DISCUSSION PAPER SERIES

DP16678

Competition and Misconduct

John Thanassoulis

FINANCIAL ECONOMICS

INDUSTRIAL ORGANIZATION

ISSN 0265-8003

Competition and Misconduct

John Thanassoulis

Discussion Paper DP16678
Published 30 October 2021
Submitted 22 October 2021

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

Competition and Misconduct

Abstract

Misconduct is widespread; practices such as mis-selling, pump&dump, and money laundering harm counterparties while raising profits. This paper presents a mechanism which can determine what sorts of misconduct can be sustained in competitive equilibrium in concentrated markets, oligopoly settings, and in markets with many small competing firms. The model studied allows general demand and makes a distinction in types of ethical dilemma using current psychological understanding. The paper shows, for example, that markets with many small competing firms are not vulnerable to misconduct if firms respond to entry with niche strategies or if the ethical dilemma draws an emotional response.

JEL Classification: N/A

Keywords: N/A

John Thanassoulis - john.thanassoulis@wbs.ac.uk
Warwick University and CEPR

Competition and Misconduct*

John Thanassoulis†

October 22, 2021

Abstract

Misconduct is widespread; practices such as mis-selling, pump&dump, and money laundering harm counterparties while raising profits. This paper presents a mechanism which can determine what sorts of misconduct can be sustained in competitive equilibrium in concentrated markets, oligopoly settings, and in markets with many small competing firms. The model studied allows general demand and makes a distinction in types of ethical dilemma using current psychological understanding. The paper shows, for example, that markets with many small competing firms are not vulnerable to misconduct if firms respond to entry with niche strategies or if the ethical dilemma draws an emotional response.

*My sincere thanks go to Philip Bond and three anonymous referees whose direction and comment have allowed me to greatly improve the exposition and scope of this paper. I am also particularly grateful for the discussions and advice I have received from Pablo Beker, Amil Dasgupta, Stephen Dimmock, Martin Dufwenberg, Simon Gervais, George Loewenstein, Margaret Meyer, Rani Spiegler, Anjan Thakor, Nikos Vettas, John Vickers and Paolo Volpin. Any errors are mine alone. My thanks for the comments from seminar audiences at Cass Business School, the UK Competition and Markets Authority, King's College Business School, University of Warwick, the Illinois State University Institute for Corruption Studies, the 2nd Bristol Workshop on Banking and Financial Intermediation, the 2018 Imperial College & Bank of England Conference on Competition and Regulation in Financial Markets, the CRESSE 2018 International Conference on Competition and Regulation in Crete, the 2019 Innsbruck Winter Summit on (Un)Ethical Behavior in Markets, the 2019 EARIE Conference in Barcelona, the 2019 Econometric Society Winter School in Delhi, the 2020 Cambridge Corporate Finance Theory Symposium, the Universities of Nottingham, Gothenburg, and Geneva. The views in this study cannot be taken as representing the views of any of my affiliated institutions. An earlier version of this paper was circulated with the title "Market Structure, Managerial Ethics, and a Theory of Corporate Misconduct".

†Professor of Financial Economics, Warwick Business School, University of Warwick; CEPR; Panel Member, UK Competition and Markets Authority; Associate Member, Oxford Man Institute, University of Oxford. john.thanassoulis@wbs.ac.uk

1 Introduction

Misconduct is widespread in Financial Markets. Recent types of misconduct which have been prosecuted and resulted in fines being levied include mis-selling and pressure-selling (for example by Financial Advisors in the UK, Australia and the US)[1], pump & dump schemes such as made famous in the *Wolf of Wall Street* (also known as 'ramping')[2], and money laundering[3].

This paper presents a mechanism which can determine what sorts of misconduct can be sustained in competitive equilibrium in concentrated markets, oligopoly settings, and in markets with many small competing firms. The model studied allows general demand and makes a distinction in types of ethical dilemma using current psychological understanding.

A simple link between the level of competition and misconduct is elusive. Empirically one can point to prominent misconduct cases in industries with many small competing firms, and also in concentrated markets. For example in the UK mortgage default insurance, known as PPI, was mis-sold in a very crowded market (6,619 active firms in 2008) resulting in tens of billions of pounds in fines.[4] While in concentrated markets, the fixing of the London Inter-Bank Offered Rate (LIBOR), which was set set by between 7 and 18 member banks, provides an example.[5]

Theoretically also, seemingly good arguments exist linking misconduct both with concentrated markets and ones with many competing small firms. One might reason that concentrated markets are more vulnerable to misconduct as a small amount of misconduct by a large firm creates a large increase in profits, and a small amount of misconduct is hard for a regulator to catch. The opposite view would contend that perhaps many small firms in competition are more likely to engage in misconduct: such firms make only small profits in the absence of misconduct creating a strong incentive to misconduct, and further as each firm has a small market share, any misconduct would only harm a small number of people and so be more palatable ethically. A deeper analysis is therefore required to identify what vulnerabilities different market structures have to misconduct.

To identify the link between misconduct and competition, this paper adds two new characteristics to a model of competition. The first is to make a distinction in the class of demand functions between ones which model niche-markets versus demand functions

[1]In the UK see the PPI scandal, in the US see Egan et al. (2016), in Australia see the Australian Royal Commission into Misconduct in Banking.

[2]See Geddis vs. FCA, Georgiou vs SEC, Heath vs. ASIC, Galas et al. vs. SEC, all cited in FMSB (2018).

[3]See recent cases involving ABN Amro vs. Dutch Public Prosecution Service and Natwest vs. FCA.

[4]Fines exceeded £50 billion and the sales techniques used included training in '*disturbance techniques*'. For evidence see Commission et al. (2009) §2.54, https://www.theguardian.com/business/2011/may/05/how-ppi-scandal-unfolded

[5]For evidence see links at https://www.justice.gov/opa/pr/barclays-bank-plc-admits-misconduct-related-submissions-london-interbank-offered-rate-and .

modelling mass-market competition. The second innovation is to draw on advances in psychology to make a distinction between misconduct which arises from moral dilemmas which generate an emotional or instinctive response, versus ones which generate a non-emotional or reasoned response.

Niche vs mass market demand.

If a number of firms were to enter a market, then each incumbent firm would suffer a negative shock to its volumes and so would wish to reoptimise against its residual demand. One option is to raise prices so as to increase the profits made from the remaining inframarginal consumers. This is labeled a niche-strategy. The alternative approach is to lower prices so as to try and win back some of the marginal consumers who leave for the entrant(s). This is labelled a mass-market strategy. The niche strategy is optimal when the proportion of inframarginal consumers with high valuations for the firm's product is large enough. In this case increased competition does not lower margins, it instead causes them to rise. In the mass-market setting increased competition sees margins drop towards zero, and products can be thought of as being commoditised as many consumers do not value the product they buy significantly more than a rival's. To allow for this richness in competitive response the paper adapts the random utility model (Perloff and Salop (1985)), which others have noted can accommodate both cases (Gabaix et al. (2016)).

Examples of niche financial markets in which margins remain high despite substantial competition are plentiful. Ausubel (1991) and Stango (2000) demonstrate that credit card interest rates are significantly in excess of the costs of funds, even though there are hundreds of competing banks issuing cards. Hortaçsu and Syverson (2004) document evidence of high mark-ups in the mutual fund market, even when the market has hundreds of competitive funds.[6] Biais and Green (2019) document that margins for OTC providers trading corporate bonds have remained high despite substantial competition, whereas equities exchanges secure much lower margins, a finding consistent with the arguments that OTC markets separate themselves into niches according to the level of counterparty transparency they offer (Claessens (2019), Easley et al. (1996)). Specialised lending secured on aircraft or medical equipment is a further example (Remolona et al. (1992)).[7]

An alternative definition of niche markets is one in which own firm cost pass-through is greater than one. Suppose that a firm suffers an upwards shock to its own marginal cost. In response the firm will have to adjust its price, and ultimately an optimal response will be achieved when marginal revenue rises to equal marginal cost. The firm therefore faces the same trade-off as above: whether to increase its prices by less than the cost shock, lowering margins so as to keep marginal consumers, or whether instead to raise

[6] Niches in fund management can be created by the type of asset invested in. For example the Financial Times in *Hedge fund GSA moves low-cost fund into high-fee markets*, Nov 2 2020, cites niche funds targeting German power, cheese, sunflower seeds and cryptocurrencies.

[7] Mass market setups occur when differentiation is harder and so products become commoditised, such as in the provision of Independent Financial Advice to consumers for example.

prices by more than the cost shock and so seek to profit from inframarginal consumers. In a niche market there are enough inframarginal consumers that the firm will prefer to raise prices by more than the cost shock; the own-firm cost pass-through will exceed one (Weyl and Fabinger (2013)). There are few empirical studies of cost pass-through rates in Finance at the firm level.[8] Own-firm cost pass through can be estimated however as Besanko et al. (2005) demonstrate. They find that pass-through rates are significantly greater than one for 14% of products in a major Chicago supermarket chain and reach to a high of 558% (for beer).

Types of moral dilemma

Recent advances in psychology have identified a link between the nature of a moral dilemma, the specific region of the brain used to resolve it, and the subsequent nature of our moral reasoning. It is known that humans exhibit two modes of reasoning: fast versus slow, intuitive versus the use of reason (Kahneman (2011)). It is also known which parts of the brain are responsible for the two types of thinking. The reasoning part of the brain is associated with the dorsolateral prefrontal cortex (DLPFC) while the instinctive response is mediated by the ventromedial prefrontal cortex (VMPFC).[9]

Moral dilemmas can be categorised by the part of the brain they trigger. Greene et al. (2001) confirm that intuitively personal moral dilemmas induce an instinctive response which is mediated by the part of the brain associated with thinking fast (the VMPFC). A prominent example of such a moral dilemma is the *transplant problem* (Thomson (1985)). Other types of moral dilemma can be categorised as intuitively impersonal and are reliably mediated by the part of the brain responsible for thinking slow (the DLPFC). An example of such a moral dilemma being the *trolley problem* (Thomson (1985)).

Further work builds on this insight to reveal a link between the category of moral dilemma and the nature of the philosophical reasoning it will induce. By linking brain region through fMRI to methods of philosophical reasoning Greene et al. (2004) argue that: impersonal moral dilemmas, ones which are non-emotional and trigger a thinking-slow response, cause the agent to behave *as if* they are consequentialist. Whereas personal moral dilemmas, ones which are emotional and trigger a thinking-fast intuitive response, cause the agent to behave *as if* they are deontological. Consequentialism demands that agents weigh up the consequences of their actions and act to yield the best overall consequences.[10] In a deontological approach rules dominate (an approach which is closely associated with Kant (Kant (1785))) though the emotional response can be over-ridden

[8]Most empirical studies focus instead on industry-wide pass-through of tax or exchange rates. See for example Bodnar et al. (2002), Poterba (1996), and Besley and Rosen (1999). Market-wide cost pass-through rates are less illuminating for the curvature of demand as these rates also depend on a conduct parameter which is model specific and, in general, depends upon the competitive conditions (Weyl and Fabinger (2013)).

[9]Davidson and Irwin (1999), Reiman (1997), Drevets and Raichle (1998).

[10]Consequentialism, and the related concept of utilitarianism are associated with Mill and Bentham (see Mill (1863)).

when the stakes are large enough (Nichols and Mallon (2006)).

It is an open question which types of misconduct opportunities in finance present an emotional moral dilemma (triggering a thinking-fast reflex) versus a non-emotional moral dilemma (triggering a thinking-slow reflex).[11] Those who are better at solving mathematical problems are more disposed to consequential reasoning and so think-slow more readily in response to moral dilemmas (Paxton et al. (2012)). Finance is likely to contain many such mathematically adept people. Actions which directly cause harm to others, particularly if the link to the decision maker is immediate or physical, are likely to engender an emotional thinking-fast response (Royzman and Baron (2002), Greene and Paxton (2009)). I conjecture that being invited to practice money laundering with a significant suspicion that the funds have an illegal source, or contemplating lying to support a pump & dump strategy, are likely to generate an emotional i.e. thinking-fast response to the moral dilemma. While I conjecture that pressures to engage in mis-selling, cherry picking[12] or front-running are more likely to generate a non-emotional response which would therefore trigger the thinking-slow reflex.

Model results

The two innovations in this analysis – demand type (mass vs. niche) and moral dilemma type (emotional vs. non-emotional) – allows this paper to establish, and then study, a correspondence between the number of competing firms and the vulnerability of the market to misconduct.

The first result of this study is to demonstrate that in the case of non-emotional moral dilemmas, that is ones which trigger a thinking-slow response, more competition increases misconduct in a mass-market framework, but reduces it in a niche market framework. The equilibrium level of misconduct is governed by the balance of three forces: more misconduct (1) raises profits; (2) as the ethical dilemma causes the agent to act as if she is a consequentialist it increases the disutility from being unethical; and (3) it increases the probability of being caught and so the expected penalty incurred. The equilibrium misconduct level sets the net effect of these forces to zero.

Suppose a new firm were to enter the market whilst matching prices, then volumes would fall for each of the incumbent firms, and so therefore would profits. But we show that there would be no incentive to alter misconduct levels – the lower volumes would lower the benefit of misconduct in raising profits, but would also lower the disutility of misconduct arising from ethics, and would lower the expected penalties through their dependence on volumes.[13] The net result would be no change to misconduct despite the

[11] One well-established result which is arguably less relevant here is that damage in one of the brain regions causes the other to be favoured (Mendez et al. (2005)).

[12] The practice in which a trader conducts multiple trades on the same day and assigns the best ones to his account and the less good ones to the client's. See for example Aviva vs. FCA cited in FMSB (2018).

[13] The penalty to being caught need not be an explicit regulatory fine. Penalties can be generated by

drop in profits.

However prices would not stay unchanged after entry; firms would alter their prices downwards if they compete to win back marginal consumers (a mass-market strategy), or upwards if they price to exploit inframarginal consumers (a niche strategy). Suppose the firms respond to entry by raising their prices, so that price-cost margins grow even as volumes fall. Now though all three forces towards misconduct shrink (profits, ethics, penalties), the break applied by penalties falls less rapidly than the other two as penalties are, in part, a function of profits, and profits equal volume times margin. As margins grow with the niche strategy the penalty effect shrinks more slowly than the other two – and so more competition results in less misconduct in this setting. With a mass-market approach the intuition is reversed.

The second result is to demonstrate that in the case of emotional moral dilemmas, oligopoly competition can generate multiple equilibria in which the market can be clean, or feature widespread misconduct; by contrast markets with many small firms are always clean, and concentrated markets are clean in mass-market settings, but foster misconduct in niche-market settings. The emotional nature of the moral dilemma creates a significant emotional fixed-cost from engaging in any misconduct. Multiple equilibria can be sustained if there is enough profit from misconduct to counteract the fixed ethical cost – in oligopoly settings this can be achieved. With many small firms however the profits available, whether practising misconduct or not, are low, and so it is not worth the disutility of introducing misconduct. Hence the market is clean.

The third result is to establish when more competition lowers consumer surplus overall due to misconduct. More competition improves consumers' choice, and so improves the match between client and service provider. More competition also lowers prices in mass-market settings. However in such mass-market settings misconduct levels in response to non-emotional moral dilemmas increase, and this pushes down on consumer surplus. Which effect dominates? I show that if consumers' valuations are drawn from the uniform, power law, or Weibull class[14] of density functions then more competition ultimately always lowers consumer surplus – the misconduct harm outweighs the benefits of the greater choice and lower prices. However if consumers' valuations are drawn from the normal distribution, then ultimately more competition must raise consumer surplus overall. The difference arises from the specific shape of the tails of these different distributions.

The fourth result is to draw out the implications as to when a financial market improves from professionalisation. Professional bodies mandate a given level of training

reductions in future payoffs – for example a CEO losing their position (and therefore the rents associated with it) after unethical firm behaviour due to investor or consumer pressure (Hart and Zingales (2017), or *CEOs Are Getting Fired for Ethical Lapses More Than They Used To*, Harvard Business Review, June 06, 2017).

[14]With shape parameter greater than 1.

to join, and often require ongoing training as well. This training widely includes ethics which are tested in an exam format.[15] Such training, if successful, conditions members to see ethics in terms of rules and to develop an instinctive response as to whether the rule has been broken or not. An implication of professionalisation is therefore to make ethical choices analogous to the emotional moral dilemma variety. Building on these insights I argue that professionalisation offers a clear advantage in markets with many small competing firms in which demand induces mass-market competition. This would rationalise the professionalisation of IFAs and suggests it might be advisable to extend it to the sellers of mortgages, though not of credit cards. However professionalisation offers little in concentrated markets, and may be harmful in oligopolies by generating scope for multiple equilibria and so misconduct outcomes. This rationalises the UK institutional choice to not require professionalisation amongst fixed income, commodities and currency traders.

Paper structure

In the next sections I discuss the related literature, present the model formally, and then establish the four main results described above. I then study an asymmetric duopoly version of the model which allows me to establish a channel for ethics to spillover across a market. Subsequently I consider multiple extensions to the harm, detection and punishment functions to demonstrate the robustness of the results. Finally I consider the empirical predictions of this study and explore the available empirical evidence on competition and misconduct. I then conclude. All proofs are in the appendices.

2 Literature Review

Many have noted the desirability of introducing moral reasoning into economic modeling (Arrow (1973), Hausman and McPherson (1993)). However the majority of the literature has eschewed attempts to deal with ethics. Instead the literature has identified a number of different avenues by which competition may lead to undesirable outcomes. Gabaix and Laibson (2006) explore firm competition when consumers are behavioural and ignore likely future purchases – they show that exploitative pricing can survive in competitive settings. Easley and O'Hara (2019) study a network model of an exchange and establish conditions on the density of the network which allows misconduct to spread. The two most relevant settings for this work concern the link between competition in banking and risk taking, and the separate debate as to whether competition encourages R&D.

Keeley (1990) started a lively, and ongoing, debate in the banking literature asking whether or not competition leads to more fragile banks as a result of greater risk taking. Keeley's seminal work hypothesises the break on risk taking is the worry that a bank

[15] An example being the CFA qualification exams.

will lose its charter and so all the future rents associated with it. If regulations should change to permit bank entry, then future profits will decline. Keeley (1990) demonstrated empirically in US data that as Tobin's Q declines (so future profits are anticipated by the market to be lower) banks choose to be riskier with lower capital-to-asset ratios, and higher interest rates required to attract large certificates of deposits.[16] The present study shows that it would be misleading to conclude from this literature that misconduct moves inversely to profits. Firm profits are lowest in competitive markets when firms have small market shares – but these settings have low levels of (or no) misconduct when margins do not fall with competition and the dilemma is a non-emotional one; further, if the ethical dilemma over misconduct is an emotional one then no misconduct despite low profits and competitive markets is expected whether in the mass-market or niche-market setting. Secondly, profits can fall because volumes decline or because margins are squeezed. In the the benchmark model of this study there is no effect of volume loss (alone) on misconduct levels as it affects all the forces incentivising misconduct proportionately (profits, ethics and sanctions); it is simultaneous changes in margins and volumes which can alter the balance of these forces by changing one force (sanctions) faster or slower than the other two (profits and ethics). This study highlights the composition effect of volumes and margins in determining profits when considering misconduct.

If misconduct were observable then choosing some misconduct is a cost-saving change in the production process which one might expect can be thought of as akin to an R&D or quality choice. There is a literature on whether competition encourages or deters R&D, an important contribution being Vives (2008). However the literature offers little insight into the link between misconduct and competition. The question of misconduct differs fundamentally from that of R&D due to timing and observability. In the simplest formulation of the R&D debate, firms decide first how much to innovate, they incur the sunk costs of seeking innovative products and the consumers observe the products built. Subsequently the firms compete. In competitive markets profits will be low, therefore in the prior innovation stage firms will be less inclined to incur the fixed costs of R&D and so will innovate less (Vives (2008)).[17] When studying misconduct the natural timing is reversed and misconduct is not observable. Reversing the timing implies that first firms set prices and clients choose their providers. Then firms may engage in misconduct. The unobservability of misconduct creates a difference in response between those with rational

[16]Empirically this link has been contentious. It is not found by Goetz (2018), Boyd and De Nicolo (2005) or Schaeck et al. (2009) for example. But it has found support in Beck et al. (2006) and for the loan market in Jiménez et al. (2013).

[17]At the logical extreme therefore, a monopolist would have the greatest incentive to pay for an innovation – a point prominently made by Gilbert and Newbery (1982). The R&D literature has significantly extended this insight, in particular by considering dynamic innovation as this generates a new "escape the competition" effect. Running neck-and-neck can cause firms to put more effort into innovations for the future (e.g. Aghion et al. (2001)). Empirical evidence supports that this effect can cause competition between firms to increase expenditure on future innovation, but reduce expenditure on current assets (Thakor and Lo (2019)).

expectations versus those without.[18] This study explores how volumes and the price-cost margin together alter the ethical distaste, profit incentive, and sanctions deterrent. The final result is nuanced with economic intuitions which do not have analogues in the R&D debate.

The work here complements reputation models in which firms commit to a quality which is declared through a signal, and then compete (e.g. Rhodes and Wilson (2018), Ely and Välimäki (2003)). Firms do not publicly offer misconduct as a service, and misconduct in finance (e.g. money laundering) can be conducted opportunistically, so the setting is quite different. Further, the foundational works in this reputation field require consumers to punish firms for ever when they are found to have lied about their quality (e.g. Klein et al. (1981)). However in the case of misconduct it is more common for fines to be paid and then for the firm to carry on competing with the promise of a new adherence to sound ethical conduct.

I believe this paper is the first attempt to try to interact ethical decision making about misconduct with product market competition in financial markets, and the mechanism discussed is likely to offer insights into markets beyond finance. In an influential essay Shleifer (2004) suggests that ethical behaviour may be a normal good – that is a good the demand for which increases in income. It follows that as profits decline in competitive settings agents will be less ethical.[19] The contention that wealthier people are more ethical is debatable. And formal modelling of ethics and competition identifies a previously unknown connection between niche vs mass markets, moral dilemma (emotional vs non-emotional), and the mapping between competition and misconduct.

Perhaps the most prominent work on ethics in financial markets (and similar settings) is that offered by Bénabou and Tirole (2006, 2011). In these works the authors develop the argument that agents care about the image they project to others and to themselves. Thus non-altruistic behaviour will be engaged in if the observer is not likely to conclude, as a result, that the agent is bad. Our setting here abstracts from these principal-agent concerns and instead studies ethics in a firm context. Important contributions here have focused on the screening effects of employment contracts: Song and Thakor (2019a,b), Bénabou and Tirole (2016), Carlin and Gervais (2009); and beyond finance, Besley and Ghatak (2005), and Gorton and Zentefis (2019). These contributions explore equilibria in which the remuneration incentives are competitively adjusted so that some firms attract the most able, or those with a focus on *purpose*, whereas others accept that agents will come who are less ethical and so prone to excessive risk-taking. This approach differs

[18] In misconduct cases often clients are not assessing the probability that their service provider is lying, that their IFA is seeking to harm them, or that their counterparty is conducting an illegal pump&dump scheme.

[19] Shleifer (2004) suggests that misconduct is widespread beyond financial markets, and identifies competition causing misconduct in the following settings: child labour, corruption of government officials, high executive pay, earnings manipulation, and the commercialisation of the market for education in the US.

from the present study in which the ethical actions across the market are studied as a function of the incentives created by the competitive setting alongside owner-managers' ethical preferences.

Finally note that there exists an important literature on corruption amongst officials and whether or not competition between firms enhances or diminishes graft. Prominent contributions here include Bliss and Tella (1997), Acemoglu and Verdier (2000), and Ades and Di Tella (1999). Corrupt officials extract a tax off firms by requiring kick-backs for licenses to operate. Firms' ability and willingness to pay declines in competition; but with more competing firms officials may still prefer to engage in graft. There is therefore a trade-off in this literature between extracting large payments from a few large firms, versus extracting small payments from many small firms. Note that officials seeking a kick-back are absent from the present analysis and so the works speak to distinct settings: market conduct versus corrupt officialdom.

3 Model

There are n firms competing. Each firm produces a single type of product or service at constant marginal cost c. The firms compete in a three stage game. In the first stage the firms simultaneously and publicly decide on the prices they will charge for the service offered $\{p_i\}$. Consumers select their providers for the service. In the second stage each firm privately decides whether, and to what extent, it will engage in misconduct. Misconduct allows costs to be decreased or profits increased by an amount $y_i \geq 0$ per unit. In the final stage the regulator attempts to prove that misconduct occurred and will issue fines if successful. The firms are run by owner-managers who have ethical qualms. We will study sub-game perfect equilibria in pure strategies of this game. Initially we will focus on symmetric such equilibria. In the main discussion therefore managers are homogeneous allowing us to study industry-wide misconduct. We will always focus on equilibria which are stable.[20]

There is a unit mass of consumers who all value the service on offer enough to purchase. Each consumer has expected utility from the service offered by seller i of x_i, a random variable drawn from the probability density $f(\cdot)$. We assume the firms are equally attractive so that the expected utility is drawn from the same density function. The density function $f(\cdot)$ is assumed positive on its support, (a, b) where $b = \infty$ is permitted, differentiable almost everywhere, and has bounded expectation to guarantee interior solutions. After purchase from firm i, the realised utility for the consumer $(\tilde{x}_i)$ is the sum

[20] An equilibrium is stable if, were each firm to alter its actions at a rate proportional to the local first order gain, then small deviations from equilibrium would be damped and lead the system back to the equilibrium values. See, for example, Dixit (1986) with a textbook treatment available at Anishchenko et al. (2014) Chapter 2.

of random noise plus the expected utility, x_i. This noise term has zero mean if the firm has been honest, and has negative mean if the firm has been practising misconduct. This is formalised by:

$$\text{Realised utility, } \tilde{x}_i = \begin{cases} x_i + \varepsilon & \text{no misconduct} \\ x_i - \alpha y_i + \varepsilon & \text{misconduct.} \end{cases}$$

Where ε is a zero-mean random variable. The parameter $\alpha > 1$ captures the propensity of the misconduct to cause harm: for each \$1 gained by a firm through misconduct, the client loses \$$\alpha$. This is an extension of the random utility model (Perloff and Salop (1985)) and would collapse back to the standard model if the expected valuation for product i, x_i was equal to the realised valuation $\tilde{x}_i$, which would occur if there was no misconduct cost to consumers ($\alpha = 0$) and no noise term ($\varepsilon = 0$).[21]

The adaptation of the random utility model in this study allows us to separate the price paid for the financial good or service from firm i to the realisation of the financial returns from the product. Examples of unethical practices captured by this model were given in the Introduction. For example, pump & dump is captured by having the price p representing the cost of the shares purchased by the client, the realisation of the future share value is captured by $\tilde{x}_i$, and the reduced costs for the firm through being able to source low-cost low-quality shares and sell them as high-quality is captured by y_i. The harm can also impact on wider-society rather than the client (e.g. money laundering).

A proportion r of consumers have rational expectations. These consumers draw appropriate expectations as to misconduct from the prices observed at stage 1, and $r = 1$ is permitted. The remainder, proportion $1-r$, have passive expectations. These consumers are naive and do not anticipate misconduct. Such consumers capture many examples such as the mis-selling of mortgage default insurance (PPI) to UK consumers. This model would also fit situations in which consumers, though aware of the malpractice, decline to alter their purchasing decisions. This is known as the *intentions–behaviour gap* in marketing science (Auger and Devinney (2007), Carrington et al. (2010)).

For reasons which will become apparent if the reliability function generated by the density of expected utilities, $1 - F(x)$, is log-concave then the demand system generated models mass-market competition. Whereas if the reliability function is log-convex niche competition is captured. Example distributions generating mass-market competition include the normal, uniform, power law and the Weibull with shape parameter at least 1; while the Weibull with shape parameter less than 1, and the Pareto density function

[21] Random utility models capture that a firm cannot predict the value a consumer has for its product, nor any given rivals' products. There is a positive probability that a consumer might leave one firm in response to a price rise and migrate to any of the other competitors. It is therefore an elegant way of extending the Hotelling duopoly framework to competition with multiple firms without the strong restrictions on preference orderings enforced by circular city models.

model niche-market competition (Bagnoli and Bergstrom (2005)).

We can illustrate the distinction between niche and mass-market generating density functions. Consider the residual firm-level inverse demand curves at symmetric, though not equilibrium, prices for the Pareto distribution (log-convex reliability function, niche-market competition) and the Normal distribution (log-concave reliability, mass-market competition). These are plotted in Figure 1. It is immediate from the figure that, compared to the Normal distribution, the Pareto distribution causes a clockwise rotation in the residual demand curve around the candidate equilibrium price–quantity pair. This creates a substantial minority of inframarginal consumers who value the product very highly, while the Normal distribution has a smaller dispersion in residual valuations. As prices are not in equilibrium, the larger proportion of high valuation inframarginal consumers with the Pareto distribution encourages the firm to deviate in response to its residual demand by raising price. In the Normal distribution case the more profitable deviation is to seek to capture more marginal consumers by deviating to lower prices (Johnson and Myatt (2006)).

The second way to identify niche markets, beyond pricing behaviour in response to entry or to disequilibrium, is via the own-firm cost pass-through rate. A firm's residual demand is log-concave (log-convex) if and only if own-firm cost pass-through is < 1 (> 1).[22] If the reliability function in the random-utility model, $1 - F$, is log-concave then each firm's residual demand curve is also log-concave (Quint (2014)); so mass-markets with respect to entry have own-firm cost pass-through rates below 1. The converse that niche-markets with respect to entry have own-firm cost pass-through rates greater than 1 has been confirmed numerically (Quint (2014), §4.2), but cannot be shown analytically with existing analytical techniques.

In the third stage the regulator will look for evidence to substantiate a fine in the case of misconduct. Suitable evidence would need to show managerial intent and would typically require internal documents or other corroborating evidence. The greater the level of misconduct, y_i, the easier it is to find such evidence of a policy of misconduct. The probability of successful prosecution is therefore modeled as $\varphi \cdot y_i$; increasing in y_i as $\varphi > 0$. In the event of a successful prosecution, a proportion $\delta > 0$ of profit is confiscated in the form of damages. These assumptions yield a tractable analysis, but they can be relaxed and we do so in Section 6.

Each owner-manager optimises her misconduct decision. To capture the ethics of the

[22] This was noted in Bulow and Pfleiderer (1983) with a full discussion offered in Weyl and Fabinger (2013). The result can be shown directly. Define the price-cost margin of a firm as

$$\mu := p - c \;\Rightarrow \frac{dp}{dc} = \frac{1}{1 - \mu'},$$

where $'$ denote derivatives with respect to own price. Hence the cost pass-through is larger than one if and only if $\mu' > 0$. But the firm's first order condition yields that $\mu = -q/q'$ which is the reciprocal of $-(\log q)'$.

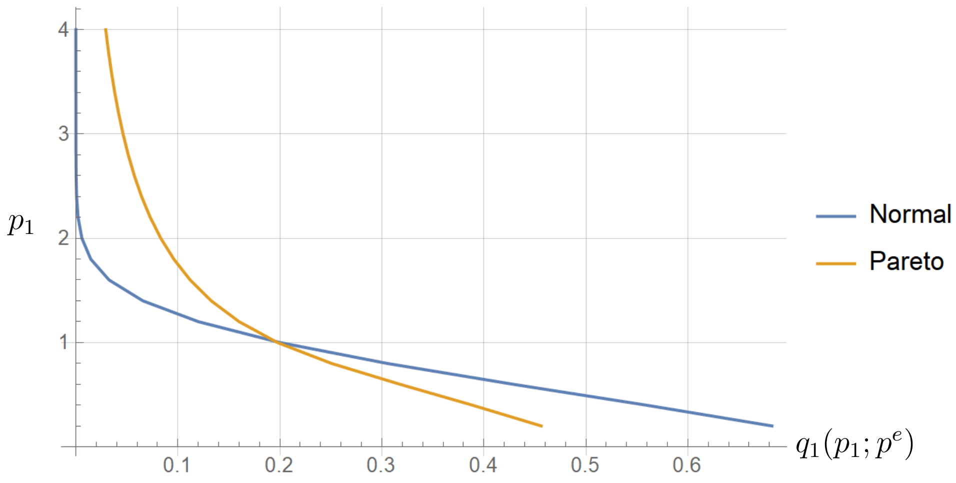

Figure 1: Inverse demand curves. The curves set $n = 5$, and common price $p^e = 1$. For the Normal distribution $\mu = 2, \sigma = 1/2$, for the Pareto the shape parameter is $\beta = 2$. The analytical expression for the residual demand curves is given in (13). The figure depicts passive expectations consumers ($r = 0$).

owner-managers alongside other considerations I model overall utility secured as:

$$U_1(p_1, y; p^e) = q_1(p_1; p^e)\left[(p_1 - c + y)(1 - \varphi y) + \varphi y(1 - \delta)(p_1 - c + y)\right] - \begin{cases} \omega\alpha q_1(p_1; p^e)y & \text{for non-emotional dilemmas,} \\ \kappa \mathbb{I}_{y>0} & \text{for emotional dilemmas.} \end{cases} \tag{1}$$

The top line reflects that there is a probability $1 - \varphi y$ of not being convicted, but if convicted damages are a proportion δ of profits. If the dilemma being modelled generates a non-emotional reflex, triggering the thinking-slow response, then we know the agent will behave *as if* she is consequentialist. This is achieved by causing the manager to dislike conducting misconduct by an amount $\omega \cdot \alpha y \cdot q$. This term is increasing in volumes (i.e. the number of clients harmed); it is increasing in the harm done to each client (αy) and therefore increasing in the level of misconduct. The weighting term ω captures the agent's willpower – her propensity to act in accordance with her moral reasoning (Roberts (1984)).[23] If the dilemma being modelled generates an emotional reflex, triggering the thinking-fast response, then we know the agent will behave *as if* she is deontological. This is achieved by creating a discontinuous reduction to utility $\kappa \cdot \mathbb{I}_{y>0}$ which is triggered by any misconduct, but does not grow in the number of consumers affected or in the extent of misconduct.

I have conjectured that money laundering is an emotional moral dilemma which triggers a thinking fast reflex. This asserts that money laundering would be seen by a financier

[23] This model of consequentialism rationalises, for example, a preference for fairness in offers made in the ultimatum game (Camerer and Thaler (1995)).

as morally wrong by reflex. This is because money laundering is often linked to predicate offences which have generated the proceeds to be laundered, often drug dealing or other organised crime (see Alldridge (2001)). But such reflexes can be over-ruled if the benefits are great enough (Nichols and Mallon (2006)) – a point permitted by the utility function (1). I have also conjectured that mis-selling is a non-emotional dilemma which triggers a thinking-slow response. This asserts that the moral status of mis-selling is not clear beyond doubt. But if the clients are vulnerable people who will incur significant harm[24] then the harm parameter α will be high, and potentially high enough for misconduct not to occur. In short this model offers a clearly derived functional form for managerial utility which draws from the evidence of neuroscience and the insights of philosophy.

4 Main Results

In this section we will establish the vulnerability to misconduct of concentrated markets, oligopolies, and markets with many small competing firms. We do this for non-emotional moral dilemmas in Section 4.1, and for emotional moral dilemmas in Section 4.2. We consider whether increasing competition can harm consumer surplus, given the potential for misconduct, in Section 4.3. In Section 4.4 we study when improving ethics improves market outcomes and draw out implications for the professionalisation of Finance. The proof of all the results of this section are contained in Appendix A.

4.1 Non-emotional Moral Dilemmas and Market Misconduct

In this section we explore the link between competition and misconduct when the moral dilemma generates a non-emotional reflex, so triggering the thinking-slow response. In this case we know agents reason as if they are consequentialist.

Proposition 1 *For non-emotional moral dilemmas (trigger thinking-slow) we have the following characterisation. If the product of the proportion of rational consumers and the harm from misconduct is not too high,*

$$\alpha \cdot r < 2, \tag{2}$$

then there is a threshold number of competing firms, N, such that for any stable symmetric equilibrium:

1. *In a mass-market framework:*

    (a) *There is no malpractice if the number of competing firms $n \leq N$.*

[24] An example being the elderly as a referee has rightly identified.

(b) *The level of misconduct is increasing in the number of competing firms, if the number of firms competing is greater than the critical threshold, N.*

2. *In a niche-market framework:*

   (a) *When n is below the threshold N there is a positive level of malpractice which declines in the number of competing firms.*

   (b) *There is no malpractice if the number of competing firms $n > N$.*

3. *If condition (2) does not hold then any symmetric equilibrium is without misconduct.*

The proof first solves the second stage of the owner-manager's decision making. Given a price set in stage 1, the objective function is concave in misconduct. The optimal level of misconduct as a function of the stage 1 price is found, noting that the optimal is bounded below by zero misconduct. We can then determine the indirect utility of the owner-manager as a function only of the price set by embedding in the subsequent choice of misconduct. In a stable symmetric equilibrium, no owner-manager will have an incentive to deviate from the equilibrium. This generates a first order condition which can be used to solve the competitive game between the owner-managers. This establishes a relationship between equilibrium prices and number of competing firms in any stable symmetric equilibrium. By then applying the optimal stage 2 behaviour we establish the relationship between equilibrium misconduct and the number of competing firms, which is reported in Proposition 1.

To develop the intuition underlying Proposition 1 we start by noting that we can rewrite each owner-manager's utility function (1) as follows:

$$U_1(p_1, y_1^*(p_1); p^e) = \overset{\underline{\text{ethics}}}{-q_1 \cdot \omega\alpha y_1^*(p_1)} \quad \overset{\underline{\text{sanctions}}}{-q_1 \cdot \varphi\delta y_1^*(p_1) \cdot (p_1 - c + y_1^*(p_1))} \quad \overset{\underline{\text{profit}}}{+q_1 \cdot (p_1 - c + y_1^*(p_1))}$$

Where $y_1^*(p_1)$ is the optimal misconduct level chosen at the second stage as a function of price (and established formally in (15)). The above formulation makes clear the three conflicting forces acting on the owner-managers: ethics, and sanctions deterrents, versus the inducement of profit. It is helpful now to consider the stage 2 incentive to increase misconduct, that is holding the price firm 1 has set as fixed:

$$\begin{array}{cccc} & \underline{\text{ethics}} & \underline{\text{sanctions}} & \underline{\text{profit}} \\ \frac{\partial U_1}{\partial y_1} = & q_1 \cdot (-\omega\alpha) & -q_1 \cdot [(p_1 - c + y_1) \; + y_1]\,\varphi\delta & +q_1 \\ & \uparrow & \uparrow & \uparrow \\ & \propto \text{ volumes} & \propto \text{ profits (+ volumes part)} & \propto \text{ volumes} \end{array} \tag{3}$$

Equation (3) demonstrates the impact of marginal changes in misconduct levels on the three key forces – ethics, sanctions and profits. At an optimal level of misconduct, these three forces must be balanced to set (3) to zero. Note that ethics and profits move in proportion to volumes. The effect of sanctions can be split into two; one part is proportional to volumes, but more importantly is a second part which is proportional to volumes times margins, that is to profits.

Consider now the thought experiment of an extra firm entering the market at some price. We will first consider the incentive for say firm 1 to alter her misconduct in stage 2, holding her own price constant, followed by the full incentive to optimise against entry.

The immediate implication of entry, before any competitive price response, is that volumes, and therefore profits, fall. Consider again the stage 2 incentive to increase misconduct, holding prices fixed, captured in (3). There is no incentive on firm 1 to alter her misconduct; the set of forces determining misconduct outlined in the first derivative (3) remain balanced. With firm 1's prices constant but volumes reduced, the ethics effect declines, but so do the sanctions and profits effects – and all at the same pace.

We establish that firms do not just respond to lower volumes and therefore lower profits with more misconduct. We must understand the effect of entry on profit margins, that is on prices.

Let us now consider firm 1's first stage response, that is the optimisation of prices to adapt to new entry. Firm 1 might lower her prices to try to attract back some marginal consumers – the mass-market strategy, or she might raise prices to extract greater rents from her remaining inframarginal consumers – the niche strategy. Suppose the market adapts to new entry by firms raising their prices and pursuing a niche strategy. (This is the case if the own-firm cost pass-through rate is greater than 1). Such a price response lowers volumes, and of course raises margins. Turning to the resultant misconduct decision in (3) we again note that the volume effect is common across the three forces, and so does not cause a change in the balance of the incentives. The margins effect however increases the deterrent from misconduct whilst not altering the other two forces.

So in the niche competition case entry causes firm 1's volumes to fall but her prices, and so margins, to rise. It follows from the volume reduction that the magnitude of the three forces (profits, ethics and sanctions) are all reduced. However the margin increase implies that the sanctions effect is reduced less rapidly than the other two. In other words, though entry lowers the absolute magnitude of the break to misconduct from ethics and sanctions and also lowers the absolute magnitude of the incentive to misconduct from the chance to profit, the margin effect means the sanctions effect declines less rapidly than other two forces. So the balance of incentives tips against misconduct.

In this benchmark model the main determinant of the probability of conviction for misconduct is the magnitude of misconduct the manager chooses. In Section 6.3 we allow this conviction probability to also depend on volumes so that entry, which lowers volumes, weakens the ability of a regulator to detect and punish misconduct. This reinforces the results for mass market settings, but weakens the results for niche markets.

Consumers who have rational expectations anticipate that the firms will conduct some misconduct and so lower their overall utility from whichever product is bought. It follows that such consumers are less responsive to firm-level price differences as they understand that price reductions will be, in part, clawed back through extra misconduct. This lowers the elasticity of demand with respect to price of such consumers and so acts to raise the equilibrium price level. This therefore lowers the equilibrium level of misconduct by the logic above. However, even if all consumers are rational then misconduct cannot be ruled out if the harm done to consumers is not too high.[25] If the misconduct is very harmful to consumers however then rational consumers would distrust low prices sufficiently to render the market clean.

Proposition 1 has empirical implications for the link between misconduct with respect to non-emotional moral dilemmas (trigger thinking slow) and the degree of competitive tension in mass and niche markets. I defer the discussion of these empirical implications and the available empirical evidence to Section 7 below.

4.2 Emotional Moral Dilemmas and Market Misconduct

In this section we consider the second type of moral dilemma – one that generates an emotional response, triggering the thinking-fast reflex.

Proposition 2 *For emotional moral dilemmas (trigger thinking-fast) stable symmetric equilibria when rationality or harm caused is not too high (product $\alpha \cdot r$ satisfies (30)) are characterised by:*

1. *In a mass-market framework there are two double-thresholds of competition: $(\underline{\nu}_2, \overline{\nu}_2) \subseteq (\underline{\nu}_1, \overline{\nu}_1)$.*
   - (a) *There is no misconduct equilibrium if $n < \underline{\nu}_1$ or if $n > \overline{\nu}_1$.*
   - (b) *When the emotional disutility of the moral dilemma (κ) is small:*
     - i. *Any symmetric equilibrium is one of misconduct for $n \in (\underline{\nu}_2, \overline{\nu}_2)$ with misconduct levels increasing in the number of competing firms.*
     - ii. *Both clean and misconduct stable symmetric equilibria can exist in the border regions: $n \in (\underline{\nu}_1, \underline{\nu}_2)$ and $n \in (\overline{\nu}_2, \overline{\nu}_1)$.*
2. *In a niche-market framework, there is a single double-threshold of competition: $\underline{\nu} < \overline{\nu}$.*
   - (a) *When n is below the threshold $\underline{\nu}$ there is a positive level of malpractice which declines in the number of competing firms.*

[25] Part 3 of Proposition 1 indicates that if $r = 1$ this requires $\alpha < 2$.

(b) Both clean and misconduct stable symmetric equilibria can exist for oligopolistic competition: $n \in [\underline{\nu}, \overline{\nu}]$.

(c) There is no malpractice if the number of competing firms is high: $n > \overline{\nu}$.

The proof begins by considering the owner-manager's optimal choice of misconduct having set the price at stage 1 and secured a given volume. If the owner-manager decides to pursue misconduct then she will incur the fixed utility cost of doing so. Utility can be optimised under this assumption to determine a candidate level of misconduct as a function of price. However, the problem is not concave as the owner-manager may decide not to commit misconduct due to the discontinuous and large utility cost incurred. A second candidate is therefore zero misconduct. The utility generated by these two can be compared and an optimal level of misconduct as a function of stage 1 prices developed. This level of misconduct can be imported into the stage 1 utility. The competitive game now takes place just over price. There are however two candidate types of equilibria; with or without misconduct. The discontinuous nature of the utility cost requires us to check that the price ensuring no incentive to deviate from symmetry is consistent with the stage 2 misconduct optimisation. Comparative static analysis of the price and therefore misconduct levels with respect to firm numbers then yields Proposition 2.

Let us develop an intuition into Proposition 2. First consider a setting in which there are a large number of firms competing, whether the market competition is one of mass or niche targeting. In this case the profits available to each firm are low. There is therefore insufficient profit available to overcome the fixed cost (κ) of engaging in misconduct. It follows that a symmetric equilibrium must be clean if a large number of firms compete. This is established in parts $1(a)$ and $2(c)$ of Proposition 2.

Recall now that an emotional dilemma creates a fixed cost of engaging in misconduct. However once over-ridden (if optimal to do so), then the utility function is analogous to that governing the non-emotional moral dilemma (set $\omega = 0$). Let us now consider the opposite extreme of there being only a small number of firms competing. Suppose first that the market takes the form of mass-market competition. We understand from the non-emotional dilemma result (Proposition 1) that equilibrium would be clean in this case. The fixed cost of misconduct in this emotional dilemma case does not encourage misconduct. Therefore the result holds. This therefore explains the whole of part $1(a)$ of Proposition 2.

Now turn to the case of a niche-market with only a small number of firms competing. In the non-emotional moral dilemma this setting was vulnerable to misconduct if the proportion of rational expectations consumers was not too great. It remains so under an emotional dilemma. The increase in margins available from misconduct multiplied by the large volumes is sufficient to overcome the fixed cost of misconduct. Hence a symmetric equilibrium involves misconduct, explaining result $2(a)$.

The analysis is more nuanced in the case of oligopoly and the predictions differ between mass and niche markets. In the niche case there is one connected range of competing firm numbers which generates multiple equilibria (one clean, the other with misconduct). In the mass-market setting there can be (depending on parameters) disconnected ranges of firm numbers with multiple equilibria, and misconduct in between.

In the case of a niche market, margins and volumes move in opposite directions with firm numbers. Low margins reduce the relative force of sanctions as discussed following Proposition 1, while large volumes make it more likely that misconduct will generate enough extra profit to outweigh the discontinuous disutility of any misconduct. The effects therefore re-enforce each other. The fixed cost creates a boundary region in which both types of equilibria are possible. That is a high-price/clean equilibrium in which the margins are high enough that the deterrent of sanctions is enough to prevent deviation to misconduct. And a low-price/misconduct equilibrium in which the sanction effect is weak enough not to deter misconduct and in addition the volumes are large enough to overcome the disutility cost.

In a mass-market setting both margins and volumes fall with more competing firms. The relative pace of decline depends upon the specifics of the value density function. As margins shrink this lowers the deterrent effect of sanctions encouraging misconduct. But as volumes shrink the extra utility available from misconduct falls and makes it less likely to be sufficient to overcome the fixed cost. Whenever one of these effects over-takes the other there is a transition and multiple equilibria can occur.

4.3 Can Competition Damage Consumer Surplus?

In this section we will establish market conditions such that more competition ultimately always damages consumer surplus. The candidate setting can only be non-emotional moral dilemmas with mass-market competition. With emotional moral dilemmas, triggering the thinking-fast reflex, if competition is great enough then only clean symmetric equilibria survive (Proposition 2). The same result applies for non-emotional moral dilemmas when the market is characterised by niche-competition (Proposition 1).

Consider therefore non-emotional moral dilemmas in mass-market competition when the number of competing firms is large. The extent of misconduct, $y_1^*(p^e)$ is inversely proportional to $\frac{1}{2}p^e$ from the owner-managers' second stage optimisation (see (15)). As the harm done is proportional to α times the extent of misconduct by assumption, the harm done to consumers is inversely proportional to $\alpha \cdot \frac{1}{2}p^e$. It is therefore immediate that if the harm multiple α is greater than 2 then the increase in harm will exceed the price reduction from greater competition. However this is not enough to guarantee that competition lowers consumers surplus.

More competition improves the match between consumers and the firms they choose.

If there are n firms competing in a symmetric equilibrium, then each consumer will buy from the firm securing the highest expected utility draw from n draws from the density function $f(x)$. The larger the number of competitors, the greater the expectation of the highest draw from n. It is therefore not clear whether competition raises or lowers consumer surplus overall. An answer is available:

Proposition 3 *Consider a non-emotional moral dilemma and suppose (2) is satisfied so misconduct equilibria are possible. For any symmetric stable equilibrium, increasing competition for n large:*

1. *Lowers consumer surplus if the density function of expected utilities $f(\cdot)$ is drawn from the:*

    - *Weibull class (shape parameter ≥ 1),*
    - *Uniform class,*
    - *Power law class;*

    and if the harm parameter is large ($\alpha > \alpha^{\dagger}$) for given constant $\alpha^{\dagger}$, whilst willpower is not ($\omega\alpha < 1$).

2. *Raises consumer surplus if the density function $f(\cdot)$ is drawn from the class of normal distributions.*

Proposition 3 solves for the limiting behaviour of consumer surplus in the case of four leading distributions. The proof gives the required bounds $\alpha^{\dagger}$ for each distribution considered. The techniques in the proof can be applied to other distributions also. To prove Proposition 3 we use the large n approximations of integrals such as those determining the demand function given in (11) and explored in Gabaix et al. (2016). The results in Gabaix et al. (2016) can be applied immediately to determine an approximation for the large n functional form for the total match value created by the industry (given explicitly in (32)). The large n behaviour of prices and misconduct are endogenous to the model. However their rate of change with respect to firm numbers can be established and combined with the large n properties of the taste distributions to establish a bound on the rate of change of consumer surplus with respect to firm numbers. Under the conditions of Proposition 3 this bound can be placed strictly above or below zero, yielding the results.

Proposition 3 part (1) demonstrates when generically more competition will harm consumers. Intuitively the critical issue is how sensitive the consumer match value is to competition as compared to misconduct. The Weibull has relatively thin tails, the uniform and power law are bounded and so do not have tails. The match value is given by the highest of n draws from the distribution. With thin tails and an already high n the match value is close to its maximum. Misconduct does not face such a hard bound. With match value playing a lesser role, misconduct grows in importance and so competition in these mass markets ultimately hurts consumers.

With the Normal density for valuations the tails are fat enough that the match value remains responsive to increases in firm numbers, and this effect dominates the misconduct which is perpetrated. With the normal therefore, competition with large n must always (ultimately) improve consumer surplus.

These results can be demonstrated numerically, and we do so in Figure 2.[26] The mass market formulations captured by the Uniform distribution and the Normal distribution have increasing amounts of misconduct, declining margins, which both reflect Proposition 1, and increasing match values ignoring any misconduct. However factoring in misconduct we see that the realised consumer surplus declines at large n in the case of the Uniform, but not the Normal as predicted by Proposition 3. The Niche setup has no misconduct for large n as predicted in Proposition 1.

4.4 In what markets should Finance be made a Profession?

Professionalisation of an industry would require that individuals practising in the industry had to be members of an appropriate professional body, as is the case in medicine and the law. Most, if not all, professional bodies require their members to receive training in ethics, and sometimes this training must be ongoing. For example, the CISI requires all of its members to pass an Integrity Test. The CFA has devoted 10% of its exam to ethical issues. The CIOBS has made only one of the modules mandatory for a Chartered designation – *Professionalism, Ethics & Regulation*. The ICAEW requires members to pass a module in *Professional Ethics*.[27]

The ethics training mandated by professional bodies is typically not nuanced. It teaches a lexicographic ordering to ethics in which the clients' interests come first. For example the CISI code of conduct requires its members to "*put the interests of clients and customers first*."[28] The CFA has a similar requirement that members should "*place their clients' interests before their employer's or their own interests*."[29] By including tests of such principles in an exam members are trained to think that ethics has a right/wrong answer devoid of tradeoffs. Professionalisation of a market, at least if conducted successfully, therefore conditions agents' to respond to moral dilemmas in a thinking-fast manner; a rule is either broken, or it is not.

[26]The parameters used to create Figure 2 are $\alpha = 5, \omega = .15, \delta = 1, \varphi = .6, c = 0, r = 0$. The Uniform is on $[0, 1]$, the Normal has moments matched $\mu = .5, \sigma = .289$. The Pareto has scale parameter 2.

[27]Requirements cited in Patel (2014). CISI is the *Chartered Institute for Securities and Investments*. CIOBS is the *Chartered Institute of Bankers in Scotland*. CFA is the *Chartered Financial Analyst Institute*. ICAEW is the *Institute of Chartered Accountants in England and Wales*.

[28]https://www.cisi.org/cisiweb2/docs/default-source/cisi-website/ethics/cisi-code-of-conduct-2021.pdf

[29]https://www.cfainstitute.org/-/media/documents/code/code-ethics-standards/code-of-ethics-standards-professional-conduct.ashx

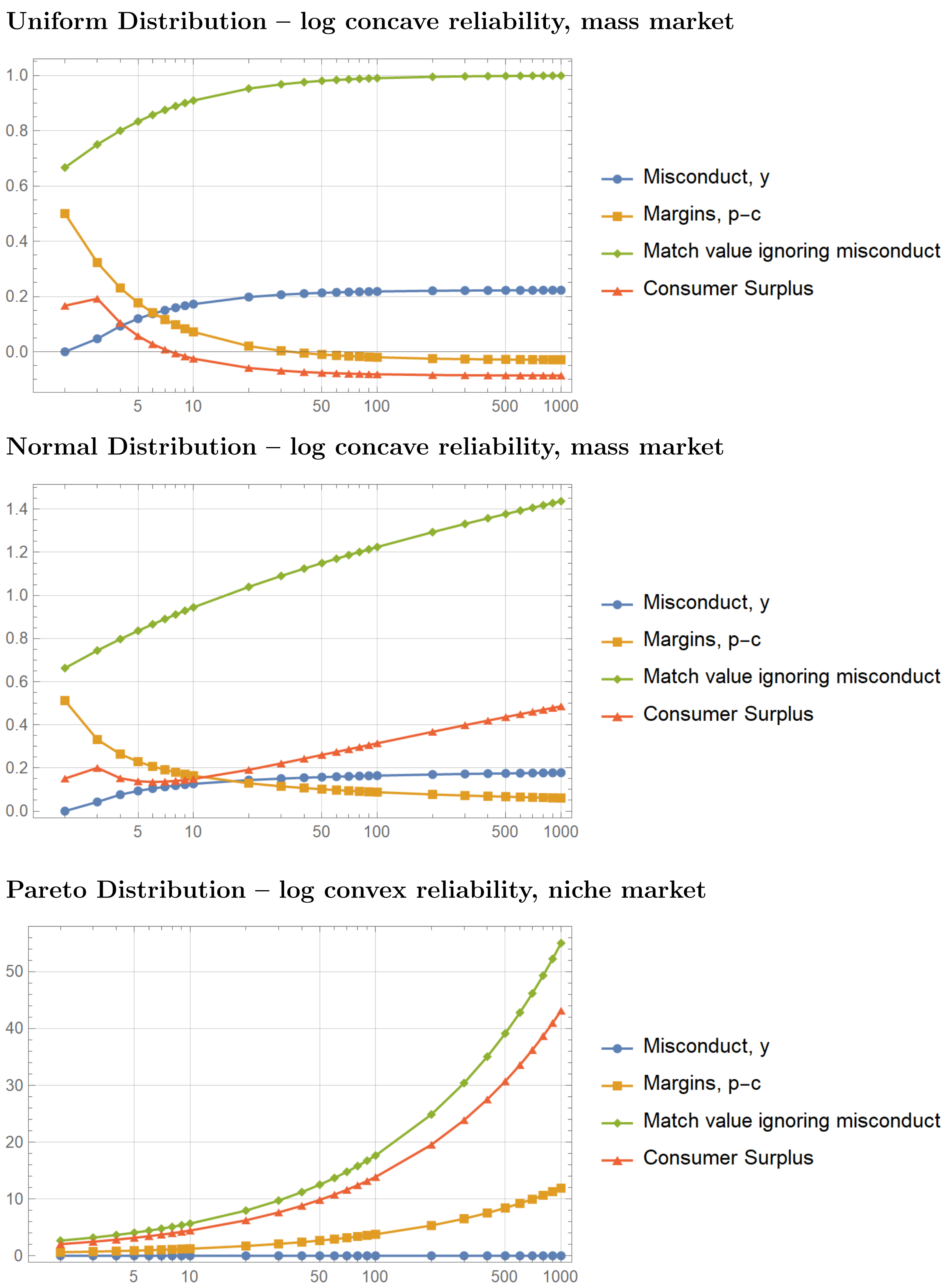

Figure 2: Numerical examples of misconduct, prices, consumer surplus and match value. *Note log scale.* The total match value is the expected value of the highest of n draws. Consumer surplus is the match value, less the price paid, and less the total harm from misconduct $(\alpha \cdot y)$. Misconduct rises with the number of competing firms in the mass market cases, but not the niche market case. With large enough n consumer surplus rises in the case of the Normal distribution, but not for the Uniform distribution (Proposition 3). Parameters in footnote 26.

Any gain from professionalisation can therefore be identified by comparing the market susceptibility to misconduct from non-emotional and emotional moral dilemmas.

To analyse this formally, let us consider an industry and let N be the critical number of firms at which industry equilibrium is on the cusp between misconduct and clean behaviour when a given moral dilemma is non-emotional and so triggers a thinking slow response. Such a number of firms exists from Proposition 1.

Suppose that ethical training mandated by professional bodies causes the market participants to be conditioned to change their psychological approach to the moral dilemma to be one of thinking fast with an emotional distaste parameter of

$$\kappa^* = \frac{1}{N\varphi\delta}(\alpha\omega)^2. \tag{4}$$

Proposition 4 *Altering the ethical reflex from thinking-slow to thinking fast with distaste parameter (4) results in the following misconduct equilibrium characterisation:*

1. *Under niche market competition the upper bound of the potential misconduct range (Proposition 2)* $\overline{\nu} = N$. *Hence the market is possibly cleaner for* $n \in [\underline{\nu}, \overline{\nu}]$, *and unchanged for other firm numbers.*

2. *Under mass market competition* $N \in [\underline{\nu}_1, \overline{\nu}_1]$, *(Proposition 2) with* $\overline{\nu}_1 < \frac{N}{(\alpha\omega)^2} < \infty$. *Hence the market is clean for large firm numbers, but may permit misconduct for* $n \in [\underline{\nu}_1, N]$.

3. *If the ethical conditioning results in* $\kappa > \ (<)\ \kappa^*$ *then the misconduct regions shrink (grow) further.*

Proposition 4 suggests that if professionalisation is moderately successful in converting non-emotional into emotional dilemmas (so (4) is satisfied) then professionalisation is beneficial in mass markets with a large number of competitors. These are markets which would see misconduct under non-emotional (thinking slow) moral dilemmas, but can be rendered clean if the number of competing firms is large enough. This therefore represents an argument for professionalisation for markets such as that for IFAs, many of whom do belong to professional bodies, and also for the sellers of mortgages.

However there is no comparable gain if the market was of a niche variety, such as credit cards.

In a market with few competing firms then creating a profession confers few advantages, and may be damaging. In the case of niche markets, such as OTC bond markets for example, professionalisation might reduce misconduct in oligopoly settings, but multiple equilibria are possible which would render the professionalisation ineffective. In the case of mass market competition (low cost pass-through rates) then professionalisation can introduce misconduct in oligopoly settings which might have been clean when agents were thinking slow. This creates an argument for institutions such as the FICC market standards board in the UK which identifies good practice for exchanges and for fund managers (among others) without having any enforcement powers or overseeing the creation of a profession.

5 Ethical spillovers across a market

Thus far we have considered a setting in which the firms were identical: owner-managers had the same ethical willpower and ran equally efficient firms. We relax both of these restrictions in this section in which, for tractability, we focus on duopoly.

Suppose there is a duopoly in a financial market subject to a non-emotional moral dilemma which therefore triggers a thinking slow response. We allow each firm's owner-manager to have her own attitude to ethics: $\{\omega_1, \omega_2\}$. Let us suppose that the firms are in a misconduct equilibrium and that both firms are active, that is sell non-zero quantities. Let us now consider, perhaps because of a corporate acquisition or training, that the owner-manager of firm 2 becomes more ethical; ω_2 increases. How do market-wide misconduct and price levels adjust?

To answer this question we generalise the owner-managers' utility function from the main model explored in Section 4 to allow for individual ethics:

$$U_1(p_1, y_1; p_2) = q_1(p_1; p_2)\left[(p_1 - c + y_1)(1 - \varphi y_1) + \varphi y_1(1 - \delta)(p_1 - c + y_1)\right] - \omega_1 \alpha q_1(p_1; p_2) y_1$$

We allow for any level of rational expectations in the population (r) which permit a misconduct equilibrium and establish:

Proposition 5 *In the case of non-emotional moral dilemmas (trigger thinking-slow) the comparative statics in a stable duopoly competitive equilibrium with respect to the ethics of firm* 2*,* ω_2*, satisfy:*

1. *A more ethical firm* 2 *raises her own prices:* $\frac{dp_2^e}{d\omega_2} > 0$*;*
2. *A more ethical firm* 2 *causes firm* 1 *to reduce her misconduct if and only if firm* 1*'s log demand displays increasing differences in firm* 2*'s prices:*

$$\frac{dy_1^e}{d\omega_2} =_{sign} -\frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2}$$

3. *A more ethical firm* 2 *causes firm* 1 *to raise her prices if and only if firm* 1*'s log demand displays increasing differences in firm* 2*'s prices:*

$$\frac{dp_1^e}{d\omega_2} =_{sign} +\frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2}$$

4. A more ethical firm 2 reduces her level of misconduct ($\frac{dy_2^e}{d\omega_2} < 0$).

If the market is characterised by mass-market competition (log-concave reliability function) then demand displays increasing differences so that:

$$\frac{dy_1^e}{d\omega_2} < 0 < \frac{dp_1^e}{d\omega_2}.$$

Proof. See Appendix B. ■

We explore the intuition for these results in turn. That the manager of firm 2 should reduce her level of misconduct when she is more ethical is intuitive. This follows as with greater dislike of misconduct the owner-manager will be less keen to cause harm to the client. Now observe that at any given price set, firm 2 will have higher final costs (as her misconduct will be less). It follows therefore that firm 2 will choose to raise prices.

Given firm 2 responds to her increased morality by raising retail prices, she becomes a less effective competitor. It follows that firm 1 gains volumes. This increases all three forces on firm 1's misconduct choice – ethics, sanctions and profit – but does so at the same rate. Firm 1 will seek to reoptimise her prices, and doing so will alter the relative weight from sanctions as compared to the other two forces. She could lower her prices to accelerate the customer gaining effect. Or she could raise prices somewhat to profit more from the new consumers who still move over.

If the log of firm 1's realised demand has increasing differences in prices ($\partial^2 \ln q_1/\partial p_1 \partial p_2 > 0$) then should firm 2 raise her price, $\partial \ln q_1/\partial p_1$ will increase. As this derivative is negative, this implies that firm 1's realised demand becomes less sensitive to her own prices if her rival's price goes up. This encourages firm 1 to raise her price.

Firm 1's level of misconduct now moves in the opposite direction to her prices. If the equilibrium dynamics cause firm 1's prices to rise, then we noted that the effect of sanctions becomes more prominent in the decision calculus. Hence the owner-manager of firm 1 lowers her level of misconduct.

If the market is characterised by mass-market competition (log-concave reliability function generated by the distribution $F(x)$) then the proof of Proposition 5 documents that log demand displays increasing differences at all prices. Thus in a mass market setting (with own cost pass-through rates less than 1) misconduct and good behaviour propagate in an industry. A more ethical firm 2 lowers misconduct at the competing firm 1.

Discussion and empirical evidence

If a less corrupt, or more ethical, firm should acquire a competitor in a perhaps corrupt local market, will the newcomer raise the ethical conduct of rivals, or will her own ethical conduct become polluted? This is an open question, and the analysis above offers some insight into it.

Proposition 5 is consistent with evidence, such as Kwok and Tadesse (2006), which argues that entry into a market of a (more ethical) multi-national lowers corruption and malpractice amongst home firms. However, might some misconduct boomerang back and damage the behaviour of the 'ethical' firm? Kartner and Warner (2015) argue through a case study of Siemens that misconduct does indeed spread to the incoming firm. Hence thinking of Siemens as an example of an ethical firm, its behaviour in foreign markets characterised by more misconduct fell to below the levels it would tolerate elsewhere. This is consistent with Proposition 1 as in studies such as Kartner and Warner (2015) one is comparing a firm's behaviour in one market (abroad) to its behaviour in another (home). These markets would be expected to have different levels of equilibrium misconduct however as the competitive conditions between the markets would likely differ; and this paper has demonstrated that market structure affects equilibrium malpractice.

Proposition 5 provides a mechanism by which positive spillovers of ethics can occur between firms. It is known that if unethical employees move employer then they take their bad practices with them (Pierce and Snyder (2008), Dimmock et al. (2018)). Proposition 5 is novel in capturing a competitive channel for good behaviour to spillover between firms.

6 Extensions to the market model

In this analysis we have made a number of assumptions:

1. We have used linear functional forms for consumer harm and the detection and conviction technology.
2. We have assumed that regulatory fines are proportional to profits and not discussed revenue based fines.
3. We have assumed that the detection and conviction technology grows in the level of misconduct, but not also in the volumes of good sold.

In this section we discuss and relax these assumptions. We will establish general conditions under which the comparative static relationship between competition (firm numbers) and the level of equilibrium misconduct remains as described in Propositions 1 and 2. I consider the case of all consumers having passive expectations[30] to allow a clearer focus on each extension. The model can also be shown to extend naturally to a repeated game in which the sanctions can be interpreted as a reduced form for future profits and punishments. However in the interests of brevity I do not report this extension in the present paper. All proofs are contained in Appendix C.

[30] i.e. $r = 0$.

6.1 Harm and Detection General Functions of Misconduct

In the analysis underpinning Propositions 1 and 2, both the harm done by misconduct, and the probability of detection were assumed to increase linearly with the level of misconduct. Let us generalise these relationships to functions $\alpha(y)$ and $\varphi(y)$ which are differentiable at least twice. Let us focus on the setting of a non-emotional moral dilemma first. Adapting (1) consider the owner-managers have objective function:

$$U_1(p_1, y_1; p^e) = q_1(p_1, p_e)\left[(p_1 - c + y_1)(1 - \delta\varphi(y_1)) - \omega\alpha(y_1)\right] \quad (5)$$

I require that the second period misconduct choice is a concave problem and that detection and harm are more likely with more misconduct. A sufficient condition for this is that over the relevant range of misconduct:

$$\varphi'(y) > 0\ ,\ \varphi'' \geq 0\ \text{ and } \alpha'(y) > 0\ ,\ \alpha''(y) \geq -2\frac{\delta}{\omega}\varphi'(y) \quad (6)$$

Proposition 6 *With general harm and detection functions $\alpha(y)$ and $\varphi(y)$ satisfying (6) for any stable symmetric misconduct equilibrium, whether the moral dilemma is non-emotional (trigger thinking-slow) or emotional (trigger thinking-fast):*

1. *In a mass-market framework the level of misconduct is increasing in the number of competing firms.*
2. *In a niche-market framework the level of malpractice declines in the number of competing firms.*

The general functional forms for harm and detection force a change in the proof steps. Nonetheless the generalised functions maintain a link between the sanctions deterrent and both margins and volumes whilst the incentives due to ethics and profits remain volume related. The intuitions of Propositions 1 and 2 therefore continue to apply.

6.2 Revenue Fines not Profit Fines

We have assumed that regulatory fines are proportional to profits. This may seem critical as the distinction between profits and volumes was important in ranking the deterrent from fines versus ethics. Here we extend the exploration of generalised harm and detection and permit revenue fines rather than profit fines.

Revenue based fines are important. In the Goldman Sachs *Abacus* scandal for example, the fine of \$550 million went an order of magnitude beyond the profit element of \$15 million. In antitrust cases the European authorities are clearer with a base fine level set at 30% of the revenue accrued from sales benefiting from wrongful behaviour.[31]

To explore we adapt the owner-managers' utility function (5) studied in Section 6.1 and consider:

$$U_1(p_1, y_1; p^e) = q_1(p_1, p_e)\,[p_1 - c + y_1 - \delta\varphi(y_1)p_1 - \omega\alpha(y_1)] \tag{5'}$$

Objective function (5′) captures that the firm faces a fine related to total revenues if caught practising misconduct. We maintain assumption (6):

Corollary 7 *Proposition 6 is unchanged under revenue fines as opposed to profit fines.*

Corollary 7 may seem surprising as the key results of Propositions 1 and 2 noted the dependence of sanctions on profits as compared to the volume dependent misconduct incentives caused by ethics and profits considerations. There is no contradiction however as profits equal, as was emphasised, volumes times margins, and margins are closely related to prices. So revenues (ie volumes times price) differ to volumes in much the same way that profits (ie volumes times margin) differ to volumes.

To make this clearer let us rewrite the incentive to misconduct from the first order condition, given before in (3), in the revenue sanctions case:

$$\begin{array}{rcccc} & & \underline{\text{ethics}} & \underline{\text{sanctions}} & \underline{\text{profit}} \\ \frac{\partial U_1}{\partial y_1} & = & q_1 \cdot (-\omega\alpha'(y)) & -q_1 \cdot p_1\delta\varphi'(y) & +q_1 \\ & & \uparrow & \uparrow & \uparrow \\ & & \propto \text{volumes} & \propto\ \text{volumes} \times \text{price} & \propto \text{volumes} \end{array} \tag{7}$$

It is possible to see that, as argued above, if volumes change without prices changing, then the three forces determining misconduct remain in balance. If firm 1 responds to entry by, for example raising her prices to target a niche, then the sanctions effect drops less rapidly than the other two effects preserving the intuitions and results described above.

6.3 Conviction probability a function of volume

In the model the probability of detection and conviction grew with the level of misconduct targeted by the owner-manager, and not with the volumes of good sold by an individual firm. As noted before, this modelling choice reflects the need to demonstrate corporate agency before issuing a substantial fine, which is easier the greater the level of misconduct targeted. Nonetheless we assess the robustness of the analysis by extending the model to allow the probability of detection and conviction to grow with individual firm volumes.

[31] See Factsheet "*Fines for breaking EU Competition law*" available at https://ec.europa.eu/competition/cartels/overview/

Some care is needed in formulating a model to study this setting. Equilibrium can be destroyed if the detection technology creates a sufficiently large incentive to raise prices so as to lower volumes which, by assumption, remove (or substantially diminish) the authority's ability to detect misconduct. This would then allow the firm to raise misconduct without limit in stage 2 so potentially rendering such a strategy optimal. A parsimonious way to study this extension, avoiding this problem, is to extend the benchmark model in (1) by altering the detection technology to:

$$\varphi y(1 + \epsilon q) \tag{8}$$

The probability of detection grows in misconduct and in volumes (as $\epsilon > 0$), and remains positive even if volumes drop to zero. We have:

Proposition 8 *Consider non-emotional moral dilemmas (trigger thinking-slow), passive expectation consumers ($r = 0$) and assume the misconduct detection technology (8). For any stable symmetric equilibrium:*

1. *Mass-market framework: the results of Proposition 1 hold.*
2. *Niche-market framework: for ϵ sufficiently small*
   - *(a) When n is below the threshold $\tilde{N}$ any equilibrium involves market-wide misconduct.*
   - *(b) There is no malpractice if the number of competing firms $n > \tilde{N}$.*

Proposition 8 demonstrates that the dependence of the misconduct detection technology on volumes does not affect the relationship between misconduct and pricing behaviour in mass markets. In the case of niche markets, the threshold result is robust to some dependence of conviction probability on volumes. However the comparative static between the level of misconduct and competition is more fragile and does not apply in this extension.

The addition of a volume dependence, as captured in the detection and conviction technology (8), adds one extra force into the model. If entry occurs then in equilibrium each firm sees its own volumes fall. By assumption this lowers the ability of the authorities to detect and prosecute misconduct. This therefore, at the margin, encourages more misconduct.

This extra effect reinforces the core economic dynamics for the case of mass-market competition. In the benchmark of Proposition 1 entry caused firms to move to lower prices, lower volumes and more misconduct. As volumes decline with entry, detection gets less likely by assumption in this extension. This makes misconduct more profitable and so reinforces the link identified in Proposition 1.

The volume dependence in the detection technology is a countervailing force under niche-competition. In the benchmark setting exit caused the firms to raise their misconduct and push prices down as they sought to appeal to marginal consumers. However exit always raises equilibrium volumes, and so as (by assumption) this raises the ability to detect misconduct then a countervailing effect on misconduct is created. This immediately weakens the comparative static between the competitive pressure and the level of misconduct. However though misconduct levels need not grow with exit, Proposition 8 shows that neither do misconduct levels fall back to zero. Hence the threshold relationship between firm numbers and misconduct equilibria identified in Proposition 1 is robust.

7 Model Predictions and Empirical Evidence

In this section we explore to what extent the model's predictions are consistent with existing empirical results. Propositions 1 and 2 each offer a cross-sectional and a longitudinal prediction, with the propositions respectively analysing the setting in which the misconduct at issue generates a non-emotional (thinking-slow) or an emotional (thinking-fast) response in finance practitioners. In the case of non-emotional moral dilemmas the cross-sectional interpretation predicts market vulnerability to misconduct when niche (mass) markets have high (low) concentration firm ratios.[32] The longitudinal interpretation predicts that misconduct is less (more) likely as concentration ratios fall in the case of niche (mass) markets.

The predictions for the case of emotional moral dilemmas can be derived similarly, and features an inverted-U shaped relationship for misconduct in the case of mass-market competition, though not niche market competition. That is, misconduct is most likely at intermediate levels of competition in the case of mass market competition.

Markets for commodity products will be characterised by mass-market competition. A rich source of historical examples of misconduct in such commodity markets which conform to the above predictions is available in Rashid (1988).[33] The case of the misselling of mortgage default insurance (PPI) in the UK was described in the introduction and fits the empirical prediction. As does the Financial Advisor scandal which has recently been the subject of a Royal Commission in Australia.[34]

More formally increased competition has been associated empirically with increased

[32]A high concentration firm ratio results from few firms competing in a market so each has a large market share. Niche versus mass market competition can be identified by the behaviour of margins to entry, or by the own-firm cost pass-through rate as discussed.

[33]The industries discussed include the milk industry of Bangladesh, the rice industry in India, and the cotton industry in England.

[34]See *Banking royal commission told 90% of financial advisers ignored clients' best interests*, Guardian, 16 April 2018.

misconduct in the case of: writing fraudulent online reviews to benefit one's own firm or denigrating rivals (Luca and Zervas (2016)); relaxing required testing standards for vehicles in the US (Bennett et al. (2013)); and avoiding corporate tax in China (Cai and Liu (2009)).

Some empirical studies have found an inverted-U relationship between competition and misconduct. This is more consistent with the results for emotional moral dilemmas – Proposition 2 – in the case of mass markets. Empirically this has been found to be the case for: industrial pollution (Polemis and Stengos (2019)), and manipulating reported earnings (Guo et al. (2019)). At least in the case of industrial pollution, the potential risk to human health is clear, and so it is plausible that owner-managers' instinctive ethics may be more prominent than their more considered thinking-slow reasoning, providing a consistent rationalisation of this finding.

8 Conclusion

This study has developed a model of competition between financial firms in which managers have the opportunity to practice misconduct, but have ethical qualms in doing so. The model draws a distinction between two important types of competition: niche and mass market categories. Niche markets are ones in which firms respond to entry by increasing prices so as to extract greater rents from their remaining inframarginal customers, so margins remain high as the number of competitors grows. Examples are credit cards and OTC markets. Mass markets are ones in which margins fall on entry as firms seek to win back marginal customers, so products become commoditised – IFAs being an example. Own-cost pass-through rates can also be used to define these markets.

The analysis has built off current psychological understanding that the brain has two modes of reasoning. Emotional moral dilemmas trigger our thinking fast machinery, and agents subject to such dilemmas act as if they are deontological. Non-emotional moral dilemmas trigger our thinking slow machinery, and agents subject to such dilemmas act as if they are consequentialist.

This study has included the two innovations – types of ethics and niche vs. mass markets – into a competitive model. Doing so allows this paper to identify the vulnerability to misconduct of concentrated markets, oligopolies, and competitive markets with many small firms. Table 1 summarises the results.

The analysis has included a wide range of robustness checks. The relationship between the level of misconduct and the number of competing firms is robust to very general specifications of harm and detection, and to the choice of revenue or profit fines.

Some open questions remain however. A leading one is which types of temptations to misconduct in Finance are best categorised as generating an emotional response in Financiers, and which a non-emotional response. Conjectures drawing on the available

<table>
<tr><th rowspan="2"></th><th colspan="2">Non-emotional dilemma
(trigger thinking-slow)</th><th colspan="2">Emotional dilemma
(trigger thinking-fast)</th></tr>
<tr><th>Mass</th><th>Niche</th><th>Mass</th><th>Niche</th></tr>
<tr><td>Concentrated</td><td rowspan="2">Clean</td><td rowspan="2">Misconduct</td><td>Clean</td><td>Misconduct</td></tr>
<tr><td rowspan="2">Oligopoly</td><td rowspan="2">Clean & Misconduct</td><td rowspan="2">Clean & Misconduct</td></tr>
<tr><td rowspan="2">Misconduct</td><td rowspan="2">Clean</td></tr>
<tr><td>Many competing firms</td><td>Clean</td><td>Clean</td></tr>
<tr><td>Conjectured examples:</td><td colspan="2">Pressure selling; Cherry picking</td><td colspan="2">Pump&Dump; AML with strong suspicions</td></tr>
</table>

Table 1: Model predicted characteristics of symmetric stable competitive equilibria

experimental literature are possible, but uncertainty remains. Secondly, the regulator has not been strategic in this analysis. With multiple competitors a regulator can use relative firm performance to prioritise its investigations. In turn this would have a feedback effect on the strategies used by firms so as to avoid drawing attention to themselves. How these forces might interact to adjust the results presented here remains, at present, a topic for future research.

A Proofs from Section 4

We first establish a useful result on the demand system. Recall the expected utility a consumer achieves at each firm absent misconduct is drawn from the density function f. The associated density function for the second highest of n draws is denoted:

$$g_{(n-1)}(x) := n(1-F(x))(n-1)f(x)F(x)^{n-2} \tag{9}$$

Lemma 9 *Suppose the proportion r of rational expectations consumers anticipate misconduct level as a function of price given by $y(p) = \gamma_0 - \gamma_1 \cdot p$ for some constants $\{\gamma_0, \gamma_1\}$. Suppose the proportion $1-r$ consumers with passive expectations do not anticipate misconduct. The derivative of own-firm demand with respect to own-price deviations from symmetric pricing at p^e is given by:*

$$\frac{\partial q_1(p^e;p^e)}{\partial p_1} = -\left(1-\gamma_1 \cdot \alpha r\right)\frac{1}{n}\int_{x=a}^{b} g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx. \tag{10}$$

Proof. Consumers choose the firm which gives them the highest expected utility. It follows that the following proportion of passive expectation consumers select firm 1 at a price of p_1 when all other firms set price p^e:

$$\int_x f(x) \cdot \Pr\left(x - p_1 > x_j - p^e \; \forall j \neq i\right) dx = \int_x f(x) \left(F(x - p_1 + p^e)\right)^{n-1} dx \tag{11}$$

Consumers with rational expectations anticipate that firm 1 will choose level of misconduct $y(p_1)$. Therefore the proportion of these consumers choosing firm 1 is:

$$\begin{aligned} &\int_x f(x) \cdot \Pr\left(x - p_1 - \alpha y(p_1) > x_j - p^e - \alpha y(p^e) \; \forall j \neq i\right) dx \\ =& \int_x f(x) \left(F(x - p_1 + p^e - \gamma_1 \alpha (p^e - p_1))\right)^{n-1} dx \end{aligned} \tag{12}$$

Combining therefore the total demand enjoyed by firm 1 when deviating from a market-wide price p^e is:

$$q_1(p_1; p^e) = \int_x f(x) \left(r \left(F(x - p_1 + p^e - \gamma_1 \alpha (p^e - p_1))\right)^{n-1} + (1 - r) \left(F(x - p_1 + p^e)\right)^{n-1}\right) dx \tag{13}$$

Equation (13) is used to establish Figure 1.

To establish the first derivative of demand, differentiate (13) with respect to p_1. Evaluating at $p_1 = p^e$, and using the order statistic (9) yields (10). ■

Proof of Proposition 1. Suppose that the owner-manager of firm 1 has set a price p_1 and secured demand q_1 in the first period. She now considers her optimal level of misconduct y_1. The owner-manager's utility function (1) under non-emotional moral dilemmas simplifies to

$$U_1(p_1, q_1, y; p^e) = q_1 \left[-\varphi \delta y^2 + y(1 - \omega \alpha - \varphi \delta (p_1 - c)) + p_1 - c\right] \tag{14}$$

This objective function is concave in misconduct y. Denoting the optimal second stage misconduct $y_1^* \geq 0$ which is a function of the model parameters and the stage 1 pricing decision we have:

$$y_1^*(p_1) = \begin{cases} \frac{1}{2\varphi\delta}\left(1 - \omega\alpha - \varphi\delta(p_1 - c)\right) & \text{if } p_1 - c < \frac{1-\omega\alpha}{\varphi\delta} \\ 0 & \text{if } p_1 - c \geq \frac{1-\omega\alpha}{\varphi\delta} \end{cases} \tag{15}$$

Consumers with rational expectations anticipate a reduction in their expected utility from the service of $\alpha y_1^*(p_1)$.

We now consider the first stage. Anticipating her misconduct behaviour, the expected utility secured by the owner manager at the first stage can be determined by substituting

(15) into (14):

$$U_1(p_1;p^e)=\begin{cases} q_1(p_1;p^e)\left[\frac{1}{4\varphi\delta}\left(1-\omega\alpha-\varphi\delta(p_1-c)\right)^2+p_1-c\right] & \text{if } p_1-c<\frac{1-\omega\alpha}{\varphi\delta} \\ q_1(p_1;p^e)(p_1-c) & \text{otherwise.}\end{cases} \tag{16}$$

At a symmetric equilibrium the first order conditions must hold:[35]

$$\left.\frac{\partial U_1(p_1;p^e)}{\partial p_1}\right|_{p_1=p^e}=0 \tag{17}$$

Stability of equilibrium requires that if the system moves to a position of disequilibrium, then myopic adjustments by each firm revert the system back to equilibrium. This condition implies that for small perturbations $\tilde{\varepsilon}$:

$$\frac{\partial U_1}{\partial p_1}(p^e-\tilde{\varepsilon};p^e-\tilde{\varepsilon})\ >\ 0\ >\ \frac{\partial U_1}{\partial p_1}(p^e+\tilde{\varepsilon};p^e+\tilde{\varepsilon}). \tag{18}$$

Equations (17) and (18) characterise a symmetric equilibrium which is stable.

In a positive misconduct equilibrium the owner-managers are in the upper branch of the utility function given by (16). The incentive to deviate locally from a common price level of p^e is given by:

$$\begin{aligned}&\frac{\partial U_1}{\partial p_1}(p^e;p^e)\\ =&\frac{1}{n}\left[1-\frac{1}{2}\left(1-\omega\alpha-\varphi\delta(p^e-c)\right)\right]\\ &-\left(1-\frac{\alpha r}{2}\right)\frac{1}{n}\left(\int_{x=a}^{b}g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx\right)\left[\frac{1}{4\varphi\delta}\left(1-\omega\alpha-\varphi\delta(p^e-c)\right)^2+p^e-c\right]\end{aligned} \tag{19}$$

Where we have used symmetry to determine the market share, and (10) in Lemma 9 along with (15) to deliver $\gamma_1=1/2$.

Suppose that (2) holds. Observe that the right hand side of (19) is a negative quadratic in p^e. A symmetric equilibrium must be a zero of (19) by the first order condition (17). The stability condition (18) delivers that only the larger of the two roots in p^e will denote a stable equilibrium. Applying the equilibrium condition (17) to (19) and simplifying we establish that a symmetric stable equilibrium is uniquely identified as the larger solution in p^e of:

$$\frac{\left(1-\omega\alpha-\varphi\delta(p^e-c)\right)^2+4\varphi\delta(p^e-c)}{2\varphi\delta\left(1+\omega\alpha+\varphi\delta(p^e-c)\right)}=\frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} \tag{20}$$

[35] Second order conditions must also hold. They are not very useful however for equilibrium comparative statics of this n firm game as the individual firm conditions do not aggregate helpfully. Stability will be more useful.

Further simplification establishes that:

$$1+\omega\alpha+\varphi\delta(p^e-c)-\frac{4\omega\alpha}{1+\omega\alpha+\varphi\delta(p^e-c)}=2\varphi\delta\frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} \tag{21}$$

By inspection the left hand side of (21) is increasing in p^e.

We can now establish the desired comparative statics in firm numbers if the symmetric equilibrium involves misconduct. If the number of competing firms increases then the distribution of the second highest draw from n draws grows in a First Order Stochastically Dominant manner. Suppose that the reliability function $1-F(x)$ is log-concave. This implies that $-\frac{f(x)}{1-F(x)}$ is decreasing in x, so that $\frac{f(x)}{1-F(x)}$ is increasing in x. As $g_{(n-1)}$ increases in a FOSD way in firm numbers n, the right hand side of (21) declines in n. It follows that at a symmetric misconduct equilibrium $\frac{\partial p^e}{\partial n}<0$. Now using (15) we have $\frac{dy^e}{dn}=\frac{dy_1^*(p^e)}{dn}=-\frac{1}{2}\frac{dp^e}{dn}>0$. Hence misconduct grows in firm numbers n. The case for log-convexity is analogous.

Next we establish that there exists a critical threshold number of firms, N, such that any symmetric equilibrium is clean for competition on one side of the threshold, and entails misconduct on the other side. The critical threshold will be the number of competing firms N defined implicitly by the relationship:

$$\frac{1}{\int_x g_{(N-1)}(x)\frac{f(x)}{1-F(x)}dx}=\frac{1-\omega\alpha}{\varphi\delta}\left(1-\frac{\alpha r}{2}\right). \tag{22}$$

Observe that if $\frac{f(x)}{1-F(x)}$ is monotonic, which it is if $1-F(x)$ is log-concave or log-convex, then (22) is uniquely defined.[36]

We will first show that if $1-F(x)$ is log-concave then any symmetric equilibrium is clean for $n<N$ and misconduct for $n>N$.

Suppose $n<N$ with $1-F(x)$ log-concave then claim any symmetric equilibrium is clean. Suppose otherwise that there exists $n<N$ such that there exists a symmetric misconduct equilibrium. From (15) $p^e(n)-c<\frac{1-\omega\alpha}{\varphi\delta}$ and:

$$\begin{aligned}\frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} &=_{(21)} \frac{1}{2\varphi\delta}\left(1+\omega\alpha+\varphi\delta(p^e-c)-\frac{4\omega\alpha}{1+\omega\alpha+\varphi\delta(p^e-c)}\right)\\ &<\left[\frac{1}{2\varphi\delta}\left(1+\omega\alpha+\varphi\delta(p^e-c)-\frac{4\omega\alpha}{1+\omega\alpha+\varphi\delta(p^e-c)}\right)\right]_{p^e-c=\frac{1-\omega\alpha}{\varphi\delta}}\\ &=\frac{1-\omega\alpha}{\varphi\delta}\\ &=_{(22)} \frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(N-1)}(x)\frac{f(x)}{1-F(x)}dx}\end{aligned} \tag{23}$$

[36] It could take the value $\pm\infty$ which would imply that the parameters yield only one type of equilibrium.

Now $n < N \Rightarrow g_{(N-1)} \succ_{\text{FOSD}} g_{(n-1)}$; and $1-F(x)$ log-concave implies $\frac{f(x)}{1-F(x)}$ is increasing in x. This therefore yields a contradiction to the chain of inequalities in (23), proving the result.

Now claim that if $n > N$ with $1 - F(x)$ log-concave, then any symmetric equilibrium entails misconduct. Suppose otherwise that there exists $n > N$ such that there exists a symmetric clean equilibrium. Consumers with rational expectations anticipate the equilibrium is clean. From (15) $p^e(n) - c \geq \frac{1-\omega\alpha}{\varphi\delta}$. The equilibrium satisfies the first order condition (17). Using the lower branch of (16) and (10) we therefore have

$$\begin{aligned} 0 = \frac{\partial U_1}{\partial p_1}(p^e; p^e) &= \tfrac{1}{n} - \tfrac{1}{n}\left(\int_{x=a}^{b} g_{(n-1)}(x)\tfrac{f(x)}{1-F(x)}dx\right)(p^e - c) \\ &\Rightarrow p^e(n) - c = \frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} \end{aligned} \tag{24}$$

And so we can write

$$\begin{aligned} \frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} = p^e(n) - c \geq_{(15)} \frac{1-\omega\alpha}{\varphi\delta} &=_{(22)} \frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(N-1)}(x)\frac{f(x)}{1-F(x)}dx} \\ &> \frac{1}{\int_x g_{(N-1)}(x)\frac{f(x)}{1-F(x)}dx} \end{aligned} \tag{25}$$

Now $n > N \Rightarrow g_{(n-1)} \succ_{\text{FOSD}} g_{(N-1)}$; and $1-F(x)$ log-concave implies $\frac{f(x)}{1-F(x)}$ is increasing in x. This therefore yields a contradiction to the chain of inequalities in (25), proving the result.

The case for $1 - F(x)$ log-convex is shown analogously.

We complete the proof by showing that if $\alpha r \geq 2$ then a symmetric misconduct equilibrium cannot exist. Under this condition the second term of (19) is positive as at an optimal we require $U_1 > 0$. Observe from (14) that $U_1 > 0$ in a misconduct equilibrium requires $y_1 < 1/\varphi\delta$ and $p^e - c > -\left(\frac{1+\omega\alpha}{\varphi\delta}\right)$. So the first term of (19) is positive. Combining we see that $\partial U_1/\partial p_1 > 0$ so that equilibrium is not possible. This delivers the third result.

■

Proof of Proposition 2. Suppose the firm had set a price of p_1 and secured demand q_1. Consider the level of misconduct which would be chosen. The utility function (1) under an emotional moral dilemma reduces to the quadratic

$$q_1(p_1; p^e)\left[-\varphi\delta y^2 + y(1 - \varphi\delta(p_1 - c)) + p_1 - c\right] - \kappa$$

The value of the misconduct parameter $y \geq 0$ which maximises this expression is y^{**} given by

$$y_1^{**}(p_1) = \begin{cases} \frac{1}{2\varphi\delta}(1 - \varphi\delta(p_1 - c)) & \text{if } p_1 - c < \frac{1}{\varphi\delta} \\ 0 & \text{otherwise.} \end{cases}$$

Therefore, in stage 2, if $p_1 - c \geq \frac{1}{\varphi\delta}$ then the optimal misconduct is $y_1^*(p_1) = 0$. If $p_1 - c < \frac{1}{\varphi\delta}$ then the optimal choice of misconduct takes one of only two possible values: $y_1^*(p_1) \in \{0, y_1^{**}(p_1)\}$, and the owner-manager would choose misconduct y_1^{**} if and only if

$$\begin{aligned}
U_1(p_1, 0; p^e) &< U_1(p_1, y_1^{**}; p^e) \\
\Leftrightarrow q_1 \cdot (p_1 - c) &< q_1 \cdot \left[\frac{1}{4\varphi\delta}(1 - \varphi\delta(p_1 - c))^2 + p_1 - c\right] - \kappa \\
\Leftrightarrow \kappa &< q_1 \cdot \frac{1}{4\varphi\delta}(1 - \varphi\delta(p_1 - c))^2 \\
\Leftrightarrow p_1 - c < \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa}{\varphi\delta q_1}} &\quad \text{or} \quad p_1 - c > \frac{1}{\varphi\delta} + 2\sqrt{\frac{\kappa}{\varphi\delta q_1}}
\end{aligned}$$

Recalling that $y_1^{**}(p_1) = 0$ if $p_1 - c \geq 1/\varphi\delta$ we have established that:

$$y_1^*(p_1) = \begin{cases} \frac{1}{2\varphi\delta}(1 - \varphi\delta(p_1 - c)) & \text{if } p_1 - c < \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa}{\varphi\delta q_1}} \\ 0 & \text{otherwise.} \end{cases} \tag{26}$$

Anticipating her optimising behaviour, the expected utility secured by the owner manager at the first stage is therefore:

$$\begin{aligned}
&U_1(p_1; p^e) \\
&= \begin{cases} q_1(p_1; p^e)\left[\frac{1}{4\varphi\delta}\left(1 - \varphi\delta(p_1 - c)\right)^2 + p_1 - c\right] - \kappa & \text{if } p_1 - c < \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa}{\varphi\delta q_1(p_1; p^e)}} \\ q_1(p_1; p^e)(p_1 - c) & \text{otherwise.} \end{cases}
\end{aligned} \tag{27}$$

Suppose that the market fundamentals yield a stable symmetric misconduct equilibrium. We first establish the relationship between the level of misconduct and the number of competing firms. We proceed as in the non-emotional moral dilemma case. At an interior equilibrium with positive misconduct the owner-managers are in the upper branch of (27). The derivative of own-firm demand with respect to own-firm price is given by Lemma 9 with $\gamma_1 = 1/2$ which derives from (26). The derivative of the owner-manager objective function (27) with respect to p_1 yields an expression analogous to (19). It follows that a symmetric stable equilibrium must be given by the larger of the two roots to:

$$\frac{\left(1 - \varphi\delta(p^e - c)\right)^2 + 4\varphi\delta(p^e - c)}{2\varphi\delta\left(1 + \varphi\delta(p^e - c)\right)} = \frac{1}{\left(1 - \frac{r\alpha}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx}$$

This expression simplifies analogously to (21) to yield:

$$p^e - c = -\frac{1}{\varphi\delta} + \frac{2}{\left(1 - \frac{r\alpha}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} \tag{28}$$

Identical reasoning to that used for the non-emotional moral dilemma case confirms that:

- Misconduct equilibria are only possible if (2) is satisfied.
- If $1 - F(x)$ is log-concave then at a symmetric misconduct equilibrium $\frac{\partial y^e}{\partial n} > 0$.
- If $1 - F(x)$ is log-convex then at a symmetric misconduct equilibrium $\frac{\partial y^e}{\partial n} < 0$.

We now turn to establishing the safe harbour equilibrium regions. Define the pair of functions:

$$\begin{aligned} \Psi_1(n) &:= \left(\frac{1}{\varphi\delta} - \sqrt{\frac{\kappa n}{\varphi\delta}}\right)\left(1 - \frac{\alpha r}{2}\right) \\ \Psi_2(n) &:= \left(\frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa n}{\varphi\delta}}\right). \end{aligned} \tag{29}$$

Both functions are declining in n. We assume $\Psi_2(n) < \Psi_1(n)\ \forall n \geq 2$ which requires

$$\left(\frac{\alpha r/2}{1 + \alpha r/2}\right)^2 \leq 2\varphi\delta\kappa \tag{30}$$

Next define the thresholds for $i \in \{1, 2\}$ as:

$$\begin{aligned} \overline{\nu}_i &:= \inf\left\{ n \,\middle|\, \frac{1}{\int_x g_{(\tilde{n}-1)}(x)\frac{f(x)}{1-F(x)}dx} > \Psi_i(\tilde{n})\ \forall \tilde{n} > n \right\} \\ \underline{\nu}_i &:= \sup\left\{ n \,\middle|\, \frac{1}{\int_x g_{(\tilde{n}-1)}(x)\frac{f(x)}{1-F(x)}dx} > \Psi_i(\tilde{n})\ \forall \tilde{n} \in [2, n] \right\}. \end{aligned} \tag{31}$$

These functions are well defined, though their values could be $+\infty$ or < 2 in which case the regions they identify are degenerate.

Niche-competition

This is the case in which $1 - F(x)$ is log-convex, and so $\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx}$ is increasing in n. It follows that $\underline{\nu}_i$ does not exist in $[2, \infty)$. We will show that the thresholds in the theorem are given by $\overline{\nu}_2 \leq \overline{\nu}_1$.

First claim that for $n < \overline{\nu}_2$ any symmetric equilibrium entails misconduct. Suppose otherwise that there exists $n < \overline{\nu}_2$ such that there exists a clean equilibrium. In this case the first order condition matches that in (24). So we have:

$$\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} =_{(24)} p^e(n) - c \geq_{(27)} \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa n}{\varphi\delta}} > \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa\overline{\nu}_2}{\varphi\delta}} = \frac{1}{\int_x g_{(\overline{\nu}_2-1)}(x)\frac{f(x)}{1-F(x)}dx}$$

But this is a contradiction to the fact noted above that, with niche products, $\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx}$ is increasing in n. This proves the result.

Suppose instead that $n > \overline{\nu}_1$ then claim any symmetric equilibrium is clean. Suppose otherwise that there exists $n > \overline{\nu}_1$ such that there exists a symmetric equilibrium with misconduct. The equilibrium price in this case must satisfy (28) and lie in the upper branch of (27). So we have:

$$\begin{aligned}
\frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_{x=1}^{\infty} g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} &=_{(28)} \frac{1}{2\varphi\delta} + \frac{p^e(n)-c}{2} \\
&<_{(27)} \frac{1}{2\varphi\delta} + \frac{1}{2}\left(\frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa n}{\varphi\delta}}\right) \\
&= \frac{1}{\varphi\delta} - \sqrt{\frac{\kappa n}{\varphi\delta}} \\
&< \frac{1}{\varphi\delta} - \sqrt{\frac{\kappa \overline{\nu}_1}{\varphi\delta}} \\
&= \frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(\overline{\nu}_1-1)}(x)\frac{f(x)}{1-F(x)}dx}
\end{aligned}$$

We again have a contradiction as $n > \overline{\nu}_1 \Rightarrow g_{(\overline{\nu}-1)} \prec_{\text{FOSD}} g_{(n-1)}$; and $1-F(x)$ log-convex implies $\frac{f(x)}{1-F(x)}$ is decreasing in x.

Finally, if $n \in [\overline{\nu}_2, \overline{\nu}_1]$ then the clean stable equilibrium is given by prices (24) which lies in the lower branch of (27) when $1-F(x)$ is log-convex as required. The misconduct equilibrium is given by prices (28) which lies in the upper branch of (27). Therefore both types of equilibrium are possible.

Mass-market competition

The case in which $1-F(x)$ log-concave, so $\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx}$ is declining in n. First claim that if $n < \underline{\nu}_1$ or $n > \overline{\nu}_1$ then the equilibrium is clean. Suppose otherwise for a contradiction that there is a misconduct equilibrium with $n < \underline{\nu}_1$. The equilibrium price would therefore be (28) and would be in the upper branch of (27). Hence we would have:

$$\begin{aligned}
p^e(n) - c = -\frac{1}{\varphi\delta} + \frac{2}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} &< \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa n}{\varphi\delta}} \\
\therefore \quad \frac{1}{\left(1-\frac{\alpha r}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} &< \frac{1}{\varphi\delta} - \sqrt{\frac{\kappa n}{\varphi\delta}}
\end{aligned}$$

But this is a contradiction to the definition of $\underline{\nu}_1$. The case for $n > \overline{\nu}_1$ is identical.

For the remainder of the proof we use that if κ is small then the functions Ψ_i are guaranteed to intersect the declining $\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx}$ at most twice. We can show that for $n \in (\underline{\nu}_2, \overline{\nu}_2)$ the equilibrium is one of misconduct. Suppose not for a contradiction. It follows that

$$p^e(n) - c =_{(24)} \frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} \geq_{(27)} \frac{1}{\varphi\delta} - 2\sqrt{\frac{\kappa n}{\varphi\delta}} = \Psi_2(n)$$

But this is a contradiction as for $n \in (\underline{\nu}_2, \overline{\nu}_2)$ with κ small we must have the opposite inequality.

Finally, if n lies in the border regions and so satisfies

$$\Psi_2(n) < \frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} < \Psi_1(n)$$

then the clean stable equilibrium which is given by prices (24) lies in the lower branch of (27). While misconduct equilibrium is given by prices (28) which lies in the upper branch of (27), yielding the result. ■

Proof of Proposition 3. If there are n firms competing then the expected match value created is

$$V(n) := \int x g_{(n)}(x)dx \quad \text{with} \quad g_{(n)}(x) = nf(x)F(x)^{n-1}. \tag{32}$$

Denote $\overline{F}^{-1}$ as the inverse of the reliability function, $1-F(x)$, then by applying Theorem 3 of Gabaix et al. (2016)

$$\text{for large } n, \quad V(n) \;\sim\; \overline{F}^{-1}\left(\frac{1}{n}\right) \cdot \Gamma(1-\gamma). \tag{33}$$

With $\Gamma(\cdot)$ denoting the gamma function[37,38] and γ is the tail index of $f(\cdot)$:

$$\gamma := \lim_{x \to b} \frac{d}{dx}\frac{1-F(x)}{f(x)}.$$

Now consider the prices and misconduct. In a misconduct equilibrium prices are given by (21). It will be helpful to define the quotient:

$$Q(n) := \frac{1}{\left(1 - \frac{\alpha r}{2}\right)\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx}. \tag{34}$$

Taking differentials of (21) we establish

$$\frac{dp^e}{dQ}\left[1 + \frac{4\omega\alpha}{(1+\omega\alpha+\varphi\delta(p^e-c))^2}\right] = 2. \tag{35}$$

This yields that $0 < \frac{dp^e}{dQ} < 2$. Further, observe that if $Q = 0$ then (21), using the larger

[37] $\Gamma(t) \equiv \int_{x=0}^{\infty} x^{t-1}e^{-x}dx$.

[38] To derive (33) apply Theorem 3 of Gabaix et al. (2016) setting $G(x) = x$ and using part 2 of Lemma 1 (Gabaix et al. (2016)) to determine the index of variation in the limit for $t \to 0$ of $\overline{F}^{-1}(t)$.

root which captures stability, implies that $1+\omega\alpha+\varphi\delta(p^e-c)=\sqrt{4\omega\alpha}$, inserting this lower bound for p^e into (35) delivers:

$$1<\frac{dp^e}{dQ}<2. \tag{36}$$

Now using (15) we can establish the consumer surplus as a function of firm numbers:

$$CS(n):=V(n)-\alpha y_1^*(p^e(n))-p^e(n)=V(n)+p^e(n)\cdot\left(\frac{\alpha}{2}-1\right)+[\text{constant}].$$

It follows that

$$\frac{d}{dn}CS(n)=\frac{dV(n)}{dn}+\frac{1}{2}(\alpha-2)\frac{dp^e}{dQ}\frac{\partial}{\partial n}Q(n). \tag{37}$$

The last preliminary is to note that the large n approximation for $Q(n)$ is derived from Gabaix et al. (2016), Theorem 1:

$$\text{For large } n, \quad Q(n) \;\sim\; \frac{1}{\left(1-\frac{\alpha r}{2}\right)nf\left(\overline{F}^{-1}\left(\frac{1}{n}\right)\right)\Gamma(\gamma+2).} \tag{38}$$

We now prove the first result for the case of the Weibull distribution (e.g. $f(x)=\beta x^{\beta-1}e^{-x^\beta}$, $\beta\geq 1$). Using Table 4 of Gabaix et al. (2016) we observe that in this case $nf\left(\overline{F}^{-1}\left(\frac{1}{n}\right)\right)=\beta n^{1/\beta}$. It follows from (38) that $\lim_{n\to\infty}Q(n)=0$. Assume for a contradiction that the industry is clean, then from (24) prices approach cost, but then this contradicts that margins lie above $(1-\omega\alpha)/\varphi\delta$ established in (15). Hence a symmetric equilibrium is one of misconduct.

Table 4 of Gabaix et al. (2016) documents that, for a Weibull distribution, for large n, $\overline{F}^{-1}(1/n)\sim -n^{-1/\beta}$. Therefore using (33) and (38) we have that for large n

$$\frac{\partial V(n)}{\partial n}\sim\Gamma(1-\gamma)\cdot\frac{1}{\beta}n^{-\frac{1}{\beta}-1} \quad\text{and}\quad \frac{\partial Q(n)}{\partial n}\sim-\frac{1}{\Gamma(2+\gamma)}\cdot\frac{1}{\beta^2}n^{-\frac{1}{\beta}-1}\cdot\frac{1}{\left(1-\frac{\alpha r}{2}\right)}$$

Then using (37) as $dp^e/dQ>1$, (given in (36)):

$$\frac{d}{dn}CS(n)\;<\;\frac{1}{\beta^2}n^{-\frac{1}{\beta}-1}\left[\beta\Gamma(1-\gamma)-\frac{1}{2\Gamma(2+\gamma)}(\alpha-2)\frac{1}{\left(1-\frac{\alpha r}{2}\right)}\right]$$

For the case of the Weibull, $\gamma=-1/\beta$,[39] hence a sufficient condition for consumer surplus to decline in firm numbers is if

$$\alpha>\alpha^\dagger:=2\left(\frac{1+\beta\Gamma\left(2-\frac{1}{\beta}\right)\Gamma\left(1+\frac{1}{\beta}\right)}{1+r\cdot\beta\Gamma\left(2-\frac{1}{\beta}\right)\Gamma\left(1+\frac{1}{\beta}\right)}\right).$$

[39] Table 4, Gabaix et al. (2016)

The proof for the Power law distribution $\left(f(x) = \beta x^{\beta-1}\right)$, $\beta \geq 1$, $x \in [0,1]$ is identical. The uniform distribution follows the same steps and requires $\alpha^{\dagger} = 4/(1-r)$.

We now consider the normal distribution. From Table 4 of Gabaix et al. (2016), for large n, $nf\left(\overline{F}^{-1}\left(\frac{1}{n}\right)\right) \sim \sqrt{2\ln n}$. It follows from (38) that $\lim_{n\to\infty} Q(n) = 0$. By the argument above a symmetric equilibrium for large n must be one of misconduct. Gabaix et al. (2016) also document that for large n, $\overline{F}^{-1}(1/n) \sim \sqrt{2\ln n}$. Therefore using (33) and (38) in (37) and the fact that $dp^e/dQ < 2$ (from (36)):

$$\frac{d}{dn}CS(n) > \frac{1}{n\left(2\ln n\right)^{3/2}}\left(2\ln n - \left(\frac{\alpha-2}{1-\frac{\alpha r}{2}}\right)\right) > 0 \text{ for large } n.$$

Where we have used that for the normal, $\gamma = 0$. ■

Proof of Proposition 4. The critical number of firms under non-emotional (thinking slow) dilemmas is given by (22). Consider niche markets first then from Proposition 2 we have $\overline{\nu}$ as the solution in n to

$$\frac{1}{\int_x g_{(n-1)}\frac{f(x)}{1-F(x)}dx} = \left(\frac{1}{\varphi\delta} - \sqrt{\frac{\kappa n}{\varphi\delta}}\right)\left(1 - \frac{\alpha r}{2}\right) \tag{39}$$

This solution is unique as $\frac{1}{\int_x g_{(n-1)}\frac{f(x)}{1-F(x)}dx}$ is increasing in n under niche markets and the right hand side is declining in n. Substituting κ^* into (39) then observe that (22) implies the solution to (39) is given by N. The first result is now a corollary of Propositions 1 and 2.

For part 2 observe that substituting κ^* into (29), we have from (22) that $\underline{\nu}_1 \leq N \leq \overline{\nu}_1$. Next note that $\Psi_1(N/(\alpha\omega)^2)|_{\kappa^*} = 0$. This implies that $\overline{\nu}_1 < N/(\alpha\omega)^2$. The second result is now a corollary of Propositions 1 and 2.

For the final result observe that the functions $\Psi_1(n), \Psi_2(n)$ given in (29) shift downwards in κ. By inspection of (31) we therefore have $d\overline{\nu}_i/d\kappa < 0$ for $i \in \{1,2\}$. This delivers the result for niche markets, and shows that the upper boundary in the mass market case is declining in κ. For the lower boundary in mass markets note that as $\frac{1}{\int_x g_{(n-1)}\frac{f(x)}{1-F(x)}dx}$ is decreasing in n, (31) implies that $d\underline{\nu}_i/d\kappa > 0$, completing the result in this case. ■

B Proofs from Section 5

Proof of Proposition 5. The personalisation of the willpower term, ω_1, does not alter the second stage maximisation. Thus in a misconduct equilibrium the analogue of (15) holds:

$$y_1^*(p_1) = \frac{1}{2\varphi\delta}\left(1 - \omega_1\alpha - \varphi\delta(p_1 - c)\right) \tag{40}$$

Substituting back into the owner-manager's objective function yields the indirect utility from (16):

$$U_1(p_1, y_1^*(p_1); p_2) = q_1(p_1; p_2)\left[\frac{1}{4\varphi\delta}\left(1 - \omega_1\alpha - \varphi\delta(p_1 - c)\right)^2 + p_1 - c\right] \tag{41}$$

At an equilibrium, using the notation that $U_{1;p_1} \equiv \partial U_1/\partial p_1$ we have first and second order conditions given by:

$$U_{1;p_1} = 0 = U_{2;p_2} \text{ and } U_{1;p_1p_1}, U_{2;p_2p_2} < 0. \tag{42}$$

Now consider the requirements of stability (Dixit (1986)). Suppose the firms find themselves at a non-equilibrium point $\{\tilde{p}_1, \tilde{p}_2\}$, which is close to the equilibrium values $\{p_1^e, p_2^e\}$. Suppose each firm updates its prices proportionally to the first order gain. Using a Taylor Expansion for each firm for points close to the equilibrium we have the system path near to an equilibrium point given by:

$$\begin{pmatrix} \dot{p}_1 \\ \dot{p}_2 \end{pmatrix} = \underbrace{\begin{pmatrix} U_{1;p_1p_1} & U_{1;p_1p_2} \\ U_{2;p_1p_2} & U_{2;p_2p_2} \end{pmatrix}}_{\mathcal{A}} \begin{pmatrix} \tilde{p}_1 - p_1^e \\ \tilde{p}_2 - p_2^e \end{pmatrix}.$$

The Hessian matrix $\mathcal{A}$ has its terms evaluated at the equilibrium values $\{p_1^e, p_2^e\}$. Stability of the equilibrium requires that all the eigenvalues of $\mathcal{A}$ have negative real parts (Dixit (1986), Anishchenko et al. (2014) Chapter 2). The second order conditions (42) directly yield that the trace is negative. Stability therefore ensures that

$$\det \mathcal{A} > 0. \tag{43}$$

Now consider taking differentials of the first order conditions in (42) with respect to ω_2. Using the fact that $U_{1;p_1\omega_2} = 0$ the two first order conditions yield:

$$\begin{aligned} &\begin{pmatrix} U_{1;p_1p_1} & U_{1;p_1p_2} \\ U_{2;p_2p_1} & U_{2;p_2p_2} \end{pmatrix} \begin{pmatrix} dp_1 \\ dp_2 \end{pmatrix} + \begin{pmatrix} U_{1;p_1\omega_2} \\ U_{2;p_2\omega_2} \end{pmatrix} d\omega_2 = 0 \\ &\Rightarrow \begin{pmatrix} dp_1 \\ dp_2 \end{pmatrix} = \frac{1}{\det \mathcal{A}} \begin{pmatrix} \cdot & -U_{1;p_1p_2} \\ \cdot & U_{1;p_1p_1} \end{pmatrix} \begin{pmatrix} 0 \\ -U_{2;p_2\omega_2} \end{pmatrix} d\omega_2 \end{aligned} \tag{44}$$

We can sign the actions of firm 2:

$$\begin{aligned} \frac{dp_2^e}{d\omega_2} &=_{\text{using (44)}} -\frac{U_{1;p_1p_1}}{\det \mathcal{A}} U_{2;p_2\omega_2} =_{\text{sign}} U_{2;p_2\omega_2} \text{ using (42) and (43)} \\ &=_{\text{using (41)}} -\frac{\partial q_2}{\partial p_2} \cdot \alpha \underbrace{y_2^*(p_2)}_{\text{simplifying using (40)}} + \frac{\alpha}{2} q_2 > 0. \end{aligned} \tag{45}$$

It then follows from (40) that $\frac{dy_2^*}{d\omega_2} < 0$.

For firm 1's behaviour in response we begin with the first order condition (42):

$$U_{1;p_1} = 0 \;\Rightarrow\; \frac{1}{4\varphi\delta}\left(1 - \omega_1\alpha - \varphi\delta(p_1 - c)\right)^2 + p_1 - c = \frac{q_1}{-\partial q_1/\partial p_1}\frac{1}{2}\left[1 + \omega_1\alpha + \varphi\delta(p_1 - c)\right]$$

Therefore

$$U_{1;p_1p_2} = \left[\frac{\partial^2 q_1}{\partial p_1 \partial p_2}\frac{q_1}{-\partial q_1/\partial p_1} + \frac{\partial q_1}{\partial p_2}\right]\frac{1}{2}\left[1 + \omega_1\alpha + \varphi\delta(p_1 - c)\right] \tag{46}$$

From (41), $U_1 > 0$ in a misconduct equilibrium requires that $p_1^e - c > -\left(\frac{1+\omega_1\alpha}{\varphi\delta}\right)$. Observing that

$$\frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2} = \frac{1}{q_1^2}\left(q_1\frac{\partial^2 q_1}{\partial p_1 \partial p_2} - \frac{\partial q_1}{\partial p_1}\frac{\partial q_1}{\partial p_2}\right),$$

we have that

$$U_{1;p_1p_2} =_{\text{sign}} \frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2}$$

It therefore follows that

$$\begin{aligned}\frac{dp_1^e}{d\omega_2} &=_{\text{using (44)}} \frac{U_{2;p_2\omega_2}}{\det \mathcal{A}} U_{1;p_1p_2} =_{\text{sign and using (45)}} U_{1;p_1p_2} =_{\text{sign}} \frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2},\\ \frac{dy_1^*(p_1^e)}{d\omega_2} &=_{\text{sign and using (40)}} -\frac{dp_1^e}{d\omega_2} = -\frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2}.\end{aligned}$$

If the market is characterised by mass-market competition so the reliability function is log-concave then we appeal to Quint (2014), Theorem 1, to establish that the log of each firm's realised demand has increasing differences in prices: $\frac{\partial^2 \ln q_1}{\partial p_1 \partial p_2} > 0$. ■

C Proofs from Section 6

Proof of Proposition 6. In the second stage the owner-manager optimises her misconduct. The first order condition implicitly defines optimal misconduct as a function of first period price: $y_1^*(p_1)$:

$$\frac{\partial U_1}{\partial y_1}(p_1, y_1^*(p_1); p^e) = 0 \tag{47}$$

Implicitly differentiating (47) we can establish the dependence of misconduct on the first period price:

$$\frac{dy_1^*}{dp_1} = -\frac{\partial^2 U_1/\partial y_1 \partial p_1}{\partial^2 U_1/\partial y_1^2} =_{\text{sign}} \partial^2 U_1/\partial y_1 \partial p_1, \tag{48}$$

where we use the concavity of the second stage misconduct choice problem.

It will be helpful to demonstrate that (48) is negative. To do this observe from (5) that:

$$\begin{aligned}\frac{\partial U_1}{\partial p_1} &= q_1(1-\delta\varphi(y_1)) + \frac{\partial q_1}{\partial p_1}\left[(p_1 - c + y_1)(1-\delta\varphi(y_1)) - \omega\alpha(y_1)\right] \\ \frac{\partial^2 U_1}{\partial p_1 \partial y_1} &= -q_1\delta\varphi'(y_1) + \frac{\partial q_1}{\partial p_1}\frac{1}{q_1}\frac{\partial U_1}{\partial y_1}\end{aligned} \tag{49}$$

Therefore, evaluating at equilibrium prices, and using the first order condition (47):

$$\left.\frac{\partial^2 U_1}{\partial p_1 \partial y_1}\right|_e = -q_1(p^e, p^e)\cdot\delta\varphi'(y_1^*) < 0 \;\Rightarrow\; \left.\frac{dy_1^*}{dp_1}\right|_e < 0. \tag{50}$$

Let us now consider the first stage price setting problem:

$$\left.\frac{dU_1}{dp_1}\right|_e = \left.\frac{\partial U_1}{\partial p_1}\right|_e + \underbrace{\frac{\partial U_1}{\partial y_1}}_{=0 \text{ by } (47)}\frac{dy_1}{dp_1} = 0 \tag{51}$$

Taking differentials of (51) we have:

$$\underbrace{\frac{d}{dp^e}\left(\left.\frac{\partial U_1}{\partial p_1}\right|_e\right)}_{(\dagger)} dp^e + \frac{\partial}{\partial n}\left(\left.\frac{\partial U_1}{\partial p_1}\right|_e\right) dn = 0 \tag{52}$$

Observe that (†) is the total derivative of $\partial U_1/\partial p_1$ with respect to the equilibrium price p^e. This expression captures the change in the first order condition for firm 1 when both firm 1 and all other firms all change their prices in unison. Stability requires that

$$\frac{\partial U_1}{\partial p_1}(p^e - \tilde{\varepsilon}, y_1^*(p^e - \tilde{\varepsilon}); p^e - \tilde{\varepsilon}) > 0 > \frac{\partial U_1}{\partial p_1}(p^e + \tilde{\varepsilon}, y_1^*(p^e + \tilde{\varepsilon}); p^e + \tilde{\varepsilon})$$

And this yields that (†) < 0. It therefore follows from (52) that

$$\frac{dp^e}{dn} =_{\text{sign}} \frac{\partial}{\partial n}\left(\left.\frac{\partial U_1}{\partial p_1}\right|_e\right). \tag{53}$$

We now use (49) and the observation that only demand is a function of n and $q_1(p^e; p^e) = 1/n$ to establish that:

$$\begin{aligned}\frac{\partial}{\partial n}\left(\left.\frac{\partial U_1}{\partial p_1}\right|_e\right) =& -\frac{1}{n^2}(1 - \delta\varphi(y_1^*(p^e))) \\ &+ \frac{\partial}{\partial n}\left(\frac{\partial q_1}{\partial p_1}(p^e; p^e)\right)\left[(p_e - c + y_1^*(p^e))(1-\delta\varphi(y_1^*(p^e))) - \omega\alpha(y_1^*(p^e))\right]\end{aligned} \tag{54}$$

But the first order condition (51) applied to (49) gives:

$$(p^e - c + y_1^*(p^e))(1 - \delta\varphi(y_1^*(p^e))) - \omega\alpha(y_1^*(p^e)) = (1 - \delta\varphi(y_1^*(p^e)))\left[\frac{1}{-n\frac{\partial q_1}{\partial p_1}(p^e, p^e)}\right] \quad (55)$$

And this in turn allows us to simplify (54) to

$$\frac{\partial}{\partial n}\left(\left.\frac{\partial U_1}{\partial p_1}\right|_e\right) = \left[-\frac{1}{n^2} + \frac{\partial}{\partial n}\left(\frac{\partial q_1}{\partial p_1}(p^e, p^e)\right)\frac{1}{-n\frac{\partial q_1}{\partial p_1}}\right](1 - \delta\varphi(y_1^*(p^e))). \quad (56)$$

Observe that (56) can be simplified as demand is downward sloping and in equilibrium the final bracket must be positive otherwise the owner-manager would have negative utility, and so we can write:

$$\frac{\partial}{\partial n}\left(\left.\frac{\partial U_1}{\partial p_1}\right|_e\right) =_{\text{sign}} \frac{\partial}{\partial n}\left[n\frac{\partial q_1}{\partial p_1}(p^e, p^e)\right] \quad (57)$$

Now using (50), and then (53) with (57) we have

$$\frac{dy_1^*(p^e)}{dn} = \frac{\partial y_1^*}{\partial p_1}(p^e) \cdot \frac{dp^e}{dn} =_{\text{sign}} -\frac{dp^e}{dn} =_{\text{sign}} -\frac{\partial}{\partial n}\left[n\frac{\partial q_1}{\partial p_1}(p^e, p^e)\right].$$

We can now use Lemma 9 with $r = 0$ and the techniques of Proposition 1 to link the direction of misconduct to the log-concavity and log-convexity of the reliability function $1 - F(x)$.

Finally note that the result applies also to the interior of a misconduct equilibrium for an emotional moral dilemma (trigger thinking-fast), by setting $\omega = 0$. ■

Proof of Corollary 7. The altered objective function ($5'$) does cause minor alterations in the proof of Proposition 6 at equation (49) and above (56). However these changes leave unaffected the subsequent analysis (at equations (50), (56) and (57)). The proof then follows. ■

Proof of Proposition 8. We initially follow the steps used in the proof of Proposition 1. Optimising misconduct in stage 2 we determine that:

$$y_1^*(p_1) = \begin{cases} \frac{1-\omega\alpha}{2\delta\varphi(1+\epsilon q_1)} - \frac{1}{2}(p_1 - c) & \text{if } p_1 - c < \frac{1-\omega\alpha}{\delta\varphi(1+\epsilon q_1)} \\ 0 & \text{otherwise} \end{cases}. \quad (58)$$

Note that if $q_1 \to 0$ then this expression remains bounded. The stage 1 utility is in turn given by

$$\begin{aligned} &U_1(p_1, y_1^*(p_1); p^e) \\ &= \begin{cases} \frac{q_1(p_1;p^e)}{4\varphi\delta}\left[\frac{(1-\omega\alpha)^2}{1+\epsilon q_1} + (\delta\varphi(p_1 - c))^2(1 + \epsilon q) + 2\delta\varphi(1 + \omega\alpha)(p_1 - c)\right] & \text{if } p_1 - c < \frac{1-\omega\alpha}{\delta\varphi(1+\epsilon q_1)} \\ q_1(p_1; p^e)(p_1 - c) & \text{otherwise} \end{cases} \end{aligned}$$

Consider now a positive misconduct equilibrium. Applying the first order condition and evaluating at equilibrium we determine the analogue of (20) which allows us to characterise a symmetric misconduct equilibrium as the solution in p^e of:

$$\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} = \frac{\left(\frac{1-\omega\alpha}{1+\frac{\epsilon}{n}}\right)^2 + 2\varphi\delta(1+\omega\alpha)(p^e-c) + (\varphi\delta(p^e-c))^2(1+2\frac{\epsilon}{n})}{2\varphi\delta(1+\omega\alpha+\varphi\delta(p^e-c)(1+\frac{\epsilon}{n}))} \tag{59}$$

Where we have used Lemma 9 with $r=0$ so focusing on passive expectations. Further simplification allows us to write:

$$\frac{2\varphi\delta}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} = \delta\varphi(p^e-c)\left(\frac{1+2\frac{\epsilon}{n}}{1+\frac{\epsilon}{n}}\right) + \frac{(1+\omega\alpha)}{\left(1+\frac{\epsilon}{n}\right)^2} - \frac{\frac{4\omega\alpha}{(1+\frac{\epsilon}{n})^2}}{1+\omega\alpha+\delta\varphi(p^e-c)\left(1+\frac{\epsilon}{n}\right)} \tag{60}$$

Note that (60) is the analogue of (21) and collapses to it if $\epsilon=0$. Also note that the right hand side of (60) is increasing in p^e.

We now define the candidate critical threshold number of firms as any solution $\tilde{N}$ to the condition:

$$\frac{1}{\int_x g_{(\tilde{N}-1)}(x)\frac{f(x)}{1-F(x)}dx} = \frac{1}{\varphi\delta}\frac{1-\omega\alpha}{1+\frac{\epsilon}{\tilde{N}}}. \tag{61}$$

Mass-market

The result that any equilibrium must be clean for $n<\tilde{N}$ and one of misconduct for $n>\tilde{N}$ follows as in Proposition 1.

Niche-market

If the reliability function is log-convex then both the right and left hand sides of (61) are increasing in $\tilde{N}$. Note that the right hand side of (61) can be arbitrarily flat for $\tilde{N}\geq 2$ by choosing ϵ small enough. Therefore there exists an open region around $\epsilon=0$ such that (61) has a unique solution and in this region

$$\frac{1}{\int_x g_{(n-1)}(x)\frac{f(x)}{1-F(x)}dx} \begin{cases} > \frac{1}{\varphi\delta}\left(\frac{1-\omega\alpha}{1+\frac{\epsilon}{n}}\right) & \forall n>\tilde{N} \\ < \frac{1}{\varphi\delta}\left(\frac{1-\omega\alpha}{1+\frac{\epsilon}{n}}\right) & \forall n\in[2,\tilde{N}). \end{cases} \tag{62}$$

The proof now uses the same argument as with the log-concave case to deliver the threshold result in part 2.

Mass-market comparative static

In the interior of a misconduct equilibrium the level of misconduct is given by (58).

Therefore the rate of change of misconduct with respect to firm numbers is given by:

$$\begin{aligned}\frac{dy_1^*(p^e(n))}{dn} =& \frac{d}{dn}\left(-\frac{1}{2}(p^e(n)-c)+\frac{1-\omega\alpha}{2\varphi\delta\left(1+\frac{\epsilon}{n}\right)}\right) = -\frac{1}{2}\frac{dp^e(n)}{dn}+\frac{1-\omega\alpha}{2\varphi\delta\left(1+\frac{\epsilon}{n}\right)^2}\frac{\epsilon}{n^2} \\ >& -\frac{1}{2}\frac{dp^e(n)}{dn}\end{aligned} \tag{63}$$

The inequality follows as $\omega\alpha < 1$ is required for (61) to hold which is required in a misconduct equilibrium. In turn the equilibrium price $p^e(n)$ is given by the solution to (59) which we can write as $Q(n) = W(p^e, n)$ where $Q(n)$ was defined in (34) and $W(p^e, n)$ is the right hand side of (59). Observe that as the reliability function is log-concave standard arguments yield that $\partial Q(n)/\partial n < 0$, and by inspection of (60), $\partial W(p^e, n)/\partial p^e > 0$. Hence:

$$\underbrace{\frac{\partial Q(n)}{\partial n}}_{<0} dn = \underbrace{\frac{\partial W}{\partial p^e}}_{>0} dp^e + \frac{\partial W}{\partial n} dn \tag{64}$$

The key final step in the proof is to demonstrate that in a misconduct equilibrium $\partial W(p^e, n)/\partial n > 0$. If this can be established then for the mass-market setting (64) implies $dp^e/dn < 0$, and therefore (63) implies $dy_1^*(p^e)/dn > 0$ as claimed.

To establish the sign of $\partial W(p^e, n)/\partial n$ differentiate (59) to establish

$$\frac{\partial W}{\partial n} =_{\text{sign}} \begin{array}{l}\left(1+\omega\alpha+\delta\varphi(p^e-c)\left(1+\frac{\epsilon}{n}\right)\right)\left[\left(\frac{1-\omega\alpha}{1+\frac{\epsilon}{n}}\right)^2\frac{2\epsilon}{n^2\left(1+\frac{\epsilon}{n}\right)}-(\varphi\delta(p^e-c))^2\frac{2\epsilon}{n^2}\right] \\ +\frac{\epsilon}{n^2}\varphi\delta(p^e-c)\left[\left(\frac{1-\omega\alpha}{1+\frac{\epsilon}{n}}\right)^2+2\varphi\delta(1+\omega\alpha)(p^e-c)+(\varphi\delta(p^e-c))^2\left(1+2\frac{\epsilon}{n}\right)\right]\end{array}$$

Now in a misconduct equilibrium we have from (58) that $\frac{1-\omega\alpha}{1+\frac{\epsilon}{n}} > \delta\varphi(p^e-c)$. Substituting this in and simplifying yields

$$\text{sign}\left(\frac{\partial W}{\partial n}\right) > (\delta\varphi(p^e-c))^2\frac{2\epsilon}{n^2}\frac{1}{1+\frac{\epsilon}{n}}\left[\delta\varphi(p^e-c)\left(1+\frac{\epsilon}{n}\right)+1+\omega\alpha\right] > 0$$

The final inequality follows from (59). ∎

References

Acemoglu, D. and T. Verdier (2000). The choice between market failures and corruption. *American economic review 90*(1), 194–211.

Ades, A. and R. Di Tella (1999). Rents, competition, and corruption. *American economic review 89*(4), 982–993.

Aghion, P., C. Harris, P. Howitt, and J. Vickers (2001). Competition, imitation and growth with step-by-step innovation. *The Review of Economic Studies 68*(3), 467–492.

Alldridge, P. (2001). The moral limits of the crime of money laundering. *Buffalo Criminal Law Review 5*(1), 279–319.

Anishchenko, V. S., T. Vadivasova, and G. Strelkova (2014). *Deterministic Nonlinear Systems*. Springer.

Arrow, K. (1973). Some ordinalist-utilitarian notes on rawls's theory of justice. *The Journal of Philosophy 70*(9), 245–263.

Auger, P. and T. M. Devinney (2007). Do what consumers say matter? the misalignment of preferences with unconstrained ethical intentions. *Journal of Business Ethics 76*(4), 361–383.

Ausubel, L. M. (1991). The failure of competition in the credit card market. *The American Economic Review*, 50–81.

Bagnoli, M. and T. Bergstrom (2005). Log-concave probability and its applications. *Economic theory 26*(2), 445–469.

Beck, T., A. Demirgüç-Kunt, and R. Levine (2006). Bank concentration, competition, and crises: First results. *Journal of Banking & Finance 30*(5), 1581–1603.

Bénabou, R. and J. Tirole (2006). Incentives and prosocial behavior. *American economic review 96*(5), 1652–1678.

Bénabou, R. and J. Tirole (2011). Identity, morals, and taboos: Beliefs as assets. *The Quarterly Journal of Economics 126*(2), 805–855.

Bénabou, R. and J. Tirole (2016). Bonus culture: Competitive pay, screening, and multitasking. *Journal of Political Economy 124*(2), 305–370.

Bennett, V. M., L. Pierce, J. A. Snyder, and M. W. Toffel (2013). Customer-driven misconduct: How competition corrupts business practices. *Management Science 59*(8), 1725–1742.

Besanko, D., J.-P. Dubé, and S. Gupta (2005). Own-brand and cross-brand retail pass-through. *Marketing Science 24*(1), 123–137.

Besley, T. and M. Ghatak (2005). Competition and incentives with motivated agents. *The American economic review 95*(3), 616–636.

Besley, T. J. and H. S. Rosen (1999). Sales taxes and prices: an empirical analysis. *National tax journal 52*(2), 157–178.

Biais, B. and R. Green (2019). The microstructure of the bond market in the 20th century. *Review of Economic Dynamics 33*, 250–271.

Bliss, C. and R. D. Tella (1997). Does competition kill corruption? *Journal of political economy 105*(5), 1001–1023.

Bodnar, G. M., B. Dumas, and R. C. Marston (2002). Pass-through and exposure. *The Journal of Finance 57*(1), 199–231.

Boyd, J. H. and G. De Nicolo (2005). The theory of bank risk taking and competition revisited. *The Journal of finance 60*(3), 1329–1343.

Bulow, J. I. and P. Pfleiderer (1983). A note on the effect of cost changes on prices. *Journal of political Economy 91*(1), 182–185.

Cai, H. and Q. Liu (2009). Competition and corporate tax avoidance: Evidence from chinese industrial firms. *The Economic Journal 119*(537), 764–795.

Camerer, C. F. and R. H. Thaler (1995). Anomalies: Ultimatums, dictators and manners. *Journal of Economic perspectives 9*(2), 209–219.

Carlin, B. and S. Gervais (2009). Work ethic, employment contracts, and firm value. *The Journal of Finance 64*(2), 785–821.

Carrington, M. J., B. A. Neville, and G. J. Whitwell (2010). Why ethical consumers don't walk their talk: Towards a framework for understanding the gap between the ethical purchase intentions and actual buying behaviour of ethically minded consumers. *Journal of business ethics 97*(1), 139–158.

Claessens, S. (2019). Fragmentation in global financial markets: good or bad for financial stability?

Commission, C. et al. (2009). Market investigation into payment protection insurance. *United Kingdom: Competition Commission*.

Davidson, R. J. and W. Irwin (1999). The functional neuroanatomy of emotion and affective style. *Trends in cognitive sciences 3*(1), 11–21.

Dimmock, S. G., W. C. Gerken, and N. P. Graham (2018). Is fraud contagious? coworker influence on misconduct by financial advisors. *The Journal of Finance 73*(3), 1417–1450.

Dixit, A. (1986). Comparative statics for oligopoly. *International economic review*, 107–122.

Drevets, W. C. and M. E. Raichle (1998). Reciprocal suppression of regional cerebral blood flow during emotional versus higher cognitive processes: Implications for interactions between emotion and cognition. *Cognition and emotion*.

Easley, D., N. M. Kiefer, and M. O'HARA (1996). Cream-skimming or profit-sharing? the curious role of purchased order flow. *The Journal of Finance 51*(3), 811–833.

Easley, D. and M. O'Hara (2019). Market ethics. *Available at SSRN 3415626*.

Egan, M., G. Matvos, and A. Seru (2016). The market for financial adviser misconduct. Technical report, National Bureau of Economic Research.

Ely, J. C. and J. Välimäki (2003). Bad reputation. *The Quarterly Journal of Economics 118*(3), 785–814.

FMSB (2018). *Behavioural Cluster Analysis – Misconduct Patterns in Financial Markets.* FICC Market Standards Board, www.fmsb.com.

Gabaix, X. and D. Laibson (2006). Shrouded attributes, consumer myopia, and information suppression in competitive markets. *The Quarterly Journal of Economics 121*(2), 505–540.

Gabaix, X., D. Laibson, D. Li, H. Li, S. Resnick, and C. G. de Vries (2016). The impact of competition on prices with numerous firms. *Journal of Economic Theory 165*, 1–24.

Gilbert, R. J. and D. M. Newbery (1982). Preemptive patenting and the persistence of monopoly. *The American Economic Review*, 514–526.

Goetz, M. R. (2018). Competition and bank stability. *Journal of Financial Intermediation 35*, 57–69.

Gorton, G. B. and A. K. Zentefis (2019). Social progress and corporate culture. Technical report, National Bureau of Economic Research.

Greene, J. D., L. E. Nystrom, A. D. Engell, J. M. Darley, and J. D. Cohen (2004). The neural bases of cognitive conflict and control in moral judgment. *Neuron 44*(2), 389–400.

Greene, J. D. and J. M. Paxton (2009). Patterns of neural activity associated with honest and dishonest moral decisions. *Proceedings of the National Academy of Sciences 106*(30), 12506–12511.

Greene, J. D., R. B. Sommerville, L. E. Nystrom, J. M. Darley, and J. D. Cohen (2001). An fmri investigation of emotional engagement in moral judgment. *Science 293*(5537), 2105–2108.

Guo, Y., B. Jung, and Y. S. Yang (2019). On the nonlinear relation between product market competition and earnings quality. *Accounting and Business Research*, 1–29.

Hart, O. and L. Zingales (2017). Companies should maximize shareholder welfare not

market value.
Hausman, D. and M. McPherson (1993). Taking ethics seriously: Economics and contemporary moral philosophy. *The Journal of Economic Literature 31*(2), 671–731.
Hortaçsu, A. and C. Syverson (2004). Product differentiation, search costs, and competition in the mutual fund industry: A case study of s&p 500 index funds. *The Quarterly journal of economics 119*(2), 403–456.
Jiménez, G., J. A. Lopez, and J. Saurina (2013). How does competition affect bank risk-taking? *Journal of Financial stability 9*(2), 185–195.
Johnson, J. P. and D. P. Myatt (2006). On the simple economics of advertising, marketing, and product design. *American Economic Review 96*(3), 756–784.
Kahneman, D. (2011). *Thinking, fast and slow.* Macmillan.
Kant, I. (2012 [1785]). *Groundwork of the Metaphysics of Morals.* Cambridge University Press.
Kartner, J. and C. M. Warner (2015). Multi-nationals and corruption systems: The case of siemens. *Working Paper*.
Keeley, M. C. (1990). Deposit insurance, risk, and market power in banking. *The American Economic Review*, 1183–1200.
Klein, B., K. Leffler, et al. (1981). The role of price in guaranteeing quality. *Journal of Political Economy 89*(4), 615–641.
Kwok, C. C. and S. Tadesse (2006). The mnc as an agent of change for host-country institutions: Fdi and corruption. *Journal of International Business Studies 37*(6), 767–785.
Luca, M. and G. Zervas (2016). Fake it till you make it: Reputation, competition, and yelp review fraud. *Management Science 62*(12), 3412–3427.
Mendez, M. F., E. Anderson, and J. S. Shapira (2005). An investigation of moral judgement in frontotemporal dementia. *Cognitive and behavioral neurology 18*(4), 193–197.
Mill, J. S. (1863). *Utilitarianism.* London: Parker, Son and Bourn.
Nichols, S. and R. Mallon (2006). Moral dilemmas and moral rules. *Cognition 100*(3), 530–542.
Patel, K. (2014). *Setting standards: Professional bodies and the financial services sector.* Centre for the Study of Financial Innovation (CSFI).
Paxton, J. M., L. Ungar, and J. D. Greene (2012). Reflection and reasoning in moral judgment. *Cognitive science 36*(1), 163–177.
Perloff, J. M. and S. C. Salop (1985). Equilibrium with product differentiation. *The Review of Economic Studies 52*(1), 107–120.
Pierce, L. and J. Snyder (2008). Ethical spillovers in firms: Evidence from vehicle emissions testing. *Management Science 54*(11), 1891–1903.
Polemis, M. L. and T. Stengos (2019). Does competition prevent industrial pollution? evidence from a panel threshold model. *Business Strategy and the Environment 28*(1), 98–110.
Poterba, J. M. (1996). Retail price reactions to changes in state and local sales taxes. *National Tax Journal 49*(2), 165–176.
Quint, D. (2014). Imperfect competition with complements and substitutes. *Journal of Economic Theory 152*, 266–290.
Rashid, S. (1988). Quality in contestable markets: A historical problem? *The Quarterly Journal of Economics 103*(1), 245–249.
Reiman, E. M. (1997). The application of positron emission tomography to the study of normal and pathologic emotions. *Journal of Clinical Psychiatry 58*(16), 4–12.

Remolona, E. M., K. C. Wulfekuhler, et al. (1992). Finance companies, bank competition, and niche markets. *Federal Reserve Bank of New York Quarterly Review 17*(2), 25–38.

Rhodes, A. and C. M. Wilson (2018). False advertising. *The RAND Journal of Economics 49*(2), 348–369.

Roberts, R. C. (1984). Will power and the virtues. *Philosophical Review 93*(2), 227–247.

Royzman, E. B. and J. Baron (2002). The preference for indirect harm. *Social Justice Research 15*(2), 165–184.

Schaeck, K., M. Cihak, and S. Wolfe (2009). Are competitive banking systems more stable? *Journal of Money, Credit and banking 41*(4), 711–734.

Shleifer, A. (2004). Does competition destroy ethical behavior? *American Economic Review 94*(2), 414–418.

Song, F. and A. V. Thakor (2019a). Bank culture. *Journal of Financial Intermediation 39*, 59–79.

Song, F. and A. V. Thakor (2019b). Ethics and talent in banking. *Available at SSRN 3347492*.

Stango, V. (2000). Competition and pricing in the credit card market. *Review of Economics and Statistics 82*(3), 499–508.

Thakor, R. T. and A. W. Lo (2019). Competition and r&d financing: Evidence from the biopharmaceutical industry. *Journal of Financial and Quantitative Analysis*, 1–69.

Thomson, J. J. (1985). The trolley problem. *The Yale Law Journal 94*(6), 1395–1415.

Vives, X. (2008). Innovation and competitive pressure. *The Journal of Industrial Economics 56*(3), 419–469.

Weyl, E. G. and M. Fabinger (2013). Pass-through as an economic tool: Principles of incidence under imperfect competition. *Journal of Political Economy 121*(3), 528–583.