



Topics in

Corporate Finance

Perspectives on Central Clearing and Competition Policy

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TOPICS IN CORPORATE FINANCE

**PERSPECTIVES ON CENTRAL CLEARING
AND COMPETITION POLICY**

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Perspectives on Central Clearing and Competition Policy

With contributions of

Albert J. Menkveld and Guillaume Vuillemeij
Maarten Pieter Schinkel and Leonard Treuren
Timo Klein and Gareth Shier

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PREFACE

In front of you is the 29th issue of the *ACCF Topics in Corporate Finance* series dedicated to two public policy issues that will play a key role in the years to come. One is related to the stability of the financial system, in particular the role of central clearing counterparties, the other deals with competition issues associated with the transition to a green economy and the use of algorithms.

Central clearing counterparties (CCPs) have become mandatory for many interest-rate and credit derivatives following the 2007-09 financial crisis. Their (coming into) existence has a logic: the uncertainty in a world where investors are subject to counterparty risk (i.e. can they deliver, or might they default on their promises) contributed to the crisis. The CCPs are designed to insulate parties from this risk. As preeminent specialists in this area, Albert Menkveld (Free University Amsterdam) and Guillaume Vuillemeys (HEC Paris) discuss the precise role that CCPs play and insights from the extant literature that have developed, including regulatory implications.

Competition issues associated with the green economy are analyzed by Maarten Pieter Schinkel (University of Amsterdam), a leading authority in antitrust and competition economics, and Leonard Treuren a post-doctoral researcher at KU Leuven. While collaboration and relaxing competition rules are often suggested as ways to accommodate a transition to the green economy, the authors argue that the evidence may not support this premise. Green washing and government failure might be exacerbated. Incentives for sustainability might be stronger when firms compete than when they are allowed to make sustainability agreements.

Finally, Timo Klein and Gareth Shier, consultants at Oxera Consulting LLP, focus on competition issues associated with the increased use of algorithms in price setting. As example, the petrol station operators in Germany use algorithmic pricing software that helps them respond to changes in markets and consumer behavior. While this could improve the efficiency in price setting, it might also facilitate collusion and undermine competition. They discuss the adequacy of existing legal frameworks, and the implications for businesses.

As Amsterdam Center for Corporate Finance, we hope that you enjoy reading this contribution to the *Topics in Corporate Finance series*, and that it may help foster a healthy public debate on these important issues.

Arnoud W.A. Boot
Director ACCF

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1 THE ECONOMICS OF CENTRAL CLEARING¹

Albert J. Menkveld and Guillaume Vuillemeij

1.1 INTRODUCTION

Following the Great Recession of 2007–2009, a key part of the agenda for financial regulators worldwide was the requirement to use central clearing counterparties (CCPs) for standardized derivatives. These reforms have by now largely been implemented, so that the microstructure of derivatives markets has changed dramatically. Consequently, central clearing has attracted the interest of a growing number of researchers over the last decade, and significant progress has been made on both the theoretical and the empirical fronts. It is this novel part of financial research that we review here.

To set the stage, what do CCPs do? The key issue they address is counterparty risk in financial markets. Namely, whenever two investors agree on a financial contract, a probability exists that at least one of them will default on his promises (payment, delivery of a security, etc.). This risk exists in any market but is more acute for derivatives, due to the long maturity of contracts.² Counterparty risk can be managed in

1 This article is in press as “The Economics of Central Clearing” in the *Annual Review of Financial Economics* (2021) and online available at <https://www.annualreviews.org/doi/10.1146/annurev-financial-100520-10032>. It is reproduced in the series *Topics in Corporate Finance* with permission from the *Annual Review of Financial Economics*. The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review. We benefited immeasurably from many conversations on this topic over the years with experts in academia and in industry. We would like to mention in particular Bruno Biais, Vincent Bignon, Jean-Edouard Colliard, Darrell Duffie, Florian Heider, Thorsten Koeppl, Christophe Pérignon, Arnoud Siegmann, Mark Spanbroek, Haoxiang Zhu, and our students at the Vrije Universiteit Amsterdam, Wenqian Huang and Shihao Yu. We are grateful to the *Annual Review of Financial Economics*’ Editorial Committee Members and to Andrew Lo for invaluable comments. We further thank Walter Verwer for his excellent research assistance. Menkveld gratefully acknowledges a 5-year Vici Grant awarded by the Netherlands Organization for Scientific Research (NWO). Vuillemeij thanks the Chair ACPR/Risk Foundation: Regulation and Systemic Risk, Investissements d’Avenir (Labex Ecodec/ANR-11-LABX-0047) and the Agence Nationale de la Recherche (Financial Infrastructure: Risks and Regulation) for supporting this work.

2 While most papers in this survey study derivatives markets, CCPs exist in other markets (e.g., equities, repurchase agreements). Furthermore, clearinghouse mechanisms also exist for payments and gave rise to a separate literature (see, for example, Börner & Hatfield, 2017; Gorton, 1985; Gorton & Mullineaux, 1987). We do not cover payment, check, and bank clearinghouses in this survey, since they are primarily dealing with netting of payments, not with the management of counterparty risk.

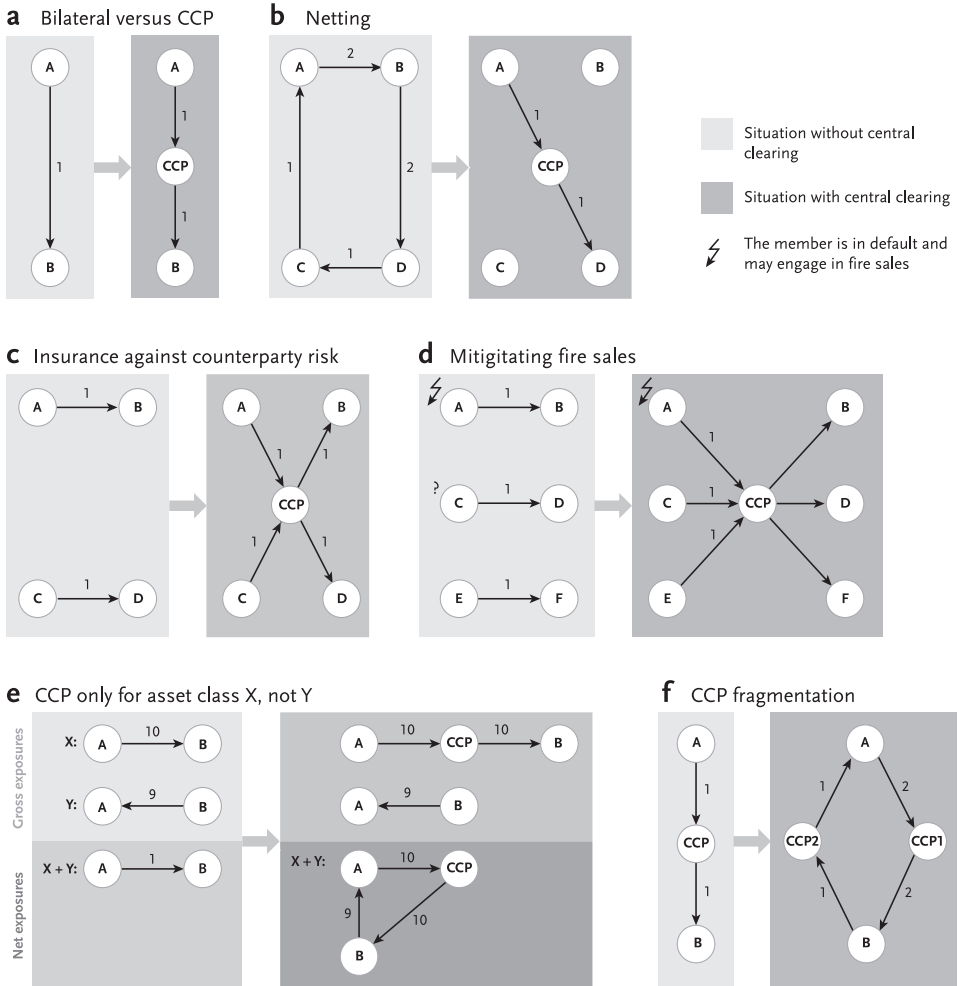
two ways, which coexist in practice. One possibility is for counterparty risk to be managed bilaterally, for example, through the direct exchange of collateral between investors, hence the name bilateral clearing. In this case, the default of one investor can cause losses to its counterparties, as illustrated in the left-hand chart of Figure 1a.

Alternatively, counterparty risk can be managed via central clearing. After a trade is bilaterally agreed upon by two investors, a CCP steps in and becomes a buyer to the seller and a seller to the buyer. This process is called novation. The CCP subsequently bears all counterparty risk and guarantees to each investor the execution of the terms of the initial contract. As illustrated in the right-hand chart of Figure 1a, investors are no longer directly exposed to each other and become exposed only to the CCP. Provided the CCP does not itself default, investors should not be concerned any more about counterparty risk. To provide insulation against investors' default, CCPs use a variety of instruments, notably the collection of collateral. That said, CCPs raise new challenges. Most importantly, when a large enough fraction of transactions is centrally cleared—as is currently the case—CCPs become extremely large, so that a CCP failure could lead to dramatic market disruptions.

The risks associated with CCPs are not just theoretical. For example, in September 2018, the Sweden-based CCP Nasdaq Clearing AB, active in the electricity futures markets, was on the verge of failure after a large trader, Einar Aas, failed to respond to margin calls. Contributions from nondefaulted members had to be tapped to a significant extent (107 million euros out of a default fund of 166 million euros).

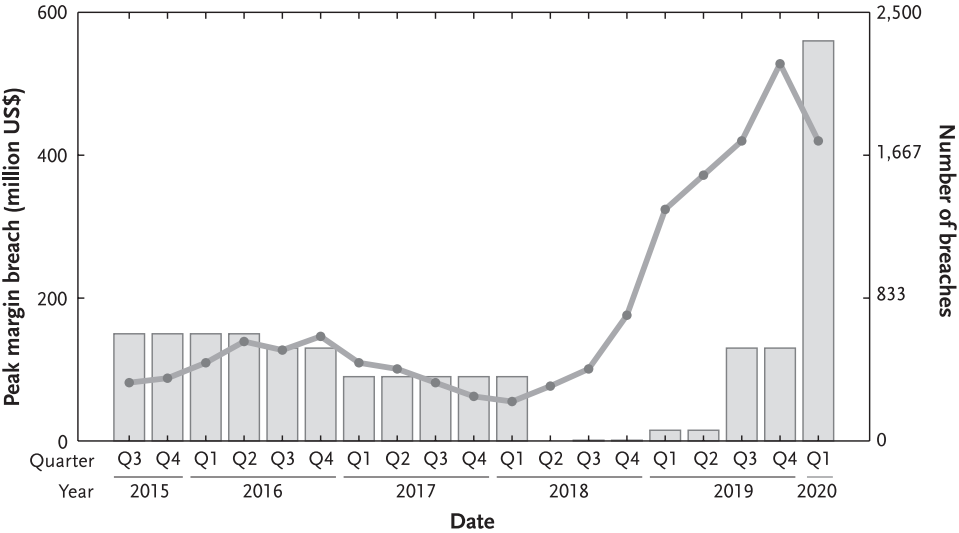
The risks are further evident from the recent coronavirus disease 2019 (COVID-19) crisis. The situation in which a clearing member's mark-to-market loss exceeds the collateral he posted is called a margin breach. Figure 2 shows that one of the largest CCPs, SwapClear, suffered serious breaches, with the largest breach amounting to half a billion US dollars. Figure 3 shows that such breaches were not idiosyncratic to SwapClear. Many CCPs experienced a substantial jump in their relative breach level. In itself, this finding is not that surprising during a crisis period, but it is worrisome that approximately half a dozen CCPs experienced breach levels in excess of one percent, which is the industry standard. Such events show that an appropriate understanding of the trade-offs involved when setting up CCPs is essential.

Figure 1



Panels *a-f* illustrate various channels by which the introduction of central clearing counterparties (CCPs) affect counterparty exposures. Each panel illustrates the channel by comparing two cases at hand. The circles with single letters are traders/clearing members. The arrows with labels indicate the size of the exposures (from the short to the long position).

Figure 2



Time series of largest margin breaches and number of margin breaches at one of the world’s largest central clearing counterparties, SwapClear, which mostly insures counterparty exposures in interest-rate derivatives. Data from Woodall (2020b).

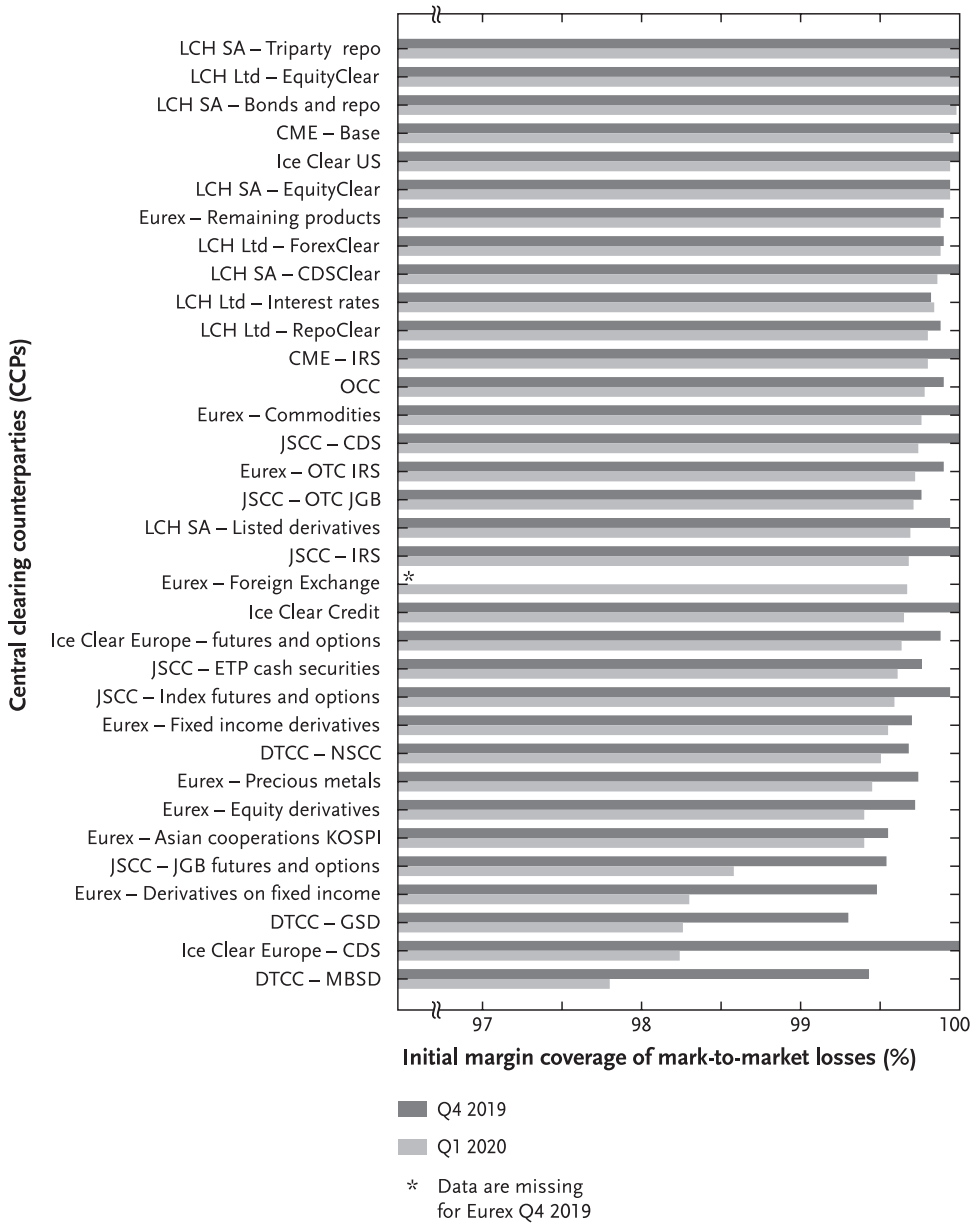
With this basic description in mind, this review is structured as follows.³ In Section 1.2, we discuss the theoretical rationales for central clearing. In Section 1.3, we review empirical studies on the effects of central clearing on the functioning of markets. Section 1.4 studies the design of CCPs and their resilience, both theoretically and empirically. Finally, Section 1.5 discusses policy issues related to central clearing. Throughout the article, we highlight research questions that remain open for future work.

1.2 THEORIES OF CENTRAL CLEARING

We start by reviewing the theories of central clearing. The key message is that CCPs have no role in perfect financial markets. Financial frictions are thus needed to justify the existence of CCPs. We group theoretical studies by the friction they have in focus and discuss them in the various subsections.

³ Our article has benefited from the industry-focused reviews by Pirrong (2011), Gregory (2015) and Spatt (2021) and from the book by Murphy (2013).

Figure 3



Margin breaches for the world’s largest central clearing counterparties (CCPs) in the first quarter of 2020. A value of 100% means that the CCP had collected sufficient margins to cover for day-to-day variation in prices. A value below 100% indicates a shortfall. Figure adapted with permission from Woodall (2020a).

1.2.1 *Central Clearing in Perfect Financial Markets*

The idea that central clearing has no economic role in perfect financial markets follows from the Modigliani & Miller (1958) theorem (see also Stiglitz, 1969). If markets are perfect—that is, if information is symmetric, there are no taxes or other transaction costs, no arbitrage opportunities, and financing does not affect cash flows from assets—then any choice of firms' capital structure is irrelevant for firm value. This is because capital structure becomes a way to split cash flows across investors. Since cash flows are perfectly priced, no particular split creates extra value.

The same logic implies that any financial intermediary interposing itself between firms and investors cannot create value (Freixas & Rochet, 2008, Chapter 1): These intermediaries are simply implementing a different split of cash flows (for example, between depositors and equity holders in the case of banks). The same holds true for CCPs. Simple intuition can be gained from Figure 1a, where any payment that the CCP makes to investor B has to come from either investor A or a CCP's own resources. The CCP is thus simply splitting cash flows in a particular way. To the extent cash flows are perfectly priced, this cannot create value.

Another intuition for why CCPs have no value in perfect markets can be gained from a replicating argument. Indeed, whatever CCPs do can be replicated by investors themselves. For example, if CCPs provide risk insulation by collecting margins, investors could equally well collect margins bilaterally. An important implication follows—namely, that any theory assigning an economic function to CCPs must be based on an explicit deviation from any of the assumptions that, collectively, define perfect markets.

1.2.2 *Efficient Posting of Costly Collateral*

A first economic rationale for CCPs relates to their role in collecting collateral or in reducing the cost of posting collateral. In economic theory, collateral can be used to mitigate a number of frictions, including moral hazard and adverse selection. Moral hazard hampers trading when the ability of an agent to make good on contractual commitments depends on unobservable effort decisions. In this case, by posting collateral, the agent increases his resources at stake and can credibly commit to exert effort, since collateral will be lost in case he defaults (Holmström & Tirole, 1997).

Then, trade can also be hampered by adverse selection, i.e., the fact that an investor is not able to distinguish between good and bad counterparties, that is, those with high or low probabilities of default (Akerlof, 1970). Requesting collateral can be used to screen counterparties. Indeed, all else equal, posting a given amount of collateral is more costly for riskier counterparties, since they are more likely to lose these resources. Therefore, if enough collateral is required, only high-quality counterparties will remain in the market (Bester, 1987). Relatedly, in the absence of adverse selection but with limited ability to enforce contractual promises, Rampini & Viswanathan (2010) show that

the amount of future promises an agent can make is limited by her current net worth, that is, her pledgeable collateral. In this context, it is also the case that posting collateral is more costly for more financially constrained agents, due to a higher opportunity cost of collateral.

What is the role of CCPs in this context? In principle, if collateral is valuable to support trading in the presence of frictions, agents should be able to post it bilaterally. Thus, it is not clear that requesting collateral to be posted centrally would further improve outcomes. However, a first possibility is that investors are imperfectly able to raise bilateral margins. This situation can arise if investors are concerned that counterparties will reinvest the collateral they receive, so that there is a risk that collateral will never be returned. A CCP, who does not play any active investment role, may be more credible at segregating margins.⁴

A second possibility is that central clearing reduces the cost of posting collateral, due to multilateral netting, that is, the ability to net positions and collateral calls across multiple counterparties. With multilateral netting—which can hardly be achieved in a bilateral market—a given quantity of collateral can support a greater number of positions.⁵ The ability to conduct multilateral netting is the key comparative advantage of CCPs in the model by Duffie & Zhu (2011). This role is illustrated by Figure 1b. The left-hand chart illustrates the no-CCP case, with arrows indicating exposures. The right-hand chart shows how exposures are reduced when a CCP is introduced. In this context, whatever friction is impairing financial markets, be it moral hazard, adverse selection, or limited enforcement, CCPs can improve outcomes by reducing the cost of posting collateral.⁶ One example is the model by Carapella & Mills (2014): In their setup, the true benefit of CCPs is to make traded contracts information-insensitive (in the sense of Gorton & Pennacchi, 1990), that is, to eliminate adverse selection. This is achieved by collecting costly collateral and reducing this cost through multilateral netting. The more information-insensitive securities become, the more liquid they will be.

1.2.3 Insurance Against Counterparty Risk

Another stream of research, mostly represented by Biais, Heider & Hoerova (2012; 2016) essentially considers CCPs as insurance companies. When investors are exposed to the risk that counterparties may fail on their commitments, value can be created

4 In practice, CCPs do reinvest margins received in cash, but only in safe assets. They can also lend securities received as collateral.

5 In a bilateral market, multilateral netting can be achieved only through trade compression, by which a third party collects data about the positions of a set of traders and advises them on how to reduce bilateral net exposures. Trade compression shares features with the historical practice of ring clearing (Emery, 1896; Moser, 1998).

6 Amini & Minca (2020) note that, during the multilateral netting process, the priority structure in the network of transactions is also changed. End users who are not part of multilateral clearing arrangements may become de facto junior.

by pooling resources across investors to insure each of them against counterparty defaults.⁷ In any insurance company, agents contribute resources that are pooled in a common fund and used to cover idiosyncratic risks. In a CCP, this pooling of resources occurs via default funds, i.e., mutualized resources that are used to cover the cost associated with member defaults, after the resources of the defaulted members themselves are depleted. Therefore, while theories explaining CCPs based on multilateral netting cannot explain the existence of default funds, it is a key element in Biais, Heider & Hoerova (2012; 2016). Figure 1c illustrates how the introduction of a CCP leads to the pooling of exposures and therefore diversifies idiosyncratic risk across members.

This theory explains another important feature of central clearing. In the presence of moral hazard, arising from unobservable effort or risk management decisions, the provision of insurance by a third party (the CCP) can weaken the incentives of investors to prevent or reduce risks. For example, it can make investors less careful about the choice of their counterparties.⁸ Thus, in the presence of moral hazard, the amount of risk is endogenous to the level of insurance provision: More insurance can increase risk-taking, potentially threatening the mere possibility of providing insurance. This outcome can be avoided by limiting the provision of insurance, i.e., by assigning part of the losses to the parties that cause them. In standard insurance contracts, this role is played by deductibles—the insured agent supports part of the damages below some threshold. In the context of CCPs, this role is played by requiring initial margins to be paid—these are resources that will be lost by any investor in case he defaults. It therefore creates incentives to avoid defaults. Thus, the theory in Biais, Heider & Hoerova (2012; 2016) also explains why margins are paid to CCPs. Finally, this theory points to an important limitation of CCPs: As any insurance contract based on the mutualization of resources, it can only cover idiosyncratic risks, not systematic risk. Thus, the role of CCPs in mitigating the effect of aggregate shocks remains very limited.

The insurance role of CCPs has also been studied in a variety of related models. In Antinolfi, Carapella & Carli (2019), CCPs act as an insurance company but give rise to a trade-off between bilateral clearing and central clearing. When some information about the credit risk of a counterparty (here, its pledgeable income) is soft, in the sense that it cannot be verified by a third party, then bilateral clearing may dominate central clearing. In particular, while providing insurance, central clearing reduces traders' incentives to acquire soft information and may worsen outcomes. Koepl & Monnet

7 If markets are complete, investors should be able to hedge the risk that their counterparties default directly by buying or selling securities, such as credit default swaps (CDS). The existence of a centralized intermediary such as the CCP thus amounts to assuming that hedging markets are incomplete or costly to use.

8 While not a full study on moral hazard in CCPs, Mayordomo & Posch (2016) show results consistent with this prediction.

(2010) further discuss the trade-off between standardized and customized financial contracts. A CCP can only achieve the novation of trades, and pool risk exposures, if contracts are sufficiently fungible, i.e., standardized. To the extent that customized contracts are valuable, they should be traded bilaterally. One important lesson is that the degree of standardization of contracts should not be taken as exogenous, but it is endogenous to clearing arrangements. Empirically, Kroszner (1999) indeed links the emergence of CCPs to progresses in the standardization of contracts. Finally, Kuong & Maurin (2020) provide a model in which loss mutualization requires collateral for preventing moral hazard. Central clearing is thus optimal only when the collateral cost is intermediate. If the cost is low, full collateralization is optimal. If the cost is high, supporting loss mutualization with collateral is too expensive. The authors then use this basic structure to study a number of important elements of the structure of CCPs, including their default waterfall.

1.2.4 Mitigating Fire Sales

A last potential economic rationale for central clearing relates to the role of CCPs in mitigating fire sales. This mechanism aims to explain one feature of CCPs. Specifically, when a member defaults on its margin calls, the CCP does not liquidate this member's position in the open market. Instead, it organizes an auction, in which surviving members have incentives to bid at high prices.⁹ These auctions can be understood as a mechanism to mitigate the inefficiencies associated with fire sales, such as deviations of prices from fundamentals, inefficient liquidations when margin constraints binds (Brunnermeier & Pedersen, 2009), or predatory trading and short-selling (Brunnermeier & Pedersen, 2005). This rationale for CCPs is modeled by Vuillemeier (2020a), and a related intuition is developed by Kuong (2020).¹⁰

Theoretically, the existence of capital or margin constraints can give rise to multiple equilibria in financial markets. If investors expect other investors to sell assets and prices to decrease, they know that they will face margin calls and may be forced to sell when prices are already low. Expecting this, they may preemptively sell, pushing down prices earlier and amplifying price drops. This equilibrium is inefficient: Collectively, all investors would be better off not selling, but individually, it may be rational for each of them to sell. This inefficient equilibrium coexists with another equilibrium in which investors do not expect other investors to sell in the future and thus have no incentives to preemptively sell. In this context, a CCP can be seen as an equilibrium selection mechanism. If agents can precommit to buying assets at high

9 These incentives take the form of juniorization of default fund contributions (i.e., resources mutualized across members) or of outright fines.

10 For other related work, see Biais, Heider & Hoerova (2020). Their main message is that fire sales need not create inefficiencies, provided that agents can write contracts on them. In the context of theories discussed in this section, CCPs can be understood as one such contract.

prices in states that would otherwise be associated with forced liquidations, all incentives to preemptively sell can be eliminated.

The auction mechanism operated by CCPs achieves exactly this, in states where one investor defaults and his position has to be liquidated. This eliminates the inefficiencies associated with multiple equilibria in these circumstances. How the introduction of a CCP mitigates fire-sale risk is illustrated in Figure 1d. If member A fails, those on the same side of the market could stay on their position or unwind it, causing fire sales. The question marks illustrate these two options and the associated multiple equilibria. The situation is resolved in the right-hand chart after the introduction of a CCP. That said, the optimal design of CCP auctions remains an open question. One of the only papers studying this topic is by Ferrara, Li & Marszalec (2019), who show that CCP auctions with penalties do not increase the CCPs' expected revenue and can also have unintended effects by fragilizing the surviving members.

1.3 EMPIRICAL STUDIES ON CENTRAL CLEARING

In this section, we review the empirical literature that studies the effect of central clearing on the functioning of markets. We study the effect of central clearing on asset prices, trade flows, and fire sales.

1.3.1 *Central Clearing and Asset Prices*

When thinking about how central clearing affects markets, a first natural outcome to study are prices of the cleared assets. Specifically, is counterparty risk priced differently before and after the introduction of central clearing? Several hypotheses can be tested. Most naturally, if CCPs are successful at eliminating counterparty risk at limited cost, prices of cleared assets should increase: Investors are willing to pay more because default probabilities are lower. On the contrary, a badly designed CCP, by providing insurance against idiosyncratic risk, may actually increase systematic risk (Biais, Heider & Hoerova, 2012). This is the case if investors, subject to moral hazard, no longer have incentives to monitor the credit quality of their counterparties. In this case, asset prices are expected to decrease. Alternatively, if the cost of central clearing, in terms of collateral requirements, is too large, then funding and market liquidity may deteriorate, also negatively impacting asset prices (Garleanu & Pedersen, 2011).

To estimate the effect of central clearing on asset prices, the main identification challenge is the fact that the introduction of central clearing often is not exogenous. It can indeed be correlated with macroeconomic conditions, such as the occurrence of financial crises. The paper that most convincingly addresses this challenge is by Bernstein, Hughson & Weidenmier (2019), who use the fact that, at the end of the nineteenth century, there were two competing stock markets in New York: the New York Stock Exchange (NYSE) and, across the street, the Consolidated Stock Exchange

(CSE). The CSE had a clearinghouse starting from 1886, which was imitated by the NYSE only in 1892. Bernstein, Hughson & Weidenmier (2019) compare prices of the same securities on the same dates, traded in either of the two exchanges, after the introduction of the NYSE clearinghouse. This setup allows for ruling out any impact of macroeconomic conditions. In a difference-in-differences specification, they find that the value of NYSE stocks, relative to CSE stocks, increased by 24 basis points after the introduction of the clearinghouse. This finding is consistent with the view that the dominant force associated with CCP introduction is to ensure that the posting of collateral is done efficiently (see Section 1.2.2). Relatedly, McSherry, Wilson & McAndrews (2017) use the same historical setup to show that the NYSE clearinghouse reduced the failure rate of brokers. Even though the findings by Bernstein, Hughson & Weidenmier (2019) constitute the best identified evidence on asset prices so far, they are focused on only one part of central clearing. Indeed, the NYSE clearinghouse was engaged only in netting (allowing for multilateral netting instead of bilateral netting) but was not interposing itself between traders to assume counterparty risk, as modern CCPs do.

Therefore, a set of papers have looked at the introduction of CCPs in other contexts. Loon & Zhong (2014) study the pricing of credit default swaps (CDS), for which central clearing was voluntarily introduced by ICE between 2009 and 2011. They conduct event studies around the date at which central clearing starts. They show that, with central clearing, protection buyers are willing to pay 1.4% more on receiving the protection (i.e., CDS spreads go up by 1.4%). While this effect could theoretically be driven by changes in liquidity or in credit risk, they show that it is robust to the inclusion of liquidity proxies. Consistent with the idea that lower counterparty risk is a key driver of the effect, they also find that the sensitivity of CDS spreads to dealers' credit risk is reduced after central clearing. That said, the main concern is that the set of CDSs that are voluntarily cleared differ from CDSs for which no voluntary clearing starts during the period (e.g., they could be more risky *ex ante*). While no exogenous source of variation can here be used for identification, Loon & Zhong (2014) show that their findings are robust when treated CDSs (i.e., those that start to be cleared) are matched with other CDSs with similar *ex ante* characteristics. Another paper by Menkveld, Pagnotta & Zoican (2015) focuses on volatility rather than on the markets: Denmark, Finland, and Sweden. This setup has the appealing feature that virtually no voluntary clearing of stocks occurred before the event (less than 1% of the trading volume), and clearing then became mandatory. This alleviates concerns about the selection of trades that end up being centrally cleared or not. As a control group, Menkveld, Pagnotta & Zoican (2015) use a sample of matched European equities with no change in clearing regime. In a difference-in-differences estimation, they find that the daily volatility of Nordic stocks declines by 20 basis points after the CCP is in place. This finding is economically large, as it represents a volatility decline by 8.77% compared with preclearing levels. Interestingly, insights into the mechanisms can be gained by exploiting specificities of the margining rules: The

drop in volatility is even larger for higher levels of margins. This is consistent with the theory that higher margins dampen the effect of counterparty risk on prices.¹¹ That said, the authors also point to an interesting trade-off, namely, higher margins make it more costly for investors to trade. Consequently, they find that the introduction of the CCP causes a decline in trading volume by 9.8%. However, this decline in market liquidity does not seem to reduce market efficiency or the informativeness of prices.

While the above papers suggest that central clearing brings asset prices closer to their fundamental value, one paper by Boissel et al. (2017) provides a more skeptical appraisal. They study rates on general collateral repurchase agreements (so-called repos) in Europe. This market is centrally cleared. Therefore, if the CCP is credible at eliminating counterparty risk, repo rates should not depend on the credit quality of the underlying collateral. Focusing on sovereign collateral, the paper indeed finds that, in times of moderate sovereign stress (2009–2010), repo rates are uncorrelated with CDS spreads in the underlying sovereigns. However, in 2011, during the European sovereign debt crisis, the two sets of rates become highly correlated. They interpret this finding as evidence that investors price the probability of CCP failure conditional on the failure of a sovereign entity. This finding is at odds with the one by Mancini, Ranaldo & Wrampelmeyer (2016), who also study the European CCP-based repo market and confirm that CCPs act as shock absorbers. In this last paper, higher market risk is associated with higher repo lending volumes but not with higher spreads or haircuts. One reason why Boissel et al. (2017) obtain different findings may be because they look at a market where securities from specific governments are delivered, and not pools of sovereign bonds.

1.3.2 *Central Clearing and Trade Flows*

Once the impact of central clearing on asset prices is established, a natural next step is to ask whether real variables are also affected. In the context of derivatives markets, does central clearing affect only the prices of derivative contracts or also outcomes in the market for the underlying goods or securities? This question was tackled mostly by Vuillemey (2020b), who studies the introduction of the first derivatives CCP in history. This CCP, called Caisse de liquidation des affaires en marchandises (CLAM), was created in the market for coffee futures in the harbor of Le Havre, France, in 1882. At the time, the northwestern part of Europe was the most active trade area worldwide. The key innovation brought about by CLAM was to interpose itself between

11 In contexts unrelated to central clearing, a few papers study the effect of margin requirements on market liquidity and price volatility (for a critique, see Hardouvelis, 1990; Hardouvelis & Peristiani, 1992; Hsieh & Miller, 1990). More generally, a large literature studies how margins can constrain the ability of investors or arbitrageurs to take positions and, in turn, affect prices (see, for example, Gromb & Vayanos, 2002). A related question is whether margins can be destabilizing, due to their procyclicality (Murphy, Vasois & Vause, 2014).

traders to fully insulate these traders against counterparty risk. The CLAM, in turn, protected itself against counterparty risk by imposing margins. Before 1882, earlier clearinghouses (e.g., in Liverpool or New York) only offered netting services to facilitate the settlement of transactions (see also Schaede, 1989).

Using archive data on trade flows in coffee and other commodities at a European scale, Vuilleme (2020b) estimates a triple difference-in-differences model, to show that central clearing had a significant effect on trade flows. After 1882, coffee (imported mostly from Brazil) entered Europe to a significantly larger extent through Le Havre, was warehoused there, and eventually was exported again to other European countries for consumption. In sum, once they had access to a hedging technology that could remove counterparty risk, coffee dealers in Le Havre could hold significantly larger inventories than dealers in other European harbors. These other traders soon realized that they were losing business and, within 10 years, approximately 10 other European harbors also introduced CCPs.

This event can finally be used to shed light on the theories of Section 1.2 and explore the friction that was mitigated by central clearing in this market. Before the introduction of central clearing, futures trading was mostly based on reputation, which was a substitute for collateral. This reputation-based system collapsed during a major crisis in the coffee market in 1880–1881: Several old and reputable trading houses in the United States failed, casting doubts worldwide about the credit quality of counterparties. While reputation was mostly a device to separate “good” from “bad” traders, the crisis pooled most of them together, creating adverse selection and slowing down trade. Evidence shows that central clearing was most valued for its credibility in calling margins at a relatively low cost (due to multilateral netting). In line with models that assign a screening role to collateral (Bester 1987), calling margins was a way to reparate “good” from “bad” traders, because posting collateral is costlier for riskier investors, all else equal.¹² The shift from a system based on reputation to a system based on collateral also removed informational barriers to entry, and the number of new traders subsequently increased.

1.3.3 Central Clearing and Fire Sales

The idea that central clearing can reduce inefficiencies associated with fire sales has received limited empirical attention, but a few studies point in this direction. To begin with historical settings, Vuilleme (2020a) studies the first event during which a CCP played an active role to avoid distressed sales: the crisis in wool futures in 1900 in Europe, during which a number of trading houses defaulted in Roubaix-Tourcoing, France, then a major center of the textile market. Instead of running an auction in a

¹² Vuilleme (2020b) further shows that, for a subset of traders, the CCP was valuable as a tool to complete markets, consistent with the theoretical arguments in Biais, Heider & Hoerova (2012; 2016).

strict sense, the CCP coordinated surviving members. They collectively agreed to buy the defaulted position at a price above the one that would have otherwise prevailed and that would have triggered additional rounds of margin calls. In difference-in-differences estimations, using local trade flows as a measure of local economic activity, no evidence was found that prices in the affected wool market remained depressed afterward. Furthermore, the decision to collectively agree on liquidation prices (made easier due to strong family connections between the main firms) was unanimously praised, suggesting that it was indeed socially beneficial.

In more recent contexts, the liquidation of the derivatives position of Lehman Brothers, following its failure in 2008, has been the object of a few studies, primarily by lawyers. A detailed narrative is given by Norman (2011). Most of the legal research focuses on the treatment of derivatives in bankruptcy and how a move toward central clearing would affect outcomes. The key feature that has attracted a lot of attention is the exemption of derivatives from automatic stays, which makes them effectively senior to all other claims (Duffie & Skeel, 2012). Concretely, this exemption means that, in bankruptcy, derivatives counterparties can repossess collateral and terminate positions immediately, without waiting for the insolvency procedure. In the case of Lehman Brothers, approximately 80% of the derivatives counterparties terminated their contracts within 5 weeks of the bankruptcy filing (Lubben 2017). Given the size of the Lehman Brothers derivatives portfolio (a notional value of \$35 trillion), this was the largest-ever mass termination of derivatives. Although any counterfactual scenario remains unknown, anecdotal evidence suggests that massive, immediate, and uncoordinated sales caused prices to be depressed and were associated with significant losses (Summe, 2012).¹³ Theoretically, the increasing use of central clearing could mitigate part of the inefficiencies: A CCP should indeed consider the entire value of a derivatives portfolio in bankruptcy, and not just specific positions. A number of studies, such as those by Summe (2012) and Roe & Adams (2015), express skepticism about the status quo: The exemption from automatic stays has essentially been left untouched by new regulations such as the Dodd-Frank Wall Street Reform and Consumer Protection Act.

1.4 DESIGN OF CENTRAL CLEARING

In this section, we discuss issues related to the design of CCPs. In short, the efficient functioning of CCPs relies on the collection of adequate amounts of margin, on a proper allocation of losses in case of member default, and on good governance. We also study issues related to the number of operating CCPs.

¹³ Other trade-offs associated with the effective seniority of derivatives are discussed by Bolton & Oehmke (2015).

1.4.1 Design of Margins

The first line of defense of CCPs against a potential default of their members is the collection of margins. Collecting the appropriate amount of margins is critically important, both to mitigate incentive problems arising from moral hazard or adverse selection (see Section 1.2.2) and to keep CCPs afloat, thus allowing them to make good on their commitments vis-à-vis surviving members. Consequently, a number of papers study, theoretically and empirically, the use of margins by CCPs.

A first strand of the literature studies how investors' net exposures, thus margin requirements, change under different clearing arrangements. The baseline theoretical framework has been laid out by Duffie & Zhu (2011).¹⁴ This paper points out a simple but important trade-off at play when moving from bilateral clearing to central clearing. As discussed in Section 1.2.2, CCPs are valuable because of the multilateral netting benefits they offer. However, these benefits operate within a given asset class but come at the cost of potentially lowering opportunities for bilateral netting across asset classes.¹⁵ This trade-off arises due to the fact that investors in a bilateral market can net margins (and reduce economic exposures) across all asset classes, while CCPs typically operate only within one asset class (and even CCPs operating in multiple asset classes typically segregate margins across classes).¹⁶ Once this trade-off is accounted for, Duffie & Zhu (2011) conclude that it cannot be taken for granted that CCPs reduce economic exposures and margin requirements between investors.¹⁷ For the same reason, they also point to the benefits of interoperability across CCPs, that is, links between CCPs that allow for multilateral netting across CCPs. Figure 1e illustrates how introducing a CCP in one asset class can only increase counterparty exposures.

The results by Duffie & Zhu (2011) have been extended along several dimensions. For example, Cont & Kokholm (2014) introduce heterogeneity along two key dimensions: the riskiness of each asset class and the correlation of investors' exposures across asset classes. Intuitively, these two quantities critically determine how much cross-asset netting benefits are lost when moving from bilateral to central clearing.

¹⁴ For an early contribution on this topic, see Baer, France & Moser (2004).

¹⁵ Relatedly, Amini, Filipović & Minca (2016) show that partial multilateral netting may be worse (in terms of traders' surplus and asset prices) than no netting at all.

¹⁶ To our knowledge, the theoretical rationale for segregating margins across asset classes has not been explicitly modeled in an optimal contracting framework. It can be that margin segregation is the efficient solution to mitigate agency or incentive problems. A more mundane reason for CCPs' specialization in a single asset class is in-depth knowledge about risk profiles of the various securities and clearing members. Path dependence might also explain the status quo since if, historically, every asset class started out with their own CCP, integrating CCPs further down the road with more global, across-asset class trading becomes a nontrivial merger and/or acquisition endeavor.

¹⁷ For a related argument, see Amini, Filipović & Minca (2020). A working paper version of that article (Amini, Filipović & Minca, 2017) had a stylized model to study the capital structure of CCPs.

Garratt & Zimmerman (2020) explore another dimension of heterogeneity. Indeed, while Duffie & Zhu (2011) assume that all bilateral exposures are nondegenerate random variables so that their financial network becomes fully connected, Garratt & Zimmerman (2020) study the impact of centralized netting in a variety of network structures. A related contribution, by Glasserman, Moallemi & Yuan (2016) studies traders' incentives to split positions across CCPs when margins increase with position sizes and studies equilibrium in this context.

Furthermore, while the above papers rely on simulated networks to assess the impact of central clearing on net exposures, Duffie, Schleichner & Vuillemeys (2015) use actual data to study the amount of collateral required to safely clear CDSs under various market structures (e.g., the status quo as baseline, an increase in CCP membership, an increase in the number of CCPs, client clearing, etc.).¹⁸ They find that aggregate collateral demand is massively increased via the imposition of initial margins for interdealer trades. However, once these margins are accounted for, central clearing reduces aggregate collateral demand, provided that CCPs do not proliferate.

A second strand of the literature asks whether margin levels used by CCPs are sufficient to allow them to make good on their commitments vis-à-vis members. Jones & Pérignon (2013) use data on the daily gains and losses that clearing members realized on their Chicago Mercantile Exchange (CME) positions to study the probability of margin breaches (that is, the probability that the change in the value of the cleared portfolio exceeds the amount of initial margin posted).¹⁹ Over a 3-year period (1999–2001), they find that margin breaches cluster in time—a finding that raises concerns about systematic risk. A recent article by the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO), “Principles for Financial Market Infrastructures” (CPMI-IOSCO 2012, 2015), requires CCPs to publish margin breaches to increase transparency. Huang & Takáts (2020), for example, use such data to analyze model risk and conclude that CCPs with more “skin in the game” are associated with more prudent initial-margin setting. Finally, Capponi et al. (2020) find that CCPs set margins more conservatively than standard value-at-risk measures would imply.

The study of positive correlation across member positions has been taken up theoretically by Menkveld (2017), who calls them crowded positions.²⁰ Crowded positions arise when multiple investors take positions on the same side of the market and thus

18 In a client-clearing regime, large CCP members (typically dealers) clear the derivatives portfolio of their client end users.

19 In this literature, margin breaches are often interpreted as the probability of default of a member vis-à-vis the CCP. However, upon a margin breach, a CCP would call additional margin that the member may be able to pay using unencumbered resources. These resources are often left unmodeled, because they are hard to observe in practice. Also note that a member may default on its commitments vis-à-vis the CCP for reasons unrelated to changes in the price of cleared portfolios.

20 Crowding in financial markets has also been studied by Pedersen (2009).

end up with highly correlated portfolios. This practice can put the CCP at risk, since multiple members are likely to default at the same time.²¹

Crowded positions have then been shown to be empirically relevant by Menkveld (2017). This paper starts from a simple but important observation: Current methodologies used by CCPs compute margins for each member based on the characteristics of the member's own portfolio (volatility, size, diversification, etc.). As such, margin methodologies overlook the risk associated with correlated exposures across members. Menkveld (2017) proposes measures of CCP exposure (inspired by Duffie & Zhu, 2011) that account for crowded positions as well as measures of crowding per se. This method can potentially be used to collect more resources from members who contribute more to crowding – a method akin to a polluter-pay principle.²² The paper also empirically documents that measures of crowding spike when aggregate or idiosyncratic volatility rises, which further confirms the relevance of crowded positions for systemic risk. A similar intuition is explored by Cruz Lopez et al. (2017), who build on the CoVaR methodology of Adrian & Brunnermeier (2016) (albeit with some differences) to propose a methodology called CoMargin. Using copulas, they estimate the multivariate profit-and-loss distribution of the clearing members in a CCP. The CoMargin of a clearing member is then computed based on its probability of margin breach conditional on one or several other clearing members also facing margin breaches. Furthermore, building on Menkveld (2017), Huang, Menkveld & Yu (2021) propose a methodology to decompose intraday changes in CCP exposure after accounting for crowded positions. The exposure of CCPs is decomposed at high frequency into price components (changes in the level, the volatility, or the correlation of price changes) and trade components (changes due to new trades and to crowding). Finally, the literature on margins gives rise to an emerging literature on stress testing of CCPs.

The early attempts in this respect were heavily inspired by the large literature on the stress testing of banks (Benoit et al., 2017) and thus failed to account for the specificities of CCPs (as pointed out by Cox & Steigerwald, 2018). These specificities include obviously the key role of margins and of other resources originating from the default waterfall (see next section) as well as specificities associated with the treatment of derivatives in bankruptcy (Bliss & Kaufman, 2006). One recent study by Paddrik, Rajan & Young (2020a), focusing on variation margin calls following a shock, finds that CCPs limit rather than amplify the propagation of shocks in networks.

21 Menkveld (2017) also shows that, while crowding may be excessive, the optimal level of crowding is not zero. Also note that, in a CCP context, crowding can be a concern for only a subset of members, since CCPs operate, by definition, with matched books (that is, with a long position for every short position, and vice versa).

22 Whether these resources should be collected in the form of margins or via other forms of contributions (default fund, CCP equity) remains an open question. Another open question is how alternative margining rules would change the sets of members and portfolios.

1.4.2 *Default Waterfall and CCP Resolution*

In addition to margins, CCPs can use a variety of other resources to protect themselves against the potential default of members. These resources, described by Duffie (2015), are known as the CCP's default waterfall: Typically, after a defaulting member's margins and default fund contributions have been used, a first tranche of the CCP's equity is impaired, then resources mutualized across members (default fund) are used. If this is not enough, then a second layer of CCP equity is impaired before exceptional end-of-waterfall procedures, such as variation margin gains haircutting or contractual tear-ups, are used.²³ Whenever losses fall deep into the default waterfall, the CCP itself may experience financial distress. In the current context, where central clearing is mandatory and CCPs are de facto key financial market utilities, the failure of CCPs is expected to be disastrous. This topic also gives rise to growing policy discussions.²⁴

So far, the study of CCP failures has been limited to a few historical cases. A first merit of these studies is to show that CCP failures or near-failures are not impossible. Three cases of CCP failures are most often cited: the failure of the Caisse de liquidation in Paris in 1974, that of the Kuala Lumpur Commodity Clearing House in 1983, and that of the Hong Kong Futures Guarantee Corporation in 1987.²⁵ There are also a few examples of near failures, for example, in the United States during the October 1987 crash (Bernanke, 1990) or in 2018 in the Nordic energy market, when the failure of the Norwegian investor Einar Aas put the CCP at risk (Bell & Holden, 2018).²⁶ So far, the most detailed study of a CCP failure, based on archival data, is by Bignon & Vuillemey (2020), who study the failure of Caisse de liquidation, a CCP mostly active in the market for sugar futures, which failed in 1974 following the failure of its largest member when sugar prices collapsed (following a boom).

Bignon & Vuillemey (2020) first discuss the factors that led to large losses for the CCP. Among them is the existence of crowded exposures, in the sense of Menkveld (2017), and a single position of extremely large size. In this context, while average margin levels were arguably appropriately set, no mechanism was used to contain the

23 Theoretically, the main attempts to model the default waterfall of CCPs is by Kuong & Maurin (2020). The distinction between resources that are mutualized and those that are designed to alleviate moral hazard is modeled by Biais, Heider & Hoerova (2012), while Wang, Capponi & Zhang (2018) model explicitly the distinction between default funds and initial margins at the end of default waterfalls.

24 On the policy side, guidelines about risk management in CCPs are part of the Principles for Financial Market Infrastructures (PFMI), issued by the CPMI and the IOSCO (e.g., see CPMI-IOSCO 2017). As pointed out by Braithwaite & Murphy (2016), legal certainty will arguably be critical to handle CCPs defaults in the future.

25 For a brief overview of these three events, see Hills et al. (1999). The events in Hong Kong gave rise to a public report by Davison (1988), whose findings are summarized by Cox (2015).

26 Another example of near-failure, the New Zealand Futures and Options Exchange, is studied by Budding, Cox & Murphy (2016).

growth of large positions, which are arguably more costly to liquidate (and should thus be accompanied by higher initial margins). However, the most novel part of the analysis concerns the existence of severe agency problems around distress. First, evidence of risk-shifting incentives was found (Jensen & Meckling, 1976). Specifically, when the largest member defaulted on margin calls amid falling sugar prices, the CCP realized that this would impair its equity and took the decision to delay the liquidation of the defaulted position. This decision is interpreted as a bet on a price reversal: If sugar prices fall further, the loss for the CCP becomes larger but its equity value is bounded from below by zero (due to limited liability); instead, if sugar prices revert, the member does not default anymore and CCP equity is not impaired. Unfortunately for the CCP, this “gamble for resurrection” did not succeed. Second, Bignon & Vuillemeys (2020) show that the CCP had incentives to misreport relevant information to the regulator (akin to a resolution authority) to obtain a write-down of its debt vis-à-vis surviving members, to the benefit of the defaulted member. In plain terms, the CCP, which usually operates a matched book and thus has no incentives to favor a particular member, can have—in extreme stress scenarios—interests that become aligned with those of defaulting members.²⁷

1.4.3 The Governance of CCPs

Besides financial resources, the governance of CCPs is also essential to their stability, as the historical example of Caisse de liquidation, discussed in the previous section, illustrates. Specifically, CCPs can be organized as for-profit or as member-owned institutions.²⁸ In a member-owned structure, clearing members are also equity holders and play an active role in the management of the CCP. In a for-profit structure, equity holders are external investors pursuing profit maximization. The advantages of for-profit structures are well-known: For example, the interests of equity holders and of other creditors are generally aligned, except when close to distress.²⁹

However, it is doubtful whether the for-profit model is optimal for CCPs, for at least two reasons. First, the market for central clearing is unlikely to be perfectly competitive because of the benefits obtained from multilateral netting. Therefore, the management of a CCP is unlikely to be disciplined by competition. For example, it could charge excessively high clearing fees to members. Second, managers of a for-profit CCP are unlikely to internalize the costs that the default of the CCP may impose on financial markets. We are thus in a situation where equity holders of a CCP may benefit from

27 Bignon & Vuillemeys (2020) show that this further led the CCP to reject value-improving renegotiation plans, which is another form of risk shifting.

28 In the case of for-profit CCPs, an open question relates to the effect of the identity of equity holders. In some cases, the exchange can own the CCP, creating a vertical silo. For example, in 2019, the Chicago Board Options Exchange (CBOE) acquired EuroCCP.

29 For a survey on the governance of for-profit corporations, see Shleifer & Vishny (1997).

risky strategies when they work while externalizing their costs to financial markets at large when they fail. This intuition is modeled by Huang (2019), who provides a rationale for the “skin in the game” that CCP equity holders have (that is, the first tranche of equity in the default waterfall): It provides better incentives to manage risk and avoids too much of the cost of defaults to be shifted to surviving members. This paper also shows, perhaps surprisingly, that a CCP with higher equity also chooses higher margin requirements—a correlation observed in the data (Huang, 2019).

While research on the governance of financial market utilities remains scarce, a few papers suggest that member-owned structures may be preferred.³⁰ This is the case in the work by Huang (2019), in which a member-owned CCP is assumed to solve the social planner problem, rather than to maximize profit. In the presence of large externalities associated with misguided risk management decisions, member-owned structures have advantages: Members should internalize the consequences of mismanagement (e.g., the fact that the market may freeze or dysfunction). Cox & Steigerwald (2016) also point to advantages of member-owned CCPs. They note that a for-profit model is associated with recurring conflicts between CCPs and their members about either risk management (too much risk being taken) or the pricing of clearing services (CCPs extracting rents). A greater involvement of members in the governance of CCPs can mitigate these agency conflicts.³¹ While the advantages of a member-owned model are clear, its costs can be discussed based on the work by Hart & Moore (1996), one of the of the very few papers discussing the governance of cooperatives. In particular, if membership is more diverse and a member-owned institution relies on majority voting, it is possible that inefficient decisions are taken. Another possibility is that current members restrict access to new members to limit competition (e.g., see Story, 2010). Given that the market for clearing is unlikely to be competitive, such attempts may succeed.³²

1.4.4 CCP Fragmentation and CCP Basis

Regarding the design of central clearing institutions, a last topic that has received attention is that of market fragmentation, that is, trade-offs arising from the existence of multiple CCPs for a given asset class. The study of this trade-off goes back to work by Duffie & Zhu (2011). While the use of multiple CCPs within a given asset class may bring benefits in terms of financial stability or regulation, it also breaks netting sets, thus reducing opportunities for multilateral netting. Figure 1f illustrates this inefficiency. In the left-hand chart, a single CCP is between A and B, and the arrows indicate net expo-

30 An older but related literature looked at the trade-offs between member-owned and for-profit securities exchanges. For example, see Pirrong (2000) and Aggarwal (2002).

31 Even in for-profit CCPs, members typically have some role in CCP governance, for example, by participating in risk committees.

32 This mechanism helps explain the wave of stock exchange demutualizations that occurred in the 1990s (Aggarwal & Dahiya, 2006).

tures. If an additional CCP is introduced, then if member A cleared his long position in some security through CCP₁ but his short position is in a highly correlated security through CCP₂, then exposures in the system can be larger in the two-CCP case.

This form of fragmentation has been most carefully studied by Benos et al. (2019) and is shown to give rise to a CCP basis, that is, an equilibrium difference between the prices of two identical contracts, depending on the CCP in which they are cleared. Theoretically, they build a model of inventory management with the following structure: Clients are required to clear transactions with the local CCP, while dealers act as liquidity providers across jurisdictions. This market structure implies that dealers clear similar contracts at different CCPs. This increases their collateral requirements—even more so if inventory imbalances exist across markets. Provided that collateral is costly, this leads dealers to quote higher or lower prices across markets characterized by different levels of local inventories and netting opportunities (as in Hendershott & Menkveld, 2014; Ho & Stoll, 1981). Therefore, this fragmentation gives rise to a nonzero CCP basis.

From this model, Benos et al. (2019) derive a number of predictions that they test using data on dollar-denominated swaps cleared by two CCPs: London Clearing House (LCH) and CME. First, the CCP basis should allow dealers to recoup collateral costs and thus increase when collateral is more costly to pledge. This should be the case either when more collateral has already been pledged or when the credit risk of dealers rises.³³ Empirically, it is indeed the case that the CME–LCH basis correlates positively with these two quantities. Second, the CCP basis should be lower when there are more sophisticated clients who can choose where to clear. Third, the local quoting activity of dealers should depend on local inventories and contribute to reduce the basis. In timeseries specifications, these two other predictions are also confirmed. Finally, the magnitude of the CCP basis over the sample period (2014–2016) fluctuates between one and four basis points, which is economically significant given the large size of swap markets. Clearing fragmentation thus has meaningful asset pricing consequences.

1.5 POLICY INTERVENTION IN CENTRAL CLEARING

CCPs had remained lightly regulated until the global financial crisis of 2008–2009. Since central clearing became mandatory for a large set of transactions, a number of new issues arose. Many of them remain open and deserve further research.

33 One reason why higher credit risk translates into a higher marginal cost of collateral for dealers is because it worsens debt overhang problems associated with entering new trades (Andersen, Duffie & Song, 2019).

1.5.1 Why Mandate CCPs? The Socially Optimal Level of Central Clearing

Central clearing became mandatory for a large set of standardized derivatives following the financial crisis of 2008–2009.³⁴ The clearing mandate was part of the Dodd-Frank Wall Street Reform and Consumer Protection Act in the United States and the European Market Infrastructure Regulation (EMIR) directive in Europe.³⁵ Furthermore, regulation also aimed to penalize transactions that remain bilateral with high margin requirements. The regulators' goal is to move most of the trading volume to CCPs.³⁶ Given that central clearing arose as a private arrangement between investors (Vuillemeij, 2020b) and existed in a variety of markets long before any requirement came into place, a natural question is why central clearing needs to be mandated. In other words, one needs to explain why the level of central clearing that exists between private agents can be too low from a social perspective.

One first possibility is that central clearing is not adopted by private agents because of a coordination failure. This stems from the fact that central clearing features network externalities, like other technologies such as the telephone (Katz & Shapiro, 1985; 1986). Indeed, the possibility to engage in multilateral netting implies that, if everyone is already part of a CCP, a marginal investor also wants to join the CCP. Instead, if no investor is part of a CCP, the incentives to join are nonexistent: For an investor, being the first member of a CCP would imply losing bilateral netting opportunities while not enjoying any benefits from multilateral netting.³⁷ A CCP can thus be created only if a sufficient number of investors coordinate to join a CCP. Historically, it is indeed the case that CCPs appeared primarily in markets where coordination costs are low (e.g., in the interdealer market for OTC derivatives).³⁸ Therefore,

34 Besides Lehman Brothers, the failure of Bear Stearns also played a role in shaping the regulators' decisions (Brunnermeier, 2009). Some papers (such as Cerezetti et al., 2019) challenge the view that CCPs are the best instrument to enhance financial stability. They argue that financial stability is a public good, while CCPs can only manage club goods. Others suggest amendments to existing rules (Murphy, 2020).

35 The Financial Stability Board regularly publishes progress reports on the implementation of OTC derivatives market reforms (e.g., see Financial Stability Board, 2019).

36 Ghamami & Glasserman (2017) use simulations, calibrated to confidential data on the positions of large banks, to argue that the cost advantage imposed by regulators in favor of centrally cleared trades is not clear-cut, even after accounting for higher margins on bilateral transactions. This finding can explain why a significant share of derivative transactions remains uncleared as of 2021. Instead, comparing bilaterally and centrally cleared interest rate swaps using real data, Cenedese, Rinaldo & Vasios (2020) provide empirical evidence that EMIR regulation made bilateral trades more costly.

37 In their simulations for the CDS market, Duffie, Schleicher & Vuillemeij (2015) confirm that the aggregate collateral demand is nonmonotonic in the fraction of centrally cleared transactions. A low fraction of central clearing leads to higher collateral needs (since the loss of bilateral netting benefits dominates), while a high share of central clearing reduces aggregate collateral demand (since benefits from multilateral netting start to dominate).

38 At the end of the nineteenth century, CCPs appeared first in futures exchanges where traders knew each other well or had strong family ties (Depitre, 1907).

it is plausible that some value-enhancing CCPs are not created. If so, the role of the regulator is simply to force coordination on the efficient outcome.

A second general reason why regulators may want to mandate central clearing is because they believe that the level of protection against counterparty risk that agents privately choose is too low. For example, while requiring collateral from each other, agents may still demand too little collateral and thus default too often in equilibrium. This can be because they don't internalize the cost of their default onto other market participants (or on the government and the real economy). Such an argument can be made given any of the theoretical rationales for collateralization (see Section 1.2.2), particularly if the failure of trading institutions is costly, because of, for example, their large size.³⁹

A third possible reason for a clearing mandate stems from friction that may come from an investor who may not be able to observe a counterparty's positions with other investors.⁴⁰ Acharya & Bisin (2014) and Leitner (2012) show that, in this case, the counterparty might leverage excessively, by promising the same amount of resources to various other parties. This gives rise to a counterparty risk externality. Acharya & Bisin (2014) and Leitner (2012) show that inefficiencies coming from this counterparty risk externality can be suppressed if trade occurs via a single counterparty, which is able to observe all transactions. This institution can be interpreted to be a CCP.⁴¹

1.5.2 Moral Hazard and Regulation of CCPs

While central clearing has benefits, mandatory central clearing also has costs. Therefore, it is an empirical question whether clearing mandates bring significant improvements to the functioning of financial markets—and research at this stage remains scarce.⁴² Specifically, mandatory central clearing is likely to create novel agency problems in the form of moral hazard. Moral hazard is of two types. First, the clearing mandate creates moral hazard for the CCP itself. Indeed, before the clearing mandate, CCPs had to attract investors to operate. Afterward, CCPs have a captive clientele, since investors are required to clear and competition between CCPs is limited.

39 A large literature studies the costs associated with bank failures (Ashcraft, 2005) and those more generally associated with shocks to banks (Chodorow-Reich, 2014).

40 Relatedly, Koepl, Monnet & Temzelides (2012) study a case where agents are imperfectly able to write bilateral contracts to mitigate counterparty risk.

41 Interestingly, Leitner (2012) shows that a clearing mandate may not be necessary. By setting position limits appropriately, the CCP can induce agents to clear all their bilateral trades via the CCP voluntarily, even if this involves some small cost.

42 Other aspects of the postcrisis OTC derivatives market reform have been studied more carefully, including centralized trading (Benos, Payne & Vasios, 2020; Collin-Dufresne, Junge & Trolle, 2020; Loon & Zhong, 2016) and the pricing of OTC derivatives (Cenedese, Rinaldo & Vasios, 2020). Rinaldo, Schaffner & Vasios (2020) show that the new regulatory framework induces CCPs to supply large amounts of cash in reverse repurchase agreements (repos) thus decreasing short-term rates.

This mechanism could potentially induce CCPs to relax risk management standards, for example, to attract larger quantities of trades. This is even more the case now that CCPs are becoming an order of magnitude larger than before and are thus more systemic. In a context where they are mandatory, it is hard to believe that distressed CCPs could be resolved just as any other firm. In this context, implicit guarantees exist (France & Kahn, 2016) and have sometimes become explicit in the form of commitments by central banks to lend to CCPs. These guarantees are known to create convexity in the equity value function and thus to incentivize higher risk-taking (see, for example, Keeley, 1990).

Second, while CCP members in an unregulated market have incentives to monitor the CCP (since they bear the cost of its failure), these incentives are weakened when central clearing is mandatory. Instead, members may benefit from loose CCP risk management (lower clearing fees and lower margins) most of the time, also betting on high transfers from the government in stress periods. Thus, not only the CCP but also its members could choose risk to maximize the value of risk transfers to the government.

Given these new agency problems, the regulation of CCPs seems warranted. Unfortunately, at this moment, very little work is being done on the regulation of CCPs. Theoretically, the main goal should be to curb risk-taking incentives. For example, the main topics being discussed in policy circles are standardization of initial margins, constraints on CCP leverage, and more explicit regulation of the recovery and resolution of CCPs. These topics are largely open for future research.

1.6 CONCLUSION

While the literature on central clearing has made significant progress over the past 10 years, a number of important questions remain open. On the theoretical front, there is still no standard model of the capital structure of CCPs, the structure of their default waterfall, their governance, or client clearing. This leaves room for important future contributions, given the centrality of policy debates on this question. That said, how to optimally structure CCPs and their resources must depend on the specific financial friction they are meant to mitigate. In this respect, empiricists should work increasingly on the economic function of CCPs. Whether CCPs are primarily valuable for collateral netting, for enforcement of margin calls, or to mitigate adverse selection or moral hazard problems remains an open question. Relatedly, very little theoretically motivated empirical assessments of the post-2008 reforms have been done. A related topic is also that of the interaction between CCPs and other financial market infrastructures, such as trading platforms or swap execution facilities. Finally, CCPs potentially raise new risks, which are still poorly understood. For policy makers, an open issue is the design of stress-testing exercises that account for the specificities of CCPs and are not just the same tests as those used for banks. More broadly, the potential recovery and resolution of CCPs remains a largely unexplored question.

Summary Points

1. When markets are perfect, the Modigliani-Miller theorem applies and central clearing counterparties (CCPs) cannot create any value. The existence of CCPs presupposes financial frictions.
2. CCPs are counterparties to all traders and can thus set margins based on net positions. Such multilateral netting reduces collateral demand.
3. CCPs mutualize idiosyncratic default risk through default funds and can thus act as insurance providers. Insurance comes at the cost of reduced incentives for members to monitor counterparties when trading.
4. CCPs can avoid socially costly fire-sale dynamics by coordinating traders on a socially preferred outcome after a member defaults (e.g., by applying penalties for low bids in a follow-up auction).
5. Empirical studies show that the introduction of CCPs affects the trading in secondary markets (e.g., a lower required return and less risk) and thereby affects the real economy (e.g., global coffee flows in the nineteenth century).
6. Studies on the optimal design of CCPs focus on several issues: crowded positions that create exposure beyond what member-specific margins account for; the default waterfall; and the level of “skin in the game” for nonmember-owned CCPs, CCP fragmentation, and more generally, the corporate governance of CCPs.
7. The regulation of CCPs is nontrivial. Network externalities create a role for regulators to coordinate investors on a socially desirable equilibrium. However, CCPs are systemic in nature because they absorb all counterparty risk in securities markets. This feature creates a need for regulatory oversight and, potentially, for financial support, which in turn creates moral hazard.

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2 GREEN ANTITRUST: MORE FRIENDLY FIRE IN THE FIGHT AGAINST CLIMATE CHANGE¹

Maarten Pieter Schinkel and Leonard Treuren

“People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices. ... But though the law cannot hinder people of the same trade from sometimes assembling together, it ought to do nothing to facilitate such assemblies; much less to render them necessary.”

Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Book I, Chapter 10.

2.1 INTRODUCTION

The urgency of the climate crisis and the apparent failure of many governments to meet the Paris Agreement objectives have led inspired competition law scholars to push for ‘green antitrust policy’.² The idea behind this movement is to revise the competition rules, as far as they may stand in the way of companies contributing to sustainability factors and a climate-neutral economy. Corporate lobbies claim to want to take more social responsibility for a better world, but that this is impossible without collectively restricting competition first. Acting alone while competing, no company would be able to hurdle the so-called “first-mover disadvantage”. Whereas in cooperation, the argument is, competitors would be able to make the transition to more sustainable ways of production. The transferred concern is that with restrictions of competition potentially being illegal, companies are restricted from taking joint sustainability initiatives through fear of competition law interventions and liabili-

1 We thank Eric van Damme, Marco Haan, Simon Holmes, Edith Loozen and Luc Peeperkorn for useful comments and discussions. Remaining errors are our own. This is an extended and (November 1, 2021) updated version of our paper “Green antitrust: Friendly fire in the fight against climate change,” in: Holmes, S., D. Middelschulte and M. Snoep (eds.), *Competition Law, Climate Change & Environmental Sustainability, Concurrences*, 2021, that is available on SSRN as Amsterdam Center for Law & Economics Working Paper No. 2020-07. Earlier, parts of this paper were published in Dutch as one of the KVS Preadviezen in Haan and Schinkel (2020), titled “Beter geen mededingingsbeperkingen voor duurzaamheid,” and presented in ProMarket (March 26, 2021) under the title “Green Antitrust: Why Would Restricting Competition Induce Sustainability Efforts?”.

2 Townley (2009), Kingston (2011) and Monti (2020).

ties. In response, several European competition authorities are already considering to allow anticompetitive conduct that would be forbidden under the current interpretation of competition law, in return for sustainability benefits. Proposals on how to implement such exemptions of the cartel prohibition, the rules to prevent abuse of dominance, and merger control are being avidly put forward and discussed.³ They are well received by corporates, politicians lawyers and some competition authorities.

The central idea behind the green antitrust movement is that conflicts between market and environment could be resolved by the build-up of market power. Most concrete are proposals to exempt sustainability agreements restrictive of competition from the cartel law, under Article 101(3) of the Treaty on the Functioning of the European Union (TFEU).⁴ In essence, these proposals interpret the advance of sustainability factors as “economic progress”, and an anticompetitive agreement contributing to such progress can be allowed if it gives consumers a “fair share” of the benefits that compensates them for the anticompetitive effects of the agreement. The European Commission set a precedent with CECED (1999), in which avoided emissions of carbon dioxide, sulfur dioxide and nitrous oxide were taken into consideration to allow a collective of washing machine producers to take their least energy-efficient models off the market. Importantly, CECED (1999) was not decided on the projected environmental benefits. The Commission concluded that a typical consumer would be compensated for the increased purchase costs of more energy-efficient washing machines by saving more on electricity bills in use alone.⁵ While the sustainability benefits for all of Europe were valued at more than seven times the higher product price, these were additional collective benefits for which the Commission did not assess the appreciation of consumers.⁶

The green antitrust movement, however, seeks to exempt collaborating companies on decisive compensatory sustainability benefits. From allowing such ‘green cartels’,

3 Panel at the 2019 *Competition and Consumer Day*, 25-26 September 2019, Helsinki; GCLC conference *Sustainability and Competition Policy: Bridging two Worlds to Enable a Fairer Economy*, 24 October 2019, Brussels; Hellenic Competition Commission, *Competition Law and Sustainability*, 28 September 2020, online; OECD, *Sustainability and Competition*, 1 December 2020, online. The subject of green state aid control, which is also part of this discussion, is outside the scope of this article.

4 In US antitrust, wider public policy arguments on welfare merits traditionally have had little traction, see Werden (2014). However, the idea that agreements amongst competitors would be necessary for impactful corporate sustainability efforts is gaining popularity there too. See, for example, Nidumolu et al. (2014), Scott (2016), Henderson (2020), and Polman and Winston (2021).

5 This assessment appears to be based on the presumption that the prices of high-end washing machines would remain the same – for example is no compensation requirement mentioned for consumers who would have bought a more efficient washing machine anyways. Yet the coordinated elimination of a low-end product likely results in high-end product price increases – see Ahmed and Segerson (2011), which discusses the CECED case as lead example. The anticompetitive effects of the collaborative elimination of low-end products are not yet well understood.

6 *CECED* (1999), recital 56.

it seems a small step to condoning other forms of market power-based conduct on the companies' promise to switch to more sustainable production methods. A merger, for example, that leads to appreciable market power yet also promises to shift all production to low-emission plants. Performing the trade-off of expected cost synergies against the anticompetitive effects of a merger quantitatively is standard application in assessing the efficiency-defense in merger control. The Commission is already considering methods for measuring 'green merger efficiencies' in this context.⁷ Also in enforcement against abuse of dominance, there is discretion to take sustainability benefits into account.⁸ For example, a dominant firm that excludes a polluting rival from the market may, in the same spirit, be able to count on a friendly review. The ever more widely felt need that climate change requires immediate action to improve sustainability has created a strong urge with competition authorities to also do their bit.

The Dutch Authority for Consumers and Markets (ACM) is a forerunner of reorienting competition policy this way. In the Spring of 2014, the ACM was obliged by the Dutch Ministry of Economic Affairs to take "sustainability" into account in its application of the Dutch cartel law exemption clause, which is practically identical to Article 101(3) TFEU.⁹ Up to this day very few qualifying sustainability initiatives have come forward. The two cases the ACM has publicly dealt with so far are the *National Energy Agreement* (2013) – hereafter *Coal* (2013) – and *Chicken of Tomorrow* (2015) – hereafter *Chicken* (2015). Both initiatives were denied an exemption. After extensive investigation the ACM concluded that they provided too few sustainability benefits for the respective consumers. Subsequently, the Ministry insisted that "the benefits for society as a whole" must be considered – even though it also remained required that consumers be compensated.¹⁰ Hoping to be able to welcome more initiatives, in July 2020 the ACM published draft *Guidelines Sustainability Agreements*. The requirements for an exemption are clarified by various hypothetical examples of agreements that ACM would not see in conflict with the cartel prohibition.¹¹ More importantly, the draft *Guidelines* make a landmark proposal to lower the threshold for exempting

7 "Green merger efficiencies to be looked at by the EU 'discussion group', Régibeau says", MLEX, 18 November 2020. See Goppelsroeder et al. (2008) on assessing cost efficiencies in merger control.

8 See, for instance, Kadar (2020).

9 Article 6(3) Mededingingswet. The policy rule is Beleidsregel Mededinging en Duurzaamheid, nr. WJZ/14052830, 6 May 2014.

10 Letter of 23 June 2016 by the Minister of Economic Affairs of the Netherlands to the Dutch Parliament, *Duurzame ontwikkeling en beleid. Beleidsregel Mededinging en Duurzaamheid*, nr. WJZ/16145098, 30 September 2016, paragraaf 3.3. The strict compensation requirement was insisted on in a letter of 26 February 2016 by the European Commission, Competition DG, Johannes Laitenberger to Ministry of Economic Affairs of the Netherlands, Mr. Camps, concerning the "Beleidsregels mededinging en duurzaamheid".

11 Authority Consumers and Markets (ACM), *Draft Guidelines Sustainability Agreements: Opportunities within Competition Law*, 9 July 2020.

sustainability agreements: consumers of the good no longer need to be fully compensated if others benefit sufficiently.¹²

The European Commission was called upon by the European Parliament to reconsider how competition policy can best support the Green Deal.¹³ Here too one of the proposals in antitrust is to relax enforcement of the cartel prohibition against horizontal sustainability agreements. Since *CECED* (1999), the Commission has been sparse with exemptions. In the complementary market for household laundry detergents, an accredited industry-wide initiative to promote more concentrated, and therefore environmentally friendlier washing powers – by jointly decreasing doses and packages – turned out to have become a cover for price collusion by the three main producers in *Consumer Detergents* (2011). In several recent cases, the cartels deliberately harmed transitions to more sustainable production. In *Car Battery Recycling* (2017), by fixing lower purchasing prices for their own profits, the four main purchasers of scrap automotive batteries made recycling efforts less attractive for waste disposers, scrap dealers and collectors. Part of the collusion in *Trucks* (2017) concerned a joint delaying by the manufacturers of the introduction of new engine technology that would have given lower emissions. In *Car Emissions* (2021), main German automakers colluded to restrict competition in emission cleaning technology for their diesel cars. They jointly reduced the amount of Adblue injected in the exhaust stream to clean nitrogen oxides (NOx), making their cars more pollutive than they would have been without the illegal cartel agreement.

Just before its 2021 summer break, the Commission made it clear that it would not ease competition enforcement to achieve the Green Deal.¹⁴ In response to contributions received in a public consultation and the conference *Competition Policy Contributing to the Green Deal*, hosted on 4 February 2021 by Commissioner Vestager, on 4 February 2021, the Commission concluded in the Competition policy brief:

“Firstly, environmentally ambitious policies will only be effective if markets respond to the new regulatory signals and incentives without creating distortions to competition, and if firms are pushed to innovate by competing intensely and fairly with each other. For example, EU antitrust rules allow companies to pursue genuinely green initiatives jointly, while preventing ‘greenwashing’ that would harm consumers.”

12 In the revised second draft version, published 26th January 2021 after public consultation, this proposal has been maintained.

13 EU: *MEPs demands fundamental overhaul of competition policy*, CPI February 4, 2019; European Commission, *Competition Policy supporting the Green Deal: Call for Contributions*, Brussels, 22 September 2020. See: https://ec.europa.eu/competition/information/green_deal/ for the response and the conference held February 4, 2021.

14 See Commissioner Vestager’s keynote speech “Competition policy in support of the Green Deal” delivered 10 September 2021 at the 25th IBA Competition Conference and the accompanying September 2021 Competition policy brief “Competition Policy in Support of Europe’s Green Ambition”.

It stresses that a cartel law exemption can only be given if the users of the products concerned appreciate the sustainability benefits that it promises to bring about, and are willing to pay the extra price for it, that would result from the agreement. The Commission thus refuted ACM's wide interpretation of the consumer compensation criterion under Article 101(3) TFEU, to the disappointment of proponents of green cartels.¹⁵

Green antitrust appears very sympathetic: a fast transition to more sustainable production and consumption is essential to the future of our planet, and corporations must certainly take their responsibility for it. Where government coordination fails to nudge the balance from grey to green equilibria – because of lack of information, legal options, political will, or otherwise – perhaps private coordination can come to the rescue. After all, polluting companies will typically know best how to reduce their own externalities. And indeed, green CEOs increasingly stand up for good causes. For some time now, passionate competition law scholars have been hammering home the importance of sustainability.¹⁶ But is contributing to the fight against climate change truly a nail in this case? Or is it rather a screw? Deciding this first is essential when selecting the right tool to use to fix the problem – all the more so when it is urgent. The central question here, therefore, is whether it can be expected that undertakings will take more corporate social responsibility when they compete less. The key premise of the green antitrust movement is that tensions between competition and sustainability can be eased with less competition. But is that premise true?

In this article we review the available economic literature to find that it provides little to no ground for believing that restrictions of competition would incentivize companies to take more sustainability initiatives. On the contrary, it appears that competition induces companies to produce more sustainably, also if they are in part intrinsically motivated to do so. Even if first-mover disadvantage, a concept to which the proponents of green antitrust policy point, would lead to a deadlock preventing more sustainable production, sustainability agreements create no incentive to break that impasse. The rare genuine sustainability agreement cannot justify relaxing general competition rules. It seems proper, therefore, to regard the corporate cheers for green antitrust policy with some skepticism and suspicion. That is also the attitude that we should expect our competition agencies to have. After all, they are tasked first and foremost with the protection of competition.

We warn against two major risks of green antitrust policy. One risk is cartel greenwashing. Competitors who are allowed to coordinate their trade, have an incentive

¹⁵ According to De Brauw Blackstone Westbroek (2021), Commission moves Sustainability Discussion forward by Releasing Competition Policy Brief: "...it remains frustrating that the Commission still emphasizes that consumers should continue to be fully compensated, as opposed to receiving a "fair share" (the latter being the wording of the law and therefore in the ACM's – and our view – [sic] the correct benchmark)."

¹⁶ Holmes (2020), Dolmans (2020) and Karr et al. (2021).

to provide minimal sustainability benefits for maximum price increases. The more accommodating the competition authority, the less green will be delivered. Competition authorities will have to strictly demand sufficient compensatory sustainability benefits, and then constantly monitor exempted agreements. This task requires a staggering amount of information that these agencies cannot reasonably be expected to have. It will tie up a lot of their resources at the expense of other enforcement and advocacy priorities. The second risk is that being able to point to corporate self-regulation gives the part of government that should promote sustainability further excuses to shun their responsibility for designing proper regulation. The green anti-trust movement may thus exacerbate the very government failure it seeks to correct.

This article is structured as follows. In Section 2.2, we set out the conditions for exempting anticompetitive sustainability agreements from the cartel prohibition in the European Treaty. In Section 2.3, we briefly discuss their application in the landmark Dutch *Coal* (2013) and *Chicken* (2015) cases. Section 2.4 then turns to the relevant economic literature. Section 2.5 considers the notion of first-mover disadvantage. Enforcement issues are discussed in Section 2.6, and the argument of crowding out government regulation in Section 2.7. Section 2.8 returns to the pioneering Dutch draft guidelines to discuss the risks of the proposed stretching of the compensation criterion. Section 2.9 concludes.

2.2 CONDITIONS FOR EXEMPTING SUSTAINABILITY AGREEMENTS

A horizontal sustainability agreement in restriction of competition can be exempted from the cartel prohibition if four cumulative conditions specified in Article 101(3) TFEU are satisfied. Together they provide an assessment framework that can be applied using standard economic methods of analysis. The first requirement is that the agreement indeed generates concrete and objectively measurable sustainability benefits. It is well known that people typically have an appreciation for greener products that generate fewer or less-damaging side-effects, such as environmental pollution, and are manufactured under fairer conditions – such as no child labor, good safety at the workplace, no cruelty to farm animals, and above subsistence level wages.¹⁷ These values can be identified and quantified, for example by marketing econometrics or techniques from environmental economics.¹⁸

The second requirement is that consumers of the products concerned receive a “fair share” of the sustainability benefits. For operationalization of this condition, micro- and welfare economics provide a firm conceptual and practical framework.¹⁹

17 Kitzmueller and Shimshack (2012).

18 See, for instance, Hanley and Barbier (2009).

19 A particularly accessible textbook is Stiglitz and Rosengard (2015).

In essence, the appreciation of buyers for a more sustainably manufactured product – be it derived directly from consuming a higher quality good or from appreciation of its positive or less negative externalities – needs to be balanced against the downsides of the anticompetitive agreement made to obtain it, which typically is higher product prices. Not each and every buyer is to be compensated, but “the overall impact on consumers of the products within the relevant market” on average.²⁰ This introduces the need for interpersonal utility comparison, which is somewhat tricky to do, but nevertheless a weighing that economics can help make concrete. The policy has some leeway, because no strict Pareto-criterion is applied – which would give each consumer veto-power. The working interpretation of “fair share” is a share large enough to fully compensate the representative consumer of the product, who should not be worse off with the agreement in place.

The third condition in Article 101(3) TFEU is that the restriction of competition must be necessary for reaping the sustainability benefits. While this may suggest a broad duty of the competition authority to consider and give priority to alternative ways in which the projected sustainability benefits could be achieved – in particular government regulation – in practice the interpretation is narrow. The agreement must not go beyond what is necessary to generate the projected sustainability increase compared with competition. The actual improvement only needs to be marginal to pass the third condition. Government failure has been called on as a justification for green antitrust policy, including by the competition authorities advocating the policy. Yet it does not seem to be the case that the giving of an exemption from cartel law is seen by its proponents as a measure of last resort, that is only to be taken after all the different ways to push government to take regulatory responsibility have been probed. For doing that, competition authorities also lack the mandate and instruments. Whether narrowly or widely interpreted, economic analysis can help assess the necessity condition.

The fourth requirement is that the agreement to be exempted does not ‘eliminate’ all competition around the product concerned. Competition must remain on dimensions such as price, brand image or technological development – with which the European Commission was content in CECED (1999). It does not seem too difficult to argue some dimensions of remaining competition in any case in practice. In particular, a sustainability agreement may involve only the larger companies, excluding small or less efficient producers also active in the relevant market. Such a competitive fringe may be interpreted as remaining competition sufficient for meeting the fourth condition. Economic analysis of oligopoly models in industrial organization can bring out the anticompetitive effects of partial collusion, which can be harmful.²¹

Only agreements on sustainability parameters are meant to be considered for an

²⁰ European Commission (2004), recital 85.

²¹ See Bos and Harrington (2010) and Inderst et al. (2014).

exemption, the ACM insists in its proposal: coordination should not also extend to prices or production. Yet since a transition to more sustainable ways of manufacturing typically implies higher production costs, prices will have to increase with them. It should not be necessary to make price agreements for this, since those costs can be passed through in competition on prices. Yet, under cover of the inevitable price increases, allowing competitors to make sustainability agreements also provides them with opportunity to raise prices by more than what is necessary. They certainly have the incentive for this. It is well known that meeting can easily tempt competitors to talk about prices as well. Frequently, perfectly legitimate coordination between competitors, for example over the implementation of anti-terrorism regulation, product quality standards or R&D, has led to malignant collusion.²² This happened in *Consumer Detergents* (2011). It is quite questionable whether a competition authority will be able to enforce that agreements are limited to sustainability factors alone – however firmly it is stated that exemptions can only be given for the latter. Ultimately, the balancing will have to be between the green advance supplied and the total price increase demanded for it.

2.3 COAL (2013) AND CHICKEN (2015) FELL SHORT

The effective application of the assessment framework by the Dutch competition authority in *Coal* (2013) and *Chicken* (2015) is insightful. The first was an agreement among electricity producers to close five coal-fired electricity plants five years ahead of the regulated schedule. This meant a reduction of approximately 10% of total electricity production capacity in the Netherlands. The ACM calculated that the resulting price increases would give the Dutch, all consumers of electricity, higher electricity costs totaling 75 million euros a year. The benefits would be reductions in emissions. Using quite sophisticated environmental economics, ACM valued these at 30 million euros a year.²³ The benefits were much lower than the harm, mostly because ACM recognized that the prominently claimed CO₂ emissions reductions were not actually there. The reason was that the parties did not intend to take their unused CO₂ emissions rights out of the EU Emissions Trading System, so that the emissions were merely relocated, presenting no benefit to the Dutch consumers. Offered the option to take a compensating amount of emission rights off the market, the electricity companies refused, claiming that this would make the deal too expensive for them. The closures were later brought forward by regulation.

In *Chicken* (2015), the ACM also concluded that the sustainability benefits were

22 See Duso et al. (2014) and Veljanovski (2021).

23 ACM, Analysis of the planned agreement on closing down coal power plants from the 1980s as part of the Social and Economic Council of the Netherlands SER Energieakkoord, 26 September 2013. See also Kloosterhuis and Mulder (2015).

too small compared with the anticompetitive harm. In this initiative, poultry farmers and supermarkets responded jointly to protests of animal rights activists against the poor living conditions of so-called “plofkippen” – ‘exploding chicken’. Farmers promised to improve the welfare of broiler chicken held for this cheapest type of chicken meat for the Dutch market – only about 30% of poultry in the Netherlands, the rest was bred for export. The supermarkets pledged not to import competitive cheap chicken substitutes. The ACM investigation showed that prices would increase by € 1.46 per kilogram of chicken meat, while Dutch consumers valued the better living conditions for chicken at only € 0.82 per kilogram.²⁴ The insufficient willingness to pay reflected that the proposed agreement would achieve only a minimal increase in cage space, and only for a minority of chicken reared for the domestic market. The ACM disallowed the agreement. In 2020, the ACM’s own follow-up research found that the restriction of competition had indeed not been necessary: ‘plofkip’ has virtually disappeared from the supermarkets without agreements.²⁵

2.4 NOT LESS BUT MORE COMPETITION LEADS TO GREATER SUSTAINABILITY

The central question of whether it should be expected that firms will produce more sustainably in an anticompetitive agreement than in competition squarely falls on economics to answer. It is reasonable to base the analysis on two standard premises. The first is that (potential) consumers care about sustainability. Eichholtz et al. (2010) document a higher willingness to pay for office buildings with sustainability labels. Casadesus-Masanell et al. (2009) report a higher willingness to pay for T-shirts made with organic cotton. In a survey of the literature Kitzmueller and Shimshack (2012) conclude that willingness to pay depends in general positively on the degree of corporate social responsibility a firm engages in.²⁶ More recently, Aghion et al. (2020) find that green innovation is positively correlated with consumers’ stated sustainability preferences.

A second premise is that, no matter how noble the initiatives may appear, firms are ultimately driven by profit motives. Rate of return incentives can certainly lead to intricate and forward-looking firm behavior, for instance investing in a good public image in order to attract more consumers. Running up short term losses with a CEO passionate about corporate social responsibility can therefore still be consistent with long term profit maximization. Yet under pressure of shareholders and investors, firms are interested in sustainability initiatives first and foremost to increase their

24 ACM, Analysis of the sustainability arrangements concerning the ‘Chicken of Tomorrow’, 26 January 2015.

25 ACM, Welfare of today’s chicken and that of the ‘Chicken of Tomorrow’, 1 September 2020.

26 See also Gomez-Martinez et al. (2019).

profitability, in particular through buyers' higher willingness to pay.²⁷ The latter are the revenue returns to sustainability investments, which are costs. Therefore, companies will strive for profit-maximizing price increases and sustainability advances, for which cost-minimization is a necessary condition. That these incentives lead to little green is reflected in the literature on greenwashing. Firms certainly like to have a "green" public image, but when consumers cannot assess the true extent of their sustainability investments, they only undertake the minimum.²⁸ In general, we should expect no less, and no more, from for-profit enterprises, both in competition and in coordination.

The relationship between competition and sustainability is studied in a limited but recently growing literature. The current consensus is that competition increases investments in sustainability, with firms investing in sustainability because it lowers their costs or allows them to stand out to consumers. Green, in other words, is a dimension of product differentiation. Bansal and Roth (2000), Porter and Kramer (2006), and Roulet and Bothello (2020) point out that corporate social responsibility (CSR) can be a strong competitive advantage. Graafland (2016) finds in survey data that price competition does not influence companies' environmental performance ratings. Simon and Prince (2016) show that a reduction in industrial concentration in the United States is associated with a reduction in toxic releases at the factory level. Fernández-Kranz and Santaló (2010) and Flammer (2015) find that competition has a positive effect on CSR at the firm level, in studies of variation in import duties and concentration. Aghion et al. (2020) show that the positive relation between consumers' stated sustainability preferences and the probability that a firm engages in green innovation increases with the degree of product market competition. This suggests that as pro-environment attitudes become more common over time, the role of competition in fostering green innovation will only increase. Ding et al. (2020) link antitrust policy to sustainability by showing that stricter competition law regimes are positively associated with CSR, and that this link is stronger in countries where consumers indicate stronger pro-environment attitudes.

Few papers study the relationship between horizontal agreements and sustainability directly. They relate to the literature on exempting research joint-ventures, which can increase R&D investments above competitive levels if spillovers of innovations are so large that unilateral investments are discouraged.²⁹ For this reason, there is a broad exemption clause available for R&D joint-ventures, including for research into more sustainable production methods. However, with limited spill-overs, competition is the stronger driver of R&D. There is concern, therefore, that mergers reduce

27 In addition, in the presence of regulatory failure, firms may benefit from reducing environmental externalities through workers' willingness to accept a lower wage. See de Bettignies et al. (2020).

28 Ramus and Montiel (2005) and Delmas and Montes-Sancho (2010).

29 d'Aspremont and Jacquemin (1988).

innovation.³⁰ Importantly, sustainability initiatives of the kind considered for exemption, such as investments in cleaner technology or better quality of life for farm animals, have little or no spillover from one company to another. These cases, and the current green antitrust debate about advancing a transition to more sustainable ways of manufacturing, are primarily about the implementation of existing cleaner technologies, rather than about innovation.

Schinkel and Spiegel (2017) analyze the link between anticompetitive agreements and sustainability in a two-stage duopoly model where firms first select investments in sustainability and subsequently compete on the product market. They find that allowing the firms to coordinate their sustainability efforts leads to the lowest sustainability levels. Sustainability is a product attribute that consumers care about, and hence is used by firms to compete and attract each other's customers. Schinkel and Treuren (2021) generalize these findings to more firms remaining in competition, varying willingness to pay for sustainable products, and firms' intrinsic motivation to do good. Note that when firms coordinate prices and sustainability investments, sustainability levels are still lower than in competition. This means that if coordinating their sustainability investments allows the companies to collude on prices as well, a risk we noted above, sustainability does not benefit from coordination.

Proponents of green antitrust policy point out that today's corporate leadership increasingly pledges allegiance to take responsibility for stakeholders more widely, including for their environment.³¹ They view profit-driven firm analysis as outdated, and Friedman's appeal to it as an ancient belief.³² Green CEO's may not even be controllable by shareholders anymore if they wanted to. Importantly, however, if firms operate with an intrinsic motivation to produce more sustainably too, investments typically remain higher in competition than with sustainability agreements, and the difference may even become larger. In Schinkel and Treuren (2021), the level of sustainability investments features directly in each firm's objective function, besides in the profits part. Since intrinsically motivated investments are independent of the competitive regime, they are higher in absolute value in both competition and coordination. Moreover, co-ordination reduces the additional intrinsically motivated green investments, since the loss of profit due to increasing sustainability beyond the normal profit maximizing level is larger for firms who jointly decide on sustainability. That an intrinsic motivation to do green makes anticompetitive agreements not more, but rather even less suitable to promote sustainability investments underlines our warning not to lean too far in sympathies for initiatives to take corporate social responsibility jointly.

30 Federico et al. (2018).

31 For example, the reception of the initiative *Business Roundtable, Statement on the Purpose of a Corporation*, 19 August, 2019. Henderson (2020) contains many other examples.

32 Friedman (1970).

2.5 THE FIRST-MOVER DISADVANTAGE IS A RARE PHENOMENON

With the evidence pointing towards more, not less, competition increasing sustainability, on what basis do proponents of green antitrust build their trust of coordinated sustainability initiatives? A term that is often used in this context is ‘first-mover disadvantage’: no single firm would be able to make investments in sustainability because they come with cost increases that necessitate price increases, and consumers would not be willing to pay such price increases.³³ Unilateral initiatives would (temporarily) worsen a firm’s competitive position and profitability. This is seen as an obstacle that only the whole sector could manage to overcome together with coordinated sustainability investments.

We note that the first-mover disadvantage argument assumes that either (potential) consumers have no willingness to pay for sustainable products, that consumers fully free ride on the sustainable consumption of others, or that firms cannot credibly signal that their products are sustainable – or a combination of such conditions. As the empirical literature shows, however, firms can differentiate their products as more sustainable, and consumers do, in general and increasingly, have a willingness to pay for them that is great enough to make unilateral sustainability investments profitable. The first-mover disadvantage therefore seems a rather special case. If, nonetheless, going alone would be loss-making, it is unclear why firms would increase sustainability investments when acting jointly. After all, in that case their joint profitability would still be higher with lower investments. In order to increase sustainability above competitive levels, joint sustainability initiatives will therefore require price increases above and beyond mere cost recoupment in order for their profitability not to decline – while price agreements are explicitly not the aim of green antitrust policy.

It seems that agreements on sustainability in response to a first-mover disadvantage are only likely to increase sustainability if willingness to pay for more sustainable products increases as *a result of the agreement*. This requires consumers to be willing to pay for sustainability, but *only* if sustainability is delivered by coordinated sustainability agreements. It is unclear why this would be the case in general. Two possibilities come to mind, both rather peculiar. One is the case of full freeriding, in which no consumer would buy the greener product, despite having a willingness to pay for it, as long as a grey substitute remains available. This case seems extreme, and where it may exist a candidate for government regulation without the need to reduce competition. The other possibility is that a green corporate cooperative can “educate” consumers on their preferences by forcing them to consume more sustainably manufactured products. That idea may imply a theory of ‘green experience good’. If made to consume more sustainably produced goods really helps to cultivate a willingness to buy them, the kind paternalism required would be more appropriately provided by

³³ For example, ACM (2020), page 15.

the government, acting on democratic mandate, than by a cooperative of corporate interests.

The rare occurrence of a first-mover disadvantage appears to be a weak foundation on which to base a general revision of competition law. In fact, the common term in the literature is ‘first-mover *advantage*’.³⁴ If a good or service can truly only be developed in coordination, an assessment as joint venture seems the more obvious route for progress, avoiding Article 101 TFEU altogether. After all, if green really cannot be a dimension of competition, and no firm would provide a more sustainably manufactured product on its own, it is not clear how competition is restricted by an agreement to offer it, and so why the cartel law would apply at all. All the complexities and stretches of law to obtain exemption possibilities can then be avoided. If not, we note that consumers must have at least some willingness to pay for more sustainably produced commodities in order to be able to enjoy any sustainability benefit at all, which does not appear to be a “fair share” of those benefits by any standard. Without it, the compensation criterion for exemption under Article 101(3) TFEU cannot be met. All in all, it seems that even if the first-mover disadvantage would hold up sustainability initiatives in rare extreme cases, cartel exemptions are not the way to break the impasse.

2.6 GREEN ANTITRUST REQUIRES PERMANENT SURVEILLANCE AGAINST CARTEL GREENWASHING

In view of the incentives that companies face, competition authorities are advised not to put too much trust in the coordinated green promises of corporates. They are likely to fall short of their efforts in competition, so that consumer compensation condition needs to be strictly monitored and enforced, which in turn reduces incentives to invest – as in *Coal* (2013). Since coordination creates a deadweight loss, full compensation of consumers typically leaves the firms with a loss.³⁵

By their decision to purchase the original unsustainable product, consumers reveal a low willingness to pay for the sustainability benefits, which makes compensating them particularly expensive – as in *Chicken* (2015).³⁶ Also with competition remaining on some dimension, as required by the fourth exemption condition, these pessimistic findings continue to hold.³⁷ Maybe this explains why green initiatives are rarely proposed: there simply are few, if any, that can create a welfare increase for consumers while not be loss-making for the businesses. A competition authority that is able to enforce consumer compensation, therefore, will deter most initiatives.

34 For example, Przychodzen et al. (2020).

35 Schinkel and Spiegel (2017).

36 Schinkel and Tóth (2019).

37 Schinkel and Treuren (2021).

Companies that still do apply for exemption with a sustainability agreement, despite the unattractive conditions, have all the incentives to establish the largest possible price increase for the lowest possible sustainability benefits required to compensate consumers. They may be rare exceptions, or they may count on being able to pass the exemption-test of an imperfectly informed competition authority with less than full consumer compensation. In any case, competition authorities will need to bargain with corporate cooperatives for sustainability on behalf of consumers. The initiative will seek to choose a sustainability-price combination on the representative consumer's indifference curve, in order to meet the compensation-requirement. As long as the sustainability-level is higher than in competition – and the agreement at least does not explicitly appear to be on prices – this will satisfy the competition authority in its narrow interpretation of the necessity condition. Importantly however, after exempting such a sustainability agreement in restriction of competition, the welfare objective of the competition authority remains permanently opposed to the profit-objective of the cooperative. The competition authority must therefore strictly and constantly supervise the agreement to ensure that sustainability is in fact being delivered, and that price increases do not exceed what is needed to cover the cost of the sustainability increase.

Proper assessment and surveillance require a staggering amount of knowledge and resources for a competition authority. Even though the burden of proof lies with the firms, the competition authority will need to verify the firms' claims, which essentially requires information about the preferences of all consumers (or even all citizens, see Section 2.7) – not only on the willingness to pay for private goods, but also for public goods and broader environmental concerns such as clean air and biodiversity.³⁸ Acquiring this information, keeping it constantly up-to-date and processing it, appears to be a near impossible task for any competition authority. Green antitrust policy will therefore be extremely demanding on time and budget, crowding out other important competition enforcement objectives. Any information asymmetry in these market oversight games presents a high risk of abuse of the green antitrust policy for cartel greenwashing. Moreover, once an industry has been allowed to make agreements for some time, the higher “but-for” sustainability levels, that could have been had if competition had been preserved instead, become increasingly difficult know, to the point of no longer being knowable. Competition authorities' resources could be better spent than on permanently and imperfectly controlling sustainability agreements to do enough green, when the firms involved would have almost always done more in competition.

38 See Schinkel and Tóth (2019) and Peeperkorn (2020).

2.7 GREEN ANTITRUST EXCUSES GOVERNMENT FAILURE TO REGULATE

In the classical economic approach, damaging side-effects of market interactions are seen as externalities. The solution is to force market participants to internalize these externalities. The social costs of pollution, for example, then become part of the production costs to be expressed in the product prices. Higher prices decrease demand and thereby environmental damage, while higher costs incentivize firms to look for more sustainable production methods. This way, market forces are harnessed to benefit the environment. Through competition, an optimal allocation of production and consumption will result, based on a society's preferences for the climate relative to consumption goods. The efficient allocation of scarce resources over alternative means then remains firmly based on consumer sovereignty, i.e. the preferences of the people.³⁹ Care for the future has a prominent place in this framework. Welfare of future generations is taken into account, for instance through the intergenerational altruism and bequest motives of the current population.⁴⁰ This is also how the future can consistently enter into competition authorities' assessments of green efficiencies.

It is first and foremost a government task to ensure that the social costs of production are reflected in the private costs of manufacturers. This can be done through taxation, or by ensuring that private property rights for climate-related issues are well defined, such that private parties will ensure that the costs of their use will be priced in. Where this is hard to achieve, for instance because the source of pollution remains disputed, governments can use direct regulation to force firms to produce in a more sustainable way. Unsustainable production, like under-provision of public goods, is a well-understood market failure, but it is a government failure that well-known solutions have only been sparingly used in the last several decades. Trying to remedy this government failure by creating a market failure – market power – seems a response that is itself doomed to fail.

To begin with, trying to have private market power advance public interests is orthogonal to key lessons of classical public economic theory. One way of seeing this green antitrust policy is as mandating private companies to increase their prices by an overcharge, i.e. "tax" a private good, and to use that money to finance a compensating public good; sustainability. Samuelson's rule prescribes that public good provision should be increasing with the utility that people derive from the public good. But for an anticompetitive sustainability agreement, the higher the willingness to pay for sustainable products, the *less* sustainability the corporate cooperative needs to deliver to compensate consumers for a given product price increase. After all, consumers with a high appreciation for green can be made indifferent with less of it, compared with consumers that appreciate green little. There is no reason for a green corporate

39 See on a related legal argument Loozen (2019).

40 For instance, Galperti and Strulovici (2017).

cooperative to invest more of its extra revenue in sustainability than it is minimally required to do: the rest it can pocket as profit. Government, though certainly imperfect, at least strives for optimal taxation and break-even public good provision. Companies with market power instead have an incentive to maximize their margin.

In addition, green antitrust policy runs the risk of exacerbating government failure. That governments keep failing to live up to their mandate to guarantee the public interest has many reasons, including public choice incentives ranging from regulatory laziness to outright corruption. Being able to point to industry self-regulation, in the form of sustainability agreements in restriction of competition, is another perfect excuse for governments not to take up their regulatory responsibility. Why the effort to regulate, after all, if government officials can simply rely on private initiatives to help meet sustainability goals? This is exactly how *Chicken* (2015) entered the stage: the Dutch cabinet did not want to improve by regulation the abysmal circumstances in which poultry is reared, because it would apply to all chicken, including the vast majority bred for export purposes. Yet there was strong public pressure to act. The problem was conveniently redirected towards the ACM, which was subsequently reproached for refusing to exempt the meagre initiative. The green antitrust movement therefore insists on a turn that, once taken, risks leading us down a path where competition authorities are accused of standing in the way of sustainability initiatives, behind which accusations firms can hide as an excuse for not becoming more sustainable. That is barking up the wrong tree: where there is a need for coordinated implementation of more sustainable production, government should regulate it, and firms with such green initiatives should lobby the designated public authority for effective regulation, rather than the competition authorities for protection from competition.

2.8 A CITIZEN'S WELFARE STANDARD WEAKENS COMPETITION AUTHORITIES' ABILITY TO BARGAIN FOR GREEN

Even though, after careful investigation, the ACM said “no: too little sustainability” to the initiatives *Coal* (2013) and *Chicken* (2015), the Dutch competition authority seems keen to exempt one sometime. The ACM is leading the way in green antitrust with its recent Draft Guidelines. They importantly relax the compensation requirement by proposing that it can be satisfied if the harm to consumers is exceeded by sustainability benefits for *all* Dutch citizens, consumers and nonconsumers. The benefits to others than the consumers of products concerned are also referred to as ‘out-of-market-efficiencies’ or ‘externality benefits’.⁴¹ The approach implies a fundamental change in the interpretation of the exemption conditions of Article 101(3) TFEU. The ACM interprets “a fair share” as not having to be a fully compensating share for actual

41 Lambertini and Mantovani (2008) find such benefits from a cartel restricting output.

consumers.⁴² With this interpretation of the European Treaty, the Dutch competition authority single-handedly proposes to replace the common consumer welfare standard in European competition policy by a ‘citizens’ welfare standard’. The consequence of this that consumers may end up worse off, the ACM justifies by opining that: “their demand for the products in question essentially creates the problem for which society needs to find a solution.”⁴³ ACM disposes; the polluter pays.

At first sight, this may appear reasonable. After all, the polluter pays principle is well-established and appropriate for internalizing externalities – even though it is certainly not implied by the Coase Theorem. Also, reductions in negative externalities as a result of more sustainable production will typically be appreciated more broadly by more than just the buyers of the product. As said, consumers of a polluting product, by their very choice of buying it, typically value the sustainability benefits least. The full consumer compensation requirement can therefore be seen as discriminating against externality benefits. By no longer requiring full consumer compensation, it becomes possible to exempt more sustainability agreements, which carry lower compensation costs for the corporate cooperative, so may be profitable and thus proposed more. In *Coal* (2013), all Dutch citizens were already taken into account as electricity consumers, so the ACM decision in that case should be the same under the stretched compensation requirement. Yet *Chicken* (2015) probably could have been exempted under the citizens’ welfare standard: counting on the benefits-side vegetarians’ appreciation for improvements in living conditions of industrial broiler chicken as well should make it easily weigh up against the price increases paid by actual consumers of chicken.

The ACM tries to avoid having to revise its decision in *Chicken* (2015), by distancing itself in the Guidelines from sustainability gains other than environmental externalities. It focusses on the prevention of environmental damages, in particular reductions in CO₂ emissions that the Netherlands is bound to by the Paris Agreement, presumably to be on firmer ground for valuing benefits and legitimizing its role as redistributor of wealth. Yet such a distinction between externalities related to environment and other sustainability factors is conceptually weak. Just like air pollution or rising sea levels, cruelty to animals or antibiotic resistance are negative externalities that affect many. Without a good conceptual reason to allow the reduction of the one but not the other to count as sustainability benefits, stretching the compensation criterion is bound to have wide implications for many types of external effects and corporate agreements. Moreover, by merely giving greater weight on the benefit side to the projected sustainability efforts, the stretch of the compensation criterion does not increase sustainability investments. On the contrary: the citizens’ welfare standard just makes more agreements with *the same or fewer* sustainability advances

42 ACM (2020), recital 38.

43 ACM (2020), recital 41.

eligible for a cartel law exemption, while allowing the companies involved to charge consumers larger price increases. In addition, the proposal increases the information required by the competition authority to properly assess sustainability agreements by necessitating knowledge of the preferences of all citizens, rather than just the consumers – which, as said, is a tall order already.

There is a political side to the proposal too.⁴⁴ The citizens' welfare standard implies that the competition authority makes political decisions on redistribution. This is not the case under the common compensation requirement that consumers cannot be worse off. It asks from firms proposing an anticompetitive cooperation with benefits to at least be able to compensate their own customers.⁴⁵ Any benefits beyond that minimum standard are welcome welfare surplus. Under the citizens' welfare standard, however, the competition authority needs to make value-judgements in each and every specific case about the net harm to consumers that the authority finds acceptable in exchange for achieving the benefit for nonbuyers. "How much more is it reasonable for the Dursleys to pay for their chicken breast fillet, to the well-being of all pescatarians?" Moreover, this redistribution that competition authorities would engage in is broadly from the poor to the rich, because of the nature of the products that are particularly eligible for a cartel law exemption: primarily cheap and unsustainably produced goods, such as grey electricity, battery chicken, and low-end washing machines. Affluent nonconsumers with the means already to be self-sufficient with solar-panels, eat free-range chicken and own an A-label washer, will obtain the environmental benefits from forcing more expensive sustainable consumption on others for free. In between are the cooperating firms trying to retain a profit margin for their shareholders.

The stretched compensation criterion substantially lowers the standard for justifying an anticompetitive sustainability agreement. After all, a few nonconsumers who are sufficiently passionate about the benefits of a sustainability agreement can easily tip the balance against any net harm to consumers. The consumer compensation criterion is typically a high bar, for it would take quite a lot of green to compensate consumers with a low willingness to pay for it. The citizen compensation criterion, on the other hand, can be met with a little bit of green for enough nonbuyers against a high price increase. Just like it is expensive to compensate consumers with a low willingness to pay, it is cheap to compensate nonconsumers with a high willingness to pay. Less ambitious in demanding green, the proposal aggravates the risk of abuse by cartel greenwashing. The stretched compensation criterion weakens a competition authority's bargaining position to ask for more green. After all, the more people with an appreciation for a given increase in sustainability are counted on the benefit size,

44 See also Peeperkorn (2021).

45 Salop (2009) approves of the consumer compensation requirement as: "[T]he consumer welfare standard [...] means that anticompetitive conduct is not permitted to redistribute wealth away from consumers. Antitrust law instead involves giving them a property right in the competitive outcome."

the smaller the required compensating increase in sustainability can be. The result is a less strict test that is likely to deliver less green.⁴⁶ It also requires substantial additional information to assess benefits to others than the consumers, that is even less readily available than information on the preferences of just the consumers, making it that much harder to spot the greenwasher. Easier exemptions also tempt further government shirking. All-in-all, there appears to be a lot of collateral damage for we coming corporate agreements that are unlikely to lead to greater sustainability than their participants would achieve in competition.

2.9 CONCLUSION

The task of competition authorities is to protect competition. There is strong indication that competition is also the main force to induce firms to deliver more sustainably produced goods – along with other desired properties, high quality of service, efficient production, low prices, and an optimal allocation of scarce resources. Whenever consumers have at least some willingness to pay for more sustainably manufactured products, corporations are incentivized to deliver them in competition more than when they are allowed to conclude sustainability agreements. The drive to green can be expected to be stronger in competition than in collusion, still when firms have some intrinsic motivation to promote sustainability in addition to their profit motive. The crucial insight is that the difference in sustainability investments between competition and cooperation is positive. That competition, and therefore competition authorities, would somehow be in the way of a more sustainable future is an *idée-fixe* of corporate lawyers mainly – a false self-image, in the case of the ACM.

The European Commission did not fall for the idea, and stressed that: “it’s com-

46 In the context of merger control, the consumer compensation requirement, being a higher standard to meet, has been shown to can induce firms to propose mergers with efficiencies that deliver higher total welfare, depending on the distribution of potential mergers that parties could propose. See Lyons (2002), Farrell and Katz (2006) and Armstrong and Vickers (2010). Nevertheless, the tougher consumer welfare standard may also deter mergers that would have higher total welfare but hurt consumers a little while benefiting the merging parties much more. Merger control lacks instruments to make the merging parties share this surplus post-merger, so that consumers are not worse off. In the case of sustainability agreements, however, where the exempting competition authority already needs to strictly police the compensatory sustainability efforts, it seems possible to require the cooperating firms to shift some of their gain to increase consumer benefits – and the level of green – if the cooperation proposed does indeed generate a surplus in the form of additional profits and green appreciation by consumers and others – possibly also intrinsically by the firms themselves. Note that the fact that the firms are unable to monetize the sustainability benefits to nonconsumers, to use those to compensate their consumers, may indeed block certain sustainability agreements that would have increased extended total welfare, that is, including nonconsumers. The complexity goes to show that this cumbersome form of ‘private taxation’ on the consumers of just some specific products is inferior to regular wide and targeted government taxation.

petition that actually transmits those pressures [to find more sustainable ways to do business] to the boardroom.”⁴⁷ The debate continues, however. Criticism focusses on the Commission’s requirement that a “fair share” for consumers must be a “fully compensating share”, which several legal scholars claim is too strict.⁴⁸ This is a matter of interpretation of the European Treaty, that is for legal scholars and the European courts. Our plea in favor of the strict interpretation is that it offers the best protection against cartel greenwashing. It may be wise to make sustainability cartel exemptions more difficult to obtain than by just insisting on full consumer compensation. For should the meaning of “fair share” in the European Treaty sometime be found not to need to be a fully compensating share, this defense line against greenwashing would break and open the floodgates for thinly green-coated collusion. Additional protection could come from asking more under the indispensability requirement. The Commission has announced to issue revised guidelines on the application of Article 101 TFEU to sustainability agreements soon.⁴⁹

We are not claiming, of course, that the sustainability level in competition is always likely to be socially optimal: when there are externalities it typically is not. This is exactly why there is a clear role for government. The much-needed environmental protection requires a strong government that assigns property rights, levies taxes, grants subsidies and regulates. But it is a mistake to think that market power would make firms internalize externalities. The trust put by the green antitrust movement in anticompetitive agreements is also peculiar in light of several important cartel cases in which the objective of the colluding firms was in fact to eliminate competition in the sustainability dimension. These cases range from the *Phoebus* conspiracy in the 1920’s to reduce the design life of light bulbs, to the recent collusive hindering of car battery recycling, and the cartel members in *Trucks* (2017) and *Car Emissions* (2021) jointly delaying the introduction of lower emissions technologies.⁵⁰ Competitors that are allowed to set minimum sustainability standards in cooperative self-regulation have all the incentives to set that standard lower and slower than would have been in competition.

Conceptually, the green antitrust movement attempts to solve one market distortion – due to the persistence of externalities – by creating another market distortion – market power. In the general theory of second best, two or more market distortions may counteract each other and so improve upon the efficiency of the situation with

47 Commissioner Vestager’s keynote speech “Competition policy in support of the Green Deal” delivered 10 September 2021 at the 25th IBA Competition Conference.

48 See, for example, the ACM Legal Memo, “What is meant by a fair share for consumers in article 101(3) TFEU in a sustainability context?” of 27 September 2021, in which the authority argues there is ground for its interpretation of the text of Article 101(1) TFEU on this point in case law.

49 European Commission, Competition policy brief “Competition Policy in Support of Europe’s Green Ambition”, September 2021, page 7.

50 On the Phoebus cartel, see Krajewski (2014).

only the original distortion.⁵¹ It implies that if there exists an uncorrectable market failure, the optimal government intervention may be in another direction than the first best solution. In the case of competition policy, allowing anticompetitive conduct may be welfare enhancing if regulation is not feasible. A straightforward example would be allowing a merger or a cartel that increases prices that do not reflect the full social costs of production, thereby reducing negative externalities.⁵² The benefits do not go beyond a mere volume effect, however. As we have shown, more market power does not counteract too little investments in more sustainable production technologies – which the green cartel policy aims to stimulate. Furthermore, second best theory reinforces our warnings. It reveals the staggering amount of information required to determine the second best. The social engineering involved in balancing anticompetitive conduct against externalities would overwhelm any competition authority – as well as being at odds with the nature of their task, which is to protect the competitive processes. Done imperfectly, the supposedly counteracting market powers can easily lower welfare and create further inefficiencies. Moreover, the problem of externalities is not an uncorrectable market imperfection, but one that can be directly addressed with far superior solutions than excusing collusion.

Green antitrust is a sympathetic but counterproductive attempt to solve the global climate crisis. Fighting one market failure with another market failure will mostly make matters worse. There is huge potential for welfare improvement by preventing negative externalities and pursuing the positive, public goods. Giving firms market power does not create incentives to tap into that potential, however. On the contrary: growing awareness of the vital importance of a sustainable planet, the rise of civil society, and an increasing willingness to buy from and invest in companies that take a more socially and environmentally responsible stance are ever stronger motivators for firms to offer more sustainable produced goods and services in competition. These hopeful gathering forces for green should be given free rein, rather than be allowed to be suppressed by collaborations that risk collusion. Relaxing the strict competition law enforcement criteria in order to better accommodate generally ineffective sustainability agreements in restriction of competition is not, therefore, a good policy. Such

⁵¹ Lipsey and Lancaster (1956).

⁵² The example is given in Hammer (2000), page 860 as a “provocative” illustration of the second best principle. Hammer (2000) advocates a ‘second best-defense’ for anticompetitive conduct within individual markets in isolation – which is the standard partial equilibrium approach in competition policy – to be based on a total welfare standard. Posner (2001) disapproves of the idea, based on his classic argument that rent seeking cost should be included in the social cost of market power and his assessment that it would make antitrust enforcement “completely unworkable” (page 13, footnote 5). The concept of ‘conservation cartels’, see Adler (2004), is another example. The second best approach was recently called upon by Krugman (2014) to be creative about environmental public policies in the face of politically infeasible better solutions – without suggesting private market power buildup.

a rule of reason approach invites abuse cartel greenwashing.⁵³ Instead, governments should be held accountable for their failure to adequately address damaging production externalities. The right response of competition authorities to a corporate cartel exemption request for its sustainability initiative is referral to the part of government best placed to assess the idea and possibly implement it through proper regulation – rather than stepping in and become an excuse for government failure. However well-intended, the green antitrust movement risks doing damage to both competition and sustainability.

53 Whinston (2006) on page 18 explains how the per se rule against collusion is justified by the high social cost of listening to and evaluating claims of firms caught in price fixing that somehow their cartel was socially beneficial, despite this being theoretically possible. He quotes George Stigler noting: “Economic policy must be contrived with a view to the typical rather than the exceptional, just as all other policies are contrived. That some drivers can safely proceed at eighty miles per hour is no objection to a maximum-speed law.”

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3 THE RISKS OF USING ALGORITHMS IN BUSINESS: ARTIFICIAL PRICE COLLUSION¹

Timo Klein and Gareth Shier

3.1 INTRODUCTION

In this article on the economic consequences of algorithms and the associated risks to businesses, we look at the rise of pricing algorithms.² How do pricing algorithms benefit competition, and how does algorithmic collusion work? How suitable are the current legal tools in dealing with algorithmic collusion? And what do businesses and other organizations using pricing algorithms need to do in response to increased regulatory vigilance?

In 2017, a Danish artificial intelligence company, a2i systems, started offering its services to petrol station operators within Germany. The products that it offers ‘allow [petrol stations] to rapidly and intelligently react to changing customer behavior, changing markets, and unexpected events’.³ The product proved to be very successful; it is estimated that by mid-2018, the adoption rate of automated algorithmic pricing software by German petrol stations increased to around 30%, the majority of which coincided with the well-publicized market entry of a2i systems.⁴

On the one hand, these pricing algorithms enable businesses to set their prices more efficiently and effectively, reducing costs and increasing market efficiency. However, many competition authorities have voiced their concerns that pricing algorithms, such as those offered by a2i systems, may help firms to avoid competitive pressures and (knowingly or otherwise) coordinate with their competitors. Competition authorities are showing an increased willingness to act on this concern, and many authorities have already published studies on the topic.⁵ Moreover, in a press release concerning its proposed new market investigation tool,⁶ the European Commission explicitly cited ‘algorithm-based technical solutions’ and their propensity for tacit col-

1 This article has appeared in the November 2020 edition of the monthly Agenda publication of Oxera Consulting LLP. Link: <https://www.oxera.com/insights/agenda/articles/the-risks-of-using-algorithms-in-business-artificial-price-collusion>.

2 See Oxera (2020a) and Oxera (2020b) for other articles on the economic consequences of algorithms and their risks to business, including risks to algorithmic discrimination.

3 Azisystems.com (2020), ‘PriceCast technology’.

4 Assad et al. (2020).

5 See in particular OECD (2017); UK Competition and Markets Authority (2018); Autoridade da Concorrência (2019) and Autorité de la Concurrence and Bundeskartellamt (2019).

6 European Commission (2020).

lusion as a potential subject for investigation. Given these conflicting perspectives on algorithmic pricing, how might we respond intelligently to its increased use?

3.2 THE PRO-COMPETITIVE EFFECTS OF PRICING ALGORITHMS

Let's start with the positive. As with many more familiar business practices—such as information exchange, asset sharing or vertical restrictions—algorithmic pricing offers many *pro-competitive* and *efficiency-enhancing* effects alongside the potential risks.⁷ There are at least three ways in which pricing algorithms can produce win-win outcomes for both firms and their consumers.

3.2.1 Cost Reductions

It can be difficult for a multi-product firm to identify the 'right' price for all of its products—and this is particularly challenging for online retailers that sell hundreds or even thousands of different products in a fluctuating market with changing costs and inventories. Here, the use of automated decision rules or optimization algorithms when setting prices can lead to significant efficiency gains. These cost savings can then, in whole or in part, be passed on to consumers through lower prices.

3.2.2 Optimal Price Discovery

Well-functioning markets are powerful mechanisms for allocating scarce resources, so long as prices are set 'just right'. If prices are too high, there will be too few consumers willing to buy; if prices are too low, there will be too few producers willing to sell.

Pricing algorithms can help competitive markets function better by improving this overall price discovery process. Using data analytics, pricing algorithms can enable firms to more quickly identify the optimal price—especially in rapidly changing market conditions. Not only will this help the market to find an equilibrium of buyers and sellers, but it will signal where entrepreneurs should focus their resources and efforts to provide the products most valued by consumers.

3.2.3 Reduced Barriers to Entry

Pricing algorithms may also help firms to enter new markets previously reserved for knowledgeable and experienced players. For example, the marketing and pricing of toys previously required good knowledge of what children like and the latest playground trends, typically built on years of experience. However, with the introduction

⁷ See also Oxera (2017).

of online pricing algorithms, manufacturers can now let the data do the work for them, automatically experimenting with different prices for different toys—starting with a small assortment and gradually expanding based on actual sales.

This ability to enter unknown markets and be guided by self-generated data analytics can help level the playing field between new firms and established incumbents. Similarly, existing retailers may find it easier to broaden their product offering and include products about which they may have less expertise.

3.3 WHAT ARE THE CONCERNS

Despite the many potential pro-competitive justifications for the use of pricing algorithms, there is a concern that pricing algorithms may—inadvertently or otherwise—lead to anticompetitive market outcomes. For instance, pricing algorithms may lead to unwanted forms of price discrimination⁸ or increased barriers to entry when reliant on proprietary data.⁹ Furthermore, as we discuss below, the use of pricing algorithms could lead to another prominent concern: algorithmic collusion.

At a high level, it is possible to identify at least four different ways in which pricing algorithms may lead to collusion—each with varying degrees of feasibility in practice.¹⁰

3.3.1 Explicit Algorithmic Collusion

A 2017 EU e-commerce sector inquiry shows that a majority of online retailers use algorithms to monitor competitor prices, with approximately two-thirds using algorithms to automatically adjust prices in response.¹¹

The increasing ubiquity of automated pricing can, however, make it easier for competing managers with malicious intent to implement a price agreement. Rather than having to continuously discuss and calibrate joint pricing behavior, they can now use simple algorithms instead.

The prominent example is the 2016 *GB-Eye Trod case* in the UK (known as the 2015 *Topkins case* in the USA), in which competing online poster sellers were charged for using pre-programmed pricing algorithms to coordinate prices in a differentiated and unstable market.¹² This is, of course, just as illegal as conventional cartel arrangements contrived in smoke-filled rooms. The key difference, however, is that

8 UK Competition and Markets Authority (2018).

9 Autorité de la Concurrence and Bundeskartellamt (2019).

10 The categorization here can be seen to build on the ‘messenger’, ‘hub-and-spoke’, ‘predictable agent’, and ‘digital eye’ categorization in Ezrachi and Stucke (2017).

11 European Commission (2017).

12 United States Department of Justice (2015).

the algorithm made the implementation and monitoring of the agreement far more straightforward.

3.3.2 *Algorithmic Hub-And-Spoke Collusion*

A second way in which pricing algorithms can undermine competition is through a ‘hub-and-spoke’ construction. Here, a common supplier (the ‘hub’) coordinates the prices of downstream competitors (the ‘spokes’), without the need for these downstream competitors to formulate a horizontal agreement among themselves.

While illegal, building a solid case around allegations of hub-and-spoke collusion is generally more difficult than explicit horizontal collusion—as it requires proof that the downstream ‘spokes’ that are competing with each other are aware of the likely collusive consequences when giving up their pricing autonomy.¹³

The UK Competition and Markets Authority has already voiced concerns of algorithmic hub-and-spoke collusion in the context of third-party pricing software providers—their concern being that a dominant pricing software provider in an industry may act upon its ability and incentive to deploy algorithms that take into account the pricing spillovers of competitors—effectively orchestrating collusion.¹⁴

A specific allegation of digital hub-and-spoke collusion was voiced in a 2016 US class action against Uber, which alleged that Uber acted as a hub in a hub-and-spoke conspiracy by orchestrating the prices of its drivers through its common surge-pricing algorithm.¹⁵ The class action against Uber was eventually dismissed on the grounds that Uber competes with transport more generally, including public transport.

It is important to note that there is to date no *empirical* evidence that the use of third-party pricing software providers leads to collusive outcomes. Notwithstanding this, the increased use of vertical relations in algorithmic price-setting does raise clear *theoretical* concerns about the ability and incentive of firms to coordinate prices.¹⁶ The fact that this coordination occurs via a *vertical* channel raises the concern that the line between an illegal explicit cartel and legal tacit collusion may become much more blurred.

Platform operators and pricing software firms that supply to competing firms are therefore likely to receive increased scrutiny for their role in the price-setting behavior of competing businesses.

13 OECD (2019).

14 UK Competition and Markets Authority (2018).

15 *Spencer Meyer v Travis Kalanick*, 15 Civ 9796; 2016 US. Dist. Lexis 43944.

16 Harrington (2020).

3.3.3 Tacit Algorithmic Collusion

Collusion may not always be explicit. Pricing algorithms may also enable firms to unilaterally implement strategies that have the effect of preventing aggressive pricing in the market—in effect, reaching a tacit collusive outcome that is nearly impossible to prosecute.

However, reaching a stable but silent understanding on high prices is not easy. Firms have different cost structures and inventories, and new firms may enter the market and demand may fluctuate—factors that destabilize a tacit understanding to keep prices high.

At the same time, the practical feasibility of tacit human collusion because of algorithms should not be discounted. As RepricerExpress, a leading e-commerce pricing software supplier, communicates:

Instead of worrying so much about having the lowest costs among your competitors, RepricerExpress recommends avoiding a price war as a technique for coming out on top. [...] Within RepricerExpress, there are features to help sellers detect and avoid a price war.¹⁷

For a competition authority, any ambition to ‘avoid a price war’ may sound like an attempt to collectively maintain high prices and is accordingly a red flag—even if it is achieved tacitly and via an automated process.¹⁸

Moreover, pricing algorithms may be specified in ways that *unwittingly* lead to higher prices. For instance, recent academic research has shown that when competing algorithms fail to properly account for each other’s prices, which is often the case, they may underestimate their *own price elasticity*—the downward response in demand for their own product(s) when they increase prices.¹⁹ The net effect is that firms set prices too high.

Other academic research has shown that when competing algorithms have similar perceptions of what the optimal price points are, they may end up experimenting with equivalent prices. This, in turn, may cause them to see higher prices as optimal, not knowing that it is because they have managed to reach a supra-competitive coordinated outcome.²⁰

While such learning specifications might be regarded as irrational or suboptimal, and not technically collusion, their use may still be explained by current limitations in what pricing algorithms can or cannot do in practice.

17 Repricerexpress.com (2020).

18 Autoridade da Concorrência (2019).

19 Cooper et al. (2015).

20 Hansen et al. (2020); Svitak and Van der Noll (2019).

3.3.4 Autonomous Algorithmic Collusion

The biggest concern may arise, however, when algorithms can learn to optimally form cartels all by themselves—not through instructions from their human masters (or some irrational behavior), but through optimal autonomous learning (i.e. ‘self-learning’ algorithms). Such an outcome, were it to occur, may be very difficult to prosecute, as businesses deploying such algorithms may not even be aware of what strategy the algorithm has learned.

The big question, though, is how practicable such autonomous algorithmic collusion is in practice. Two recent academic papers have shown that such autonomous collusion is, in principle, feasible.²¹ The research is based on computer simulation experiments in which competing firms learn to set optimal prices using *reinforcement learning*—i.e. where the algorithm learns through independent trial-and-error exploration. Both papers find that the firms indeed learn collusive strategies in which they keep prices high to match their competitors, and only undercut and compete if their competitors do so.

However, many practical limitations for such autonomous algorithmic collusion remain—such as the need for a long learning period in a stable market environment. However, these papers show that autonomous algorithmic collusion is, at least in principle, possible. Moreover, advances in artificial intelligence may be able to deal with these practical limitations sooner than we might expect.

3.4 OLD WINE IN NEW BOTTLES?

Examining concerns around algorithmic collusion raises questions regarding practical feasibility and the apparent suitability of the current enforcement framework—something that is still often overlooked.

For instance, when discussing the *GB-Eye Trod* posters case, it is often quickly pointed out that this is ‘just old wine in new bottles’: this was a standard price-fixing cartel between competing sellers, but implemented using simple rules-based pricing algorithms.²² The existing Article 101 TFEU antitrust framework is suitable to deal with such cases, and the case has been successfully prosecuted in the UK and USA based on incriminating email correspondence. However, the key point is that managers may succumb to the temptation of such a form of algorithmic collusion much earlier, as it is relatively easy to implement—and increasingly so, with the growing availability of off-the-shelf pricing software.

Conversely, when discussing concerns around tacit algorithmic collusion or

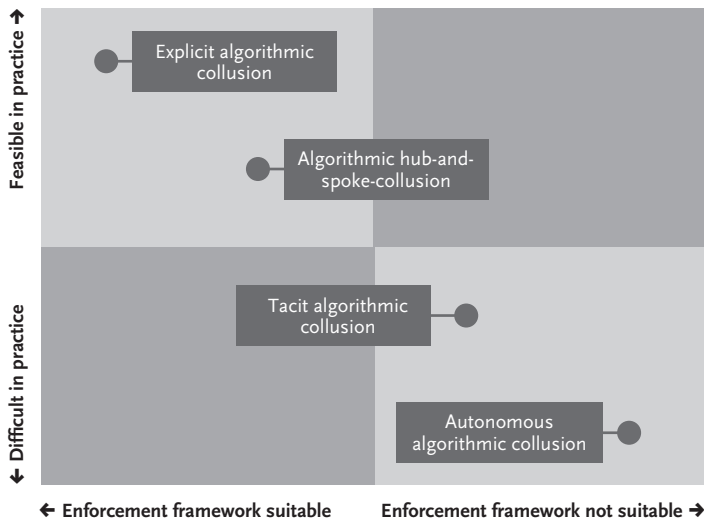
²¹ Klein (2020) and Calvano et al. (2020).

²² Li and Xie (2018) and Schrepel (2020).

autonomous algorithmic collusion, competition authorities may find it very difficult to build a case in the absence of explicit communication or proof of a ‘meeting of minds’ by the firms involved.²³ However, in such cases it should also be recognized that it is much more difficult to successfully reach a stable collusive outcome.

Figure 1 provides a stylized illustration of this general tension between practical feasibility and enforcement. This tension may offer authorities some degree of comfort: either algorithmic collusion concerns can be tackled using existing legal and compliance tools, or else the concerns are less likely to occur in practice.

Figure 1: Tension between Practical Feasibility and Enforcement Concerns



Source: Oxera

However, it should be noted that this relationship is not static—and we turn to this matter next.

3.5 AI ANTITRUST ON THE MOVE

Businesses and other organizations using pricing algorithms—or keen to explore their potential—must be increasingly aware of any anticompetitive consequences that may result from their use of pricing algorithms. This need is driven by two forces: Technological advances and increased regulatory vigilance. Technological advances refer

²³ Ezrachi and Stucke (2017) and Harrington (2018).

to developments in computer science and artificial intelligence that make novel types of anticompetitive conduct increasingly feasible. With increased regulatory vigilance we have in mind that digital conduct previously unnoticed is now increasingly on the radar of authorities that are both willing and able to act.

The first force – technological advances – pushes the dots in Figure 1 upwards. While previously even explicit human collusion using algorithms was difficult due to the absence of off-the-shelf pricing algorithms, this is no longer the case. Increasingly, businesses are relying on pricing software, possibly supplied by a common pricing software provider, raising concerns about the incentive and ability for hub-and-spoke collusion. And while autonomous algorithmic collusion is still only shown in computer simulations, its practical limitations may soon be dealt with by novel advances in artificial intelligence.

The second force—increased regulatory vigilance—pushes the dots to the right. Business may no longer find comfort in the fact that even if their conduct has an anticompetitive effect, enforcement may be too difficult to pursue.

3.6 ANTICIPATING REGULATORY VIGILANCE

So what can businesses expect from authorities? First, machine learning tools can similarly be used to detect cases of collusion.²⁴ For instance, the French Competition Authority recently created a digital economy unit to develop these competencies (in the same way as several other authorities).²⁵

Second, the use of pricing algorithms by firms will be increasingly scrutinized or even audited. As John Moore, Etienne Pfister, and Henri Piffaut (the last two of whom are the Chief Economist and Vice-President at the French Competition Authority respectively) recently proposed:²⁶

[...] firms could be required [...] first to test their algorithms prior to deployment in real market conditions ('risk assessment'), then to monitor the consequences of deployment ('harm identification').

Moreover, the US Deputy Assistant Attorney General for Criminal Enforcement, Richard Powers, recently stated:

24 Huber and Imhof (2019).

25 Autorité de la Concurrence (2020).

26 Moore et al. (2020).

*Just as there's a role for corporate compliance programs in deterring price fixing that occurs in traditional smoke-filled rooms, there's a role for corporate compliance programs in preventing collusion effectuated by algorithms.*²⁷

This echoes earlier statements by EU Competition Commissioner Margrethe Vestager, who remarked on the 'need to make it very clear that companies can't escape responsibility for collusion by hiding behind a computer program'.²⁸

3.7 CONCLUDING REMARKS

Pricing algorithms have great potential for the promotion of competition—they can reduce costs, increase market efficiency, and promote market entry. These benefits can apply to a markets as diverse as petrol pricing, airline tickets, e-commerce, and financial market trading.

However, this does not mean that the authorities have no need for concern and vigilance. There are legitimate concerns regarding competition. On the German retail petrol market, a recent academic working paper shows that the rise of pricing algorithms has led to reduced competition and increased margins—up to 28% for areas where two competing petrol stations both adopted algorithmic pricing.²⁹ The study highlights that it is a strictly economic assessment and does not pass any legal judgment on whether there is anticompetitive behavior—but results like these will attract the attention of authorities and regulators.

Overall, the benefits that pricing algorithms can provide to firms and their customers are desirable. When pursuing these benefits, businesses and other organizations using pricing algorithms need to also reflect on the competition concerns involved—so that they can show that they are indeed getting their margin on the merit.

27 MLex (2020).

28 Vestager (2017).

29 Assad et al. (2020).

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