *The Electricity Journal*, Vol.26, No.5, pp.65-71.

CPB (2006), *Kwantitatieve verkenning welvaartseffecten splitsing energiebedrijven*, CPB Notitie, 20 March 2006 (in Dutch) (https://www.cpb.nl/en/publication/kwantitatieve-verkenning-welvaartseffecten-splitsing-energiebedrijven).

Danish Energy Agency (2014), Committee for Electricity Regulation Review, *En fremtidssikret regulering af elsektoren*, Afsluttende rapport – december 2014 (only available in Dansih) (https://ens.dk/sites/ens.dk/files/CO2/en_fremtidssikret_regulering_af_elsektoren_web.pdf).

Deloitte (2005), *Reorganisatiekosten Splitsing Energiebedrijven,* Eindrapport, Ministerie van Economische Zaken, (https://anzdoc.com/reorganisatiekosten-splitsing-energiebedrijven.html).

European Commission (2009), Directive 2009/72/EC concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.

Fetz, A. & Filippini, M. (2010), *Economies of vertical integration in the Swiss electricity sector*, Energy Economics, 32, pp. 1325-1330.

Filippini, M. & Wetzel, H. (2014), *The Impact of Ownership Unbundling on Cost Efficiency: Empirical Evidence from the New Zealand Electricity Distribution Sector*, Energy Economics, 45, pp. 412-18.

Filippini, M., Farsi, M. & Fetz, A. (2008), *Economies of Scale and Scope in the Swiss Multi-Utilities Sector*, The Energy Journal, 29, pp. 123-144.

Greer, M. (2008), *A test of vertical economies for non-vertically integrated firms: The case of rural electric cooperatives*, Energy Economics, 30, pp. 679-687.

Growitsch, C. & Wetzel, H. (2008), *Testing for Economies of Scope in European Railways: An Efficiency Analysis*, Journal of Transport Economics and Policy, 43, pp. 1-24.

Hay, A. & Liu, G.S. (1997), *The Efficiency of Firms: What Difference Does Competition Make?*, The Economic Journal, Vol. 107, Issue 442, pp. 597-617.

Hennink (2016), *Long-Term Expected Credit Spreads and Excess Returns*, Applied Working Paper No. 2016-3, October 2016.

IEA (2017), *Energy Policies of IEA Countries: New Zealand 2017 Review*, International Energy Agency, 20 February 2017.

Jara-Diaz, S., Ramos-Real, F., & Martinez-Budria, E. (2004), *Economies of Integration in the Spanish Electricity Industry Using a Multistage Cost Function*, Energy Economics, 26, pp. 995-1013.

Jensen, M.C. & Meckling, W.H. (1976), *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, Journal of Financial Economics, Vol. 3, Issue 4, pp. 305-360.

Küfeoğlu, S., Pollitt, M. & Anaya, K. (2018), *Electric Power Distribution in the World: Today and Tomorrow*, EPRG Working Paper 1826.

Künneke, R. & Fens, T. (2007), *Ownership unbundling in electricity distribution: The case of The Netherlands*, Energy Policy, 35, pp. 1920-1930.

Kwoka, J., Pollitt, M., and Sergici, S., (2010), *Divestiture Policy and Operating Efficiency in U.S. Electric Power Distribution*, Journal of Regulatory Economics, 38, pp. 86-109.

Meyer, R. (2010), *Economies of scope in electricity supply and the costs of vertical separation for different unbundling scenarios*, Journal of Regulatory Economics, 42, pp. 95-114.

Meyer, R. (2011), *Vertical Economies and the Costs of Separating Electricity Supply – A Review of Theoretical and Empirical Literature*, The Energy Journal, 33, pp. 161-185.

Mulder, M. & Willems, B. (2016), *Competition in Retail Electricity Markets: An Assessment of Ten Year Dutch Experience*, TILEC Discussion Paper No. 2016-011.

Mulder, M., Shestalova, V. & Lijesen, M. (2005), *Vertical separation of the energy-distribution industry; an assessment of several options for unbundling*, CPB Document 84.

Nardi, P. (2010), *Transmission Network Unbundling and Grid Investments: Evidence from the UCTE Countries*, Utilities Policy, 23, pp. 50-58.

Nillesen, P.H.L. & Pollitt, M.G. (2011), *Ownership Unbundling in Electricity Distribution: Empirical Evidence from New Zealand*, Review of Industrial Organization, 38, pp. 61-93.

Nooij, M. & Baarsma, B. (2008), *An Ex Ante Welfare Analysis of the Unbundling of the Distribution and Supply Companies in the Dutch Electricity Sector*, UNECOM discussion paper.

Piacenza, M., Fraquelli, G. & Vannoni, D. (2005), *Cost Savings from Generation and Distribution with an Application to Italian Electric Utilities*, Journal of Regulatory Economics, 28, pp. 289-308.

Pollitt, M.G. (2018), *Electricity network charging in the presence of distributed energy resources: principles, problems and solutions*, Economics of Energy and Environmental Policy, 7(1), pp. 89-103.

Shen, D. & Q. Yang (2012), *Electricity Market Regulatory Reform and Competition – Case Study of the New Zealand Electricity Market*, in Wu, Y., X. Shi, and F. Kimura (eds.), Energy Market Integration in East Asia: Theories, Electricity Sector and Subsidies, ERIA Research Project Report 2011-17, Jakarta: ERIA, pp.103-139.

Slade, M.E. (1998), *Beer and the tie: Did Divestiture of Brewer-owned Public Houses Lead to Higher Beer Prices?*, The Economic Journal, Vol. 108, Issue 448, pp. 565-602.

Vagliasindi, M. & Besant-Jones, J. (2013), *Power market structure and performance: Revisiting Policy Options*, World Bank.
Vlerick Business School (2016), *Outlook on the European DSO landscape 2020 – The Trends That Will Change The Name of Your Game, (https://home.kpmg.com/content/dam/kpmg/pdf/2016/05/Energy-Outlook-DSO-2020.pdf)*.

World Bank (2002), *Transmission System Operators – Lessons From The Frontlines, Energy & Mining Sector Board Discussion Paper Series, Paper no. 4, June 2002*.