Analyzing exclusive dealing in two-sided markets: marketplaces for video games

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- Exclusive dealing (ED) is controversial among regulators and may sometimes require economic analysis.
- Epic's entry into online video game distribution shows that ED is an important part of an entrant's strategy in a two-sided marketplace.
- Using a simple model and structural estimation, I use sparse data sources to estimate trade-offs for consumer welfare. I estimate that market entry by Epic Games Store was unprofitable but that it has increased consumer welfare.
- When network effects are particularly high, we should expect more aggressive entry strategies (through subsidies and ED) but also lower consumer welfare from market fragmentation.

Competition law in the EU has a rich history dealing with exclusive dealing (ED). Past economic analysis has informed the view that ED is not by its nature a tool of exclusion and can serve other goals and purposes. Yet, sometimes exclusive dealing may require economic analysis.[1] This is particularly true when we look at entry into adjacent markets by large firms that are under greater scrutiny to begin with and whose business practices are sometimes generally under suspicion of having anticompetitive effects.[2] This article proposes a theoretical framework and an empirical analysis for analyzing ED in a two-sided market. I analyze Epic Games Store, an entrant into online computer game distribution which included ED as a cornerstone of its entry strategy.

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[1] Alfonso Lamadrid, `On exclusivity under Art. 102 TFEU, and on why I do care about cases – A response to Pablo' (Chillin' Competition, 24 March 2015), available at https://chillingcompetition.com/2015/03/24/on-exclusivity-under-art-102-tfeu-and-on-why-i-do-care-about-cases-a-response-to-pablo/

[2] Nicolas Petit, *Big Tech and the Digital Economy: The Moligopoly Scenario* (Oxford University Press, 2020) 158-167, emphasizes entry into new markets, especially by incumbent firms or `big tech´, as an important source of competition in digital markets. However, new EU regulations, such as the DMA, tend to stifle opportunities for entry for precisely these firms (https://www.promarket.org/2021/11/02/the-european-unions-big-policy-bet-against-the-tech-giants/).

The purpose of the article is not to provide evidence of anticompetitive conduct in this special case. The conduct in our example is likely not in violation of European competition law as it is the entrant that uses ED to take on an incumbent with a very high market share. Instead, I demonstrate the trade-off between efficiency and consumer choice in a marketplace that can be analyzed in the framework of two-sided markets. The economic theory of two-sided markets has gained increasing prominence in antitrust.[3] However, analysis rarely moves beyond the assertion that traditional tests and tools are inappropriate and sometimes misleading.

In this article, I show how to analyze welfare effects in a complex ED case involving marketplaces in two-sided markets. After formulating a theoretical model, a few readily available data points can be sufficient to estimate the model parameters. This allows us to interpret the model in the light of available data and to draw conclusions about the profitability and consumer welfare effect of entry. I describe the empirical analysis at a high level that does not require specialized knowledge to understand but offer additional explanations for experts to make my method replicable.

I model entry in a two-sided market where all buyers and sellers are initially connected on an incumbent's platform. For entry to be profitable, an entrant's platform has to get buyers and sellers on board. In the model, the entrant has two tools at his disposal: subsidies to consumers and exclusive dealing contracts to sellers. It is not obvious that ED should be profitable for an entrant as it requires the entrant to compensate sellers for joining a less valuable platform. To emphasize this point, consumers' costs of connecting with the incumbent are sunk, so even when platforms are differentiated, the entrant does not have any captive consumers to attract sellers with.

These model features are inspired by the aggressive entry of Epic Games into the market for online computer game distribution where its own offering, Epic Games Store (EGS), has been taking on Valve Corporation's Steam, which is by far the dominant marketplace for computer games in Europe and North America. This is different from previous European cases where deals for exclusivity were typically offered by a firm with market power or a dominant firm. Nonetheless, our example is

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[3] Nicolas Petit, `Two-Sided Markets and the Challenge of Turning Economic Theory into Antitrust Policy' (2015) 60(4) Antitrust Bulletin.

interesting because it illustrates the tradeoffs in a two-sided market where efficiency is a question of network effects. Starting from the proverbial `chicken-and-egg' problem, I offer a blueprint for analyzing future ED cases that involve complex market arrangements.

For economists, ED is fascinating for a conceptual reason: For the Chicago School economist of 50 years ago, the apparent question is `cui bono?', or what is the gain of the buyer who agrees to exclusivity? According to the Chicago School, the seller cannot use ED to exclude a more efficient rival, so ED must bring with itself some efficiency gain, justifying a lenient treatment of the practice. Today, many competition economists take the presumptions of the Chicago School as starting points to disprove them. We now know that situations which were traditionally seen as unproblematic, from vertical mergers to tying and bundling, can cause harm to consumers.

However, rather than merely an academic exercise for economists, this analysis is also for the benefit of legal practitioners. In the vastly growing sphere of digital markets, ED is common, especially in the media and entertainment industry, and controversial. I demonstrate that even when the overall welfare effect of entry through ED is positive, we might observe disruption of network effects, inefficient transfers between an entrant and subsidized consumers, and (momentary) losses of the entrant. When network effects are high, the incentives to enter but also the aggregate loss of consumer welfare are particularly large. Practitioners who fail to understand these complex interactions are at risk of misinterpreting economic evidence.

The video game industry in particular has drawn the attention of competition policy scholars and practitioners since Microsoft announced its intention to acquire Activision/Blizzard in 2022.[4] Entry into new and emerging markets appears in the context of the so-called `Metaverse´ for which Microsoft claims to be acquiring components through this transaction. Metaverse experiences will likely exhibit features of multi-sided markets and Microsoft is a company that is likely to draw regulatory scrutiny (both because of Microsoft's history of antitrust action and because of its potential gatekeeper status

[4] Microsoft, `Microsoft to acquire Activision Blizzard to bring the joy and community of gaming to everyone, across every device´ (18 January 2022). For further information, see the relevant article published in the same issue of this journal.

under the DMA). Therefore, an analysis along the lines of this article can help understand future entry scenarios in multi-sided markets. The rest of the article will describe the industry and business context, set up a model, estimate it empirically, and finally discuss limitations and conclusions of the analysis.

1. Background

Exclusive dealing (ED) describes a type of contract that restricts one contracting party from dealing with competitors of the other party, e.g., a TV streaming service prohibiting the streaming of a show on rival streaming services, usually in exchange for a compensation. In a market where platforms intermediate between two sides, can entrants use ED to enter a market with a strong incumbent? ED is viewed with skepticism by some regulators and researchers as a limit to market entry and competition.[5] This article shows that in the environment of asymmetric platforms, ED can make entry profitable.

Steam is the dominant marketplace for computer game. According to market research by game publisher No More Robots, Steam was responsible for about 95 % of sales for PC games in 2019.[6] Sellers, which range from large game publishers to independent and individual developers, offer their games to final consumers via Steam, who takes a percentage of revenues as a fee. Steam's competition includes game publishers that sell their games through their own channels in addition to Steam (e.g. Ubisoft's Uplay) and niche marketplaces, such as Good Old Games for primarily retro games.

Steam's business model benefits from indirect network effects: sellers offer their games on Steam because that's where most buyers (i.e., players) are. Players subscribe to Steam because of the platform's wide variety of games. Steam's leading position was challenged by market entry of EGS in December 2018, with EGS making aggressive use of exclusivity for some highly anticipated games.[7] In some cases, these exclusivity arrangements merely prevent sellers from offering them on Steam while

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[5] Notably a Chinese regulator rebuked ED in the context of music streaming. See Daniel Sanchez, `The Chinese Government Says Streaming Music Exclusives Suck' *Digital Music News* (2017), available at: https://www.digitalmusicnews.com/2017/09/18/sapprft-streaming-music-exclusives/.
[6] See No More Robots, `How well are PC games selling in 2019?' (2019).
[7] See Jason M. Bailey, `Fortnite Maker Wants to Sell More Games, and Build a Platform to Do It' *New York Times* (27 August 2019). Some of these deals for exclusivity still allow for distribution through the sellers' own channels, effectively only preventing distribution via Steam.

allowing distribution through the seller's own channels. Another key feature of EGS' entry was the costly investment in free games as an incentive for players to open a free account with EGS.

I model the asymmetry between an incumbent firm and an entrant firm inspired by this mode of competition. The entrant first attracts buyers and sellers, then both platforms compete to generate sales on their platform. All buyers are initially connected with the incumbent, so the entrant needs to incentivize buyers to join, either through a subsidy or by differentiating itself by offering exclusive access to certain sellers. By signing exclusive deals with sellers, the entrant not only attracts more buyers, but also directly affects the incumbent's incentives to compete. Both buyers and sellers can multi-home. However, in the model outcome (`in equilibrium’) some buyers do not adopt the entrant's platform and only maintain their account with the incumbent. All sellers find it attractive to multi-home, but some accept exclusivity with the entrant.

Entry affects consumer welfare through the quality of intermediation. The model does not describe the market for computer games *per se*. However, entry impacts consumer welfare in two ways. The entrant's subsidy to new buyers compensates the indifferent buyer to multi-home (which I call `excess subsidy’ effect). Buyers that are prone to multihoming (i.e., they have low transportation costs in the model) are strictly better off with entry. At the same time, relative to the counterfactual without entry, single-homing buyers have access to fewer sellers (which I call `market fragmentation’).

Competition authorities need to be careful in distinguishing between the short-term and the long-term effects of entry. In the short term, entry can disrupt the indirect network benefits that a large incumbent provides. Interpreting some readily available business data as equilibrium outcomes of the model, I will introduce and demonstrate how a method called `simulated method of moments’ (SMM) can match key parameters. Given the model's propositions, the results suggest positive immediate effects on the welfare of consumers and sellers, but not that EGS' entry is profitable.

2. Literature

This article adds to the literature on two-sided markets that was pioneered by Caillaud and Jullien (2003)[8], Rochet and Tirole (2003)[9], and Armstrong (2006).[10] Specifically, it explores a new setup for digital platforms intermediating between buyers and sellers when there are indirect network effects, as in Jullien (2005).[11] Compared to offline forms of two-sided, like print newspapers or shopping malls, negative prices are more relevant in digital markets. For example, some digital platforms can de-facto offer negative prices by offering `freebies' or tying services with their offer (Amelio and Jullien, 2012).[12] In our model, such freebies exist and take the form of a direct subsidy that the entrant pays to consumers to overcome the `transportation cost' of signing up to a new service.

Armstrong and Wright (2007)[13] considered multi-homing on both sides unlikely when market participants care about being connected per se.[14] By contrast, in this model members of both sides find it lucrative to multi-home: buyers connect to an entrant platform to enjoy subsidies and exclusive sellers, and sellers want to capture spending on both platforms.

The effects of entry in 2SM depend on the strength of indirect network effects. With single-homing, Dewenter and Rösch (2012)[15] argue that a monopoly configuration is more efficient when indirect network effects are strong. This effect can also arise in this model of multi-homing but needs to be weighed against the effect of competition on the market for the good and short-term benefits from subsidies.

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[8]Bernard Caillaud and Bruno Jullien, `Chicken & Egg: Competition among Intermediation Service Providers' (2003) 34(2) The RAND Journal of Economics, 309-328. doi: 10.2307/1593720.
[9] Jean-Charles Rochet and Jean Tirole, `Platform Competition in Two-Sided Markets (2003) 1(4) Journal of the European Economic Association, 990-1029. doi: 10.1162 / 154247603322493212.
[10] Mark Armstrong, `Competition in two-sided markets' (2006) 37(3) The RAND Journal of Economics, 668-691. doi: 10.1111/j.1756-2171.2006.tb00037.x.
[11] Bruno Jullien, `Two-sided Markets and Electronic Intermediaries' (2005) 51(2) CESifo Economic Studies, 233-260. doi: 10.1093 /12cesifo/51.2-3.233.
[12] Andrea Amelio and Bruno Jullien, `Tying and freebies in two-sided markets' (2012) International Journal of Industrial Organization 30.5, pp. 436-446. doi: 10.1016/j.ijindorg.2012.03.002.
[13] Mark Armstrong and Julian Wright, `Two-sided Markets, Competitive Bottlenecks and Exclusive Contracts' (2007) 32(2) Economic Theory, 353-380. doi: 10.1007/s00199-006-0114-6.
[14] In their example, if French-speakers learn English, English-speakers have no incentive to learn French.
[15] Ralf Dewenter and Jürgen Rösch, `Market entry into emerging two-sided markets' (2012) 32(2) Economics Bulletin, 2343-2352.

The literature on ED developed from the Chicago School critique how and why an incumbent would foreclose a more efficient entrant (see Motta, 2004, chapter 6.4.1).[16] The traditional view of ED as a tool for inefficient entry deterrence (Aghion and Bolton, 1987[17]; Spier and Whinston, 1995[18], *inter alia*) contrasts with recent articles finding welfare enhancing effects of exclusivity (D'Annunzio, 2017[19]; Carroni, Madio, and Shekhar, 2018[20]). In contrast with these latter articles, the motivating case for this paper is characterized by the use of ED specifically by an entrant. Also, I do not assume a more efficient entrant. Instead, entry can enhance welfare through pure competition effects.

The gaming market is popular in the study of two-sided markets, but most literature focuses on gaming consoles (Lee, 2013[21]; Kim, Prince, and Qiu, 2014[22]) rather than computer games. The gaming console market is illustrative for the cross-subsidization feature of two-sided markets, with consoles often sold at a loss to attract customers, making the console attractive for game developers. However, these analyses are silent on entry, for example of new gaming consoles, and the strategies adopted for this purpose. ED probably plays a role here as well. For example the Nintendo Switch, a portable gaming console, benefits from the large catalogue of exclusive games and intellectual properties of its manufacturer, Nintendo.

3. Model

Agents and actions: I consider a game between two profit-maximizing platforms, an entrant and an incumbent (which I will denote E, I, respectively). The platforms are placed at opposing ends of a line

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[16] Massimo Motta, *Competition Policy: Theory and Practice* (Cambridge University Press 2004) 650.
[17] Philippe Aghion and Patrick Bolton, `Contracts as a Barrier to Entry' (1987) 77(3) The American Economic Review, 388-401.
[18] Kathryn E. Spier and Michael D. Whinston, `On the Efficiency of Privately Stipulated Damages for Breach of Contract: Entry Barriers, Reliance, and Renegotiation' (1995) 26(2) The RAND Journal of Economics, 180-202. doi: 10.2307/2555912.
[19] Anna D'Annunzio, `Vertical integration in the TV market: Exclusive provision and program quality' (2017) 53 International Journal of Industrial Organization, 114-144. doi: 10.1016/j.ijindorg.2017.05.002.
[20] Elias Carroni, Leonardo Madio, and Shiva Shekhar, `Superstars in Two-Sided Markets: Exclusives or Not?' (2018) SSRN Electronic Journal. doi: 10.2139/ssrn.3243777.
[21] Robin S. Lee, `Vertical Integration and Exclusivity in Platform and Two-Sided Markets' (2013) 103(7) American Economic Review, 2960-3000. doi: 10.1257/aer.103.7.2960.
[22] Jin-Hyuk Kim, Jeffrey Prince, and Calvin Qiu, `Indirect network effects and the quality dimension: A look at the gaming industry' (2014) 37 International Journal of Industrial Organization, 99-108. doi: 10.1016/j.ijindorg.2014.08.005.

of unit length, their locations indexed $x^I = 1$ and $x^E = 0$, respectively. Locations are fixed (so they are not a choice variable of the platforms). Platforms compete over a unit mass of buyers and a unit mass of sellers. The entrant offers a take-it-or-leave-it exclusive contract to a range of sellers. After observing their decision (accept or reject), the entrant decides whether to enter the market at a fixed cost. Next, the entrant can choose to offer some non-negative subsidy to consumers conditional on joining the entrant platform.

Both platforms then compete in a choice variable q^i which functions similarly to quantity in a standard Cournot model (a standard model in industrial organization where firms compete in quantities and aggregate quantity determines the market price). However, rather than quantities of product sold, q^i stands in for what I call `business activity'. An increase in q^i serves to increase turnover for platform i, while reducing profitability of the own and rival platform. It represents costly intermediation effort (for example advertising, service and matching effort, e.g., through curation algorithms). This is justified by the fact that I focus on the platforms as marketplaces which are in the business of intermediating between buyers and sellers. I ignore the aspect of hybrid marketplaces where the platform owners also appear as sellers of their own product (both Steam and EGS also offer games that are produced by Valve and Epic, respectively).

Buyers, representing final consumers, are utility-maximizing agents that are evenly distributed along the unit line. They are indexed by their position x_l on the line and face transportation costs $t > 0$ for traveling a unit distance. To represent the asymmetry between an established incumbent and the entrant (who has to attract a customer base), all buyers are initially connected to the incumbent platform. In other words, transportation costs between buyers and the incumbent are sunk. In this framework, transportation costs represent heterogeneous preferences of buyers for adopting the entrant platform (e.g., because of differences in taste for the convenience of a unified game library, having fewer accounts for privacy and data security reasons, and distaste against the entrant[23]). Buyers

[23] In our example, the involvement of the Chinese tech company Tencent in EGS is considered a security risk by some consumers. https://www.pcworld.idg.com.au/article/669720/epic-games-store-china-controversy-explained/

have to decide whether they become multi-homing by joining the entrant platform for which they incur their transportation cost (which for consumer x_l is tl). Paying this transportation cost allows buyers to interact with sellers that are present exclusively on the entrant platform and to benefit from the subsidy.

Sellers are profit-maximizing agents who each own a game which they can sell for a profit π through alternative channels, for example their own website. In equilibrium, they choose to sell their product through the platforms on which they will, at a minimum, be compensated for this outside option π. In addition, the entrant offers to a fraction N of sellers to deal with him exclusively in exchange for a transfer T which they can accept or reject.

Timing: In the first stage of the model, the entrant makes a take-it-or-leave-it offer to a fraction of sellers N to join his platform exclusively in exchange for a transfer T. Conditional on their answer, the entrant enters and pays a fixed cost of entry F if and only if he expects to break even. As a simplifying assumption, either the whole targeted fraction of sellers N accepts or all ED offers are forfeited. The cost of contracting ED with a fraction N of sellers is a convex and increasing function $c_T(N)$. It includes not only a transfer T that sellers receive, but also the costs of observing the market and negotiating with sellers.

In the second stage, the entrant chooses a level of subsidy S to buyers. Buyers then choose to connect with the entrant's platform if their utility from doing so exceeds their utility from single-homing. This implies that a certain fraction of buyers D multi-homes. I denote the costs of attracting a fraction D of buyers $S(D)$.[24] In the final stage, platforms simultaneously choose their level of business activity q^i.

Payoffs: There is a unit mass of sellers of PC games. Each seller can choose between a) distributing their product through their own channels at a profit of $\pi > 0$. Alternatively, they distribute via b) one or c) both platforms. Sellers have no transportation costs. In equilibrium, each seller signs

[24] Strictly speaking, this cost will also depend on the number of sellers that accepted exclusivity with the entrant. For brevity, I will write $S(D)$ rather than $S(D, N)$, however.

up for both platforms[25] unless he accepts an exclusivity offer from the entrant. If a seller does not have an exclusivity deal with the entrant and is therefore present on both platforms, he is only compensated for his outside option by the incumbent platform. In equilibrium, a fraction N of sellers accept an exclusivity offer and receive a transfer T from the entrant. At a minimum, the equilibrium transfer must compensate sellers for the counterfactual revenue they would make if they rejected the offer. Anticipating the equilibrium result, the counterfactual is not multi-homing, but maintaining presence on the incumbent platform only, since there will be no entry without ED. The profits of sellers under ED and under multi-homing are, respectively,

$$v^{ED} = T \text{ and } v^{M} = \pi \tag{1}$$

Buyers care about the number of sellers because they prefer variety, so they receive an indirect network benefit $\gamma > 0$ per unit of sellers they face in total (i.e., all sellers if they multi-home or $1 - N$ sellers if they single-home with the incumbent). Buyers are not charged for having an account with a platform, so they will never close their account with the incumbent but can receive a subsidy $S > 0$ for joining the entrant platform. A buyers' utility from single-homing with the incumbent u^I is then independent of location, while the utility of multi-homing u_l^M depends on the buyer's location:

$$u^I = \gamma(1 - N) \text{ and } u_l^M = \gamma - tl + S \tag{2}$$

Platforms do not charge buyers or sellers directly but generate revenue by choosing a level of business activity which impacts their own and each other's profitability and they compensate sellers lump-sum for their outside option. Platform i's revenue is the product of its level of business activity q^i and its profitability p^i which is increasing in the number of buyers $\mathrm{n_b^i}$ and sellers $\mathrm{n_s^i}$ connected to it and decreasing in q^i and q^j where j represents the other platform. I define platform i's profitability

$$p^i(n_s^i, n_b^i, q^i, q^j) := n_s^i n_b^i - q^i - q^j. \tag{3}$$

So platform i's revenue is:

[25] This assumption is justified by the practice of per-transaction charges. Sellers then always connect with all platforms if they don't make losses on each sale (see Armstrong and Wright, 2007, section 4.4).

$$q^i p^i(\mathrm{n}_\mathrm{s}^\mathrm{i}, \mathrm{n}_\mathrm{b}^\mathrm{i}, q^i, q^j) = q^i(\mathrm{n}_\mathrm{s}^\mathrm{i}\mathrm{n}_\mathrm{b}^\mathrm{i} - q^i - q^j). \tag{4}$$

and the incumbent and the entrant make the following profits:

$$\Pi^I = \max_{q^I} q^I((1-N) - q^I - q^E) - (1-N)\pi \tag{5}$$

$$\Pi^E = \max_{q^E,D,N} q^E(D - q^I - q^E) - S(D) - c_T(N) - F. \tag{6}$$

The profit functions (4) and (5) follow from equation (3) and realizing that $\mathrm{n}_\mathrm{b}^I = \mathrm{n}_\mathrm{s}^\mathrm{E} = 1$, $n_b^E = D$ and $n_s^I = 1 - N$. The entrant has the advantage in sellers because he offers the full range of sellers, while the incumbent loses some to the entrant's exclusivity offer. However, the incumbent has the advantage in the customer base because all buyers are present on his platform but only a fraction of buyers joins the entrant's platform.

Equilibrium: I am looking for a subgame-perfect Nash Equilibrium of this game.

I am interested in the case where $F > \frac{1}{9}$. When fixed costs of entry are sufficiently high, the entrant cannot make any profits without ED. This makes it easier to pin down the counterfactual revenue of the sellers when they do not accept the take-it-or-leave-it offer. For the solution of the model, I also assume a specific functional form of $c_T(N)$ consisting of a quadratic term and a constant.

3.1. Profitable entry

Through backward induction, I obtain the unique subgame-perfect Nash equilibrium. From this, I can express the condition on the deep parameters t, γ, π required for positive entrant profit.

Proposition 1: The entrant will make positive profits whenever

$$\gamma(\gamma + t) > \frac{t^2(9\pi - 1) + 4\pi(2t + 1 + 4F)}{4} \tag{7}$$

Proposition 1 is the key result of the paper.[26] Unsurprisingly, the condition for profitability is more likely to be fulfilled when γ is high: in this case, attracting sellers exclusively helps the entrant

[26] The Appendices containing the proofs are omitted for this article but are available from the author upon request. They include the specification of $c_T(N)$ and the intermediate results that appear as `model analogue' in Section 4.2.

differentiate himself. In almost all models of horizontal differentiation, high transportation costs t often also benefit firms as they imply less intense competition, but here t appears on both sides of the inequality: higher transportation costs also make it costlier for the entrant to attract customers. As I impose no restrictions on t, γ, π other than that they are positive, Proposition 1 shows that there are cases when ED allows the entrant to enter when he would not have been able to do so otherwise. Signing exclusive deals with sellers allows the entrant both to differentiate his platform and to attract sellers. Furthermore it softens competition by impacting the strategic incentives of the incumbent to compete. This follows from the fact that q^I is decreasing in N.

3.2. Consumer welfare

The model has implications for the impact of entry on consumer welfare in the intermediation process. In this model, consumer welfare is total sum of utility enjoyed by buyers. Buyers who stay single-homers lose relative to a counterfactual without entry: They cannot interact any more with sellers that sign exclusive deals with the entrant. I call this effect `market fragmentation'.

Countervailing this, the total transportation costs paid by multi-homing buyers are lower than the subsidy paid by the entrant to buyers. That's because the level of the subsidy compensates the marginal multi-homing buyer for his transportation costs, while the infra-marginal multi-homing buyers pay lower transportation costs. I call this `excess subsidy effect'.

Solving for the range of parameters when this is positive, I find Proposition 2.

Proposition 2: The `excess subsidy effect' dominates the `market fragmentation effect' if and only if exactly one of the following conditions holds:

$$\frac{t}{2}(9\pi - 1) - 6\pi < \gamma \text{ or } \gamma\left(\gamma + \frac{3}{4}t\right) > \frac{4t\pi + t^2(9\pi - 1)}{8} \tag{8}$$

Proposition 2 does not take into account the counterfactual interaction between buyers and sellers. Since I do not model an equilibrium in the market for transactions between sellers and buyers, the model remains silent on the welfare implications on the market for computer games themselves. Entry can further benefit buyers if platform entry results in sellers lowering their prices or increasing quality, which is not modeled. Moreover, while such adjustments to a new equilibrium in the buyer-seller-interaction (e.g., additional investments into development of new games) may take time, the effect considered here bites immediately: multi-homing buyers are enjoying the entrant's subsidy, single-homing buyers are prevented from buying exclusive games.

3.3. Discussion

Proposition 1 demonstrates that there can be modes of competition and parameter ranges where ED allows an entrant in two-sided markets to profitably enter a market. This implies that ED should not only be expected from incumbent firms, but also from entrants. It also rebuttals any potential presumption that ED indicates anti-competitive conduct. ED can help entrants overcome the `chicken & egg' problem of two-sided markets by differentiating the entrant from the incumbent and make costly investments in a customer base worthwhile.

Proposition 2 shows that there are different ranges of parameter values for which consumers benefit from entry. It seems counterintuitive that consumer welfare is more likely to be positive when γ is large. Large values of γ are associated with a high preference for seller variety and strong indirect network effects. However, larger values of γ also result in a lower share of sellers that are exclusive to the entrant‘s platform. Keep in mind that the effect of γ on consumer welfare arises from single-homing buyers on the incumbent's platform who lose access to some sellers. Therefore, I find some regions of parameter values where consumers benefit from entry even when they feel strongly about interacting with many sellers.

The focus is on modeling the key features of the market for PC game marketplaces that are relevant to discuss the entry of EGS *vis-à-vis* Steam. It makes no claim to be a comprehensive model to answer all questions that could be asked about digital PC game distribution. As mentioned earlier, the model does not account, for example, for the possibility of hybrid marketplaces. The model is also silent on dynamic questions, for example whether entry will improve platforms or spur market entry by additional sellers. Introducing a variable mass of sellers, an interesting research question related to Carroni, Madio, and Shekhar (2018) would be to ask whether platform competition spurs additional investments or market entry on the seller-side, enhancing the welfare implications of platform entry.

It should be noted that the above model is somewhat restrictive. This allows us to make the model more tractable and easier to discuss without going too much into mathematical technicalities. The entrant commits to an `all-or-nothing' approach to ED and a fee structure. Platforms announce and commit to a rule that determines the rate at which they charge fees before negotiating exclusive deals. I justify this assumption by the fact that changes in these fees are infrequent, publicly announced, and important to all sellers, while exclusivity negotiations are secret and bilateral.[27] Another restrictive assumption to keep things simple is the compensation paid to sellers. For the multi-homing case, an analysis of prices charged to sellers could also be interesting. However, this would require much more modeling detail on the seller side, perhaps including investment risk for sellers and seller heterogeneity, because one upside from the observed exclusivity deals of EGS is the secured payment of a transfer as opposed to the risky sales success of the game.

4. Empirical analysis

This section discusses empirical approaches to test the implications of the theoretical model and investigate the impact of market entry between EGS and Steam. Section 4.1 describes the data used. Section 4.2 matches the data to the model. Section 4.3 uses key business data about users, sales and prices of Steam and EGS to structurally estimate the model. Section 4.4 presents an empirical strategy and points to the relevant proprietary data to estimate the effect of entry on seller investment and prices.

4.1. Data

Both Steam's parent Valve Corporation and EGS are privately held firms that publish little data about their business operations. Relevant data such as current revenue, operating margins and profit are therefore not available. Among the available data are seller-side prices (as percentage fees of revenue)

[27] In reality, sellers do not produce games instantly, but plan game development based on business plans years in advance. Some of EGS exclusive deals with already developed games led to cancellation of planned game launches on Steam. For example, this affected the launch of Ubisoft's Anno 1800 in 2019, see Logan Moore, `Ubisoft's Anno 1800 Will be Made Unavailable on Steam After Launch Day Due to Exclusivity Deal´ *Dualshockers* (9 April 2019), available at https://www.dualshockers.com/anno-1800-ubisoft-leaving-steam-pc/

and some historical revenue data. Together with the theoretical moments, these are summarized in Table 1.

EGS charges sellers a flat 12 % of revenue. Steam used to charge sellers a flat fee of 30 % of revenue until October 2018, 3 months before EGS' entry, when a tiered system of rebated fees was introduced under which the first $10 million of revenue of each game were charged at 30 %, the next $40 million of revenue were charged at 25 % and revenue above $50 million was charged at 20%.[28] The average fee which Steam takes then depends on the distribution of game sales, which is secret, but for which I test a range of informed estimates.[29] Assuming that 10 % of total revenue falls into the first category and is charged with the 30 % fee, then if the 25 % tier applies to 20, 40, 60, or 80 % of the total revenue, Steam's average fee can be estimated to be 22 %, 23 %, 24 % or 25 %, respectively. Table 2 presents four different estimation results, one for each of these four different assumptions on the second data moment. The estimation turns out to be robust to these different assumptions.

4.2. Theoretical moments

To estimate the unobservable parameters t, γ, π, I match the data moments described above to theoretical moments that arise from the model. First, I argue that the revenue share of platforms corresponds to the level of profitability p^i in the model because this share directly indicates the profitability of transactions for the platform. In the presence of indirect network effects, it should be increasing in the number of buyers and sellers, and indeed, the larger[30] platform Steam sets a higher value than EGS. The incumbent should pick a higher value when there is no entrant, and indeed, Steam lowered its revenue cut just before the entry. This results in the first three moments of the analysis, p^I without ED, p^I, p^E with ED.

[28] See the references in footnotes 7 and 29.
[29] Game developer Adriaan de Jongh is cited by gaming news website Kotaku that Steam's price drop affects 90 % of total revenue, implying that 10 % of total revenue is still charged at 30 %. See Nathan Grayson `Indie Developers Don't Like Steam's New Revenue Sharing Policy´ *Kotaku* (4 December 2018) available at https://www.kotaku.com.au/2018/12/indie-developers-dont-like-steams-new-revenue-sharing-policy/.
[30] The 2019 NYT article in footnote 7 compares an offer of 30,000 games on Steam to less than 100 on EGS and 90 million monthly active Steam users with 85 million total accounts on EGS, an upper bound on the number of active users. Forbes reports 108 million EGS accounts four months later, see footnote 31.

Second, some historic revenue data is available, \$4.3 billion for Steam in 2017 and \$680 million for EGS in its first full year of operation.[31] It would be difficult to scale the model parameters to match absolute revenue numbers, so I match the ratio of the two revenue values to their corresponding theoretical moment. This is the fourth moment of the analysis, ratio of incumbent revenue without and entrant revenue with ED. The available data is summarized in Table 1.

4.3. Simulated method of moments

If the model correctly represents competition between Steam and EGS, I am able to estimate the vector of parameters $\theta = [t, \gamma, \pi]$ consistently.[32] On a non-technical level, I write four equations, each of which equates one of our data points with an equation from the model, for example $\frac{2-D(\theta)}{3} = 0.3$.[33] Then, I look for values $[t, \gamma, \pi]$ under which all four equations are approximately satisfied at the same time. Typically, there will be no combination of these values for which all equations hold exactly, so I look for the vector of parameter values that minimizes the difference between the equations and the data points. This approach is called Simulated Method of Moments (SMM) as the equation with a candidate parameter value is a `simulation' of the `moments', which are quantitative measures that describe the model. A computational algorithm finds the vector θ^* that minimizes the distance between four moments that arise from the optimization problem in the model and four corresponding data moments.

I describe the computation and the results. I search for the value of θ^* such that

$$\theta^* = arg\ \min_{\theta}\ (\mu^s(\theta) - \mu_d)' I_4 (\mu^s(\theta) - \mu_d) \tag{9}$$

[31] See Matt Perez `Epic Games Store Has Hit \$680 Million In Revenue, 108 Million Customers' *Forbes* (14 January 2020), available at https://www.forbes.com/sites/mattperez/2020/01/14/epic-games-store-has-hit-680-million-in-revenue-108-million-customers/#70a606004b99. Statista, `Revenue generated by game sales on Steam from 2014 to 2017', available at https://www.statista.com/statistics/547025/steam-game-sales-revenue/.
[32] See Jérôme Adda and Russell W. Cooper, *Dynamic Economics: Quantitative Methods and Applications* (MIT Press 2003), 87-88.
[33] The equations that form the `model analogues' of the empirical moments are intermediate results for the proof of the propositions which are available upon request.

where μ_d is the second row of Table 1 and $\mu^s(\theta)$ is given by the equilibrium outcome of the model. The function $(\mu^s(\theta) - \mu_d)' I_4 (\mu^s(\theta) - \mu_d)$ is called the `error function' as it computes the deviation between the data moments and the simulated moments.[34] $\theta^*$ is the vector of parameter values (the `argument' of the error function) that minimizes this error.

Using a derivative-free function minimizer that implements the Nelder-Mead algorithm, I identify the vector θ^*. Testing different assumptions for the second data moment, I obtain four different solutions. Table 2 presents the result of the algorithm and the corresponding error. The results are robust to the assumption regarding the second data moment: The results in the third row almost don't change, no matter what I assume regarding the second data moment, that is Steam's effective value of p^I after entry.

How precisely are parameters identified? I plot the distance for the minimization problem where $\mu_{d,2} = 0.25$, holding two simulated moments fixed at their optimum and varying the third over a grid. The steeper the loss function around the minimum, the more precise is the estimation. Figure 1 shows that the parameter t is precisely estimated, γ to a lesser degree and the loss-function around π is rather flat, indicating less precise estimation.

I weight using the identity matrix I_4. This means that all equations have equal weight when determining which parameter values minimize the error. An alternative would be a variance-minimizing, so-called `optimal' weighting matrix. However, in our case this matrix is badly scaled and yields results close to the initial guess. This is likely due to the precision with which different parameters are estimated, as seen in Figure 1. In technical terms, the optimal weighting-matrix is almost singular.

4.4. Discussion, limitations, expansions

Using the arithmetic mean of the four estimates, $\theta^* = [0.24, 0.29, 0.81]$, I can evaluate propositions 1 and 2. Using these numbers, the condition of proposition 1 is not fulfilled even for $F = 0$, so entry should not be profitable even when there is no cost of entry. While this might seem at odds with the

[34] Intuitively, the error can be thought of as a `square' of the two vectors.

observed entry of EGS, it is not unusual for new businesses to run at a loss, especially in industries with network effects. Of the two conditions of proposition 2, the second, but not the first condition is fulfilled, indicating that the `excess subsidy effect' outweighs the `market fragmentation effect', i.e. the change in consumer welfare is positive.

The result of this SMM estimation is only valid if the model represents the mode of competition accurately. If, for example, pricing is sequential, or omitted features are important, the results suffer from model misspecification. The data moments only translate approximately into model parameters as the model is stylized. Finally, I assume that the observed data corresponds to equilibrium outcomes, but I might instead observe data during an adjustment to equilibrium. Then repeating the exercise with future data will lead to different results, perhaps indicating profitable entry if EGS continues to grow.

Again, the purpose of this exercise is to demonstrate how estimation and analysis of ED can be done even from a simple model and by using publicly available data. A thorough analysis in the course of a real antitrust investigation will be less limited by the availability of relevant data. Further analysis could rely on data sold by commercial brokers.[35]

5. Conclusion

This article provides a new, simple framework to discuss the effects of ED on entry in two-sided markets with positive indirect network effects. I demonstrate that in some cases, an entrant can use ED as a tool to differentiate himself and make the costly investment in a customer base worthwhile, possibly increasing consumer welfare. The observed reduction in seller fees on Steam following the announcement of entry by EGS is likely a result of increased competition. The results imply that no presumption of harm should arise from the use of ED by entrants as it can be an indispensable part of entry strategies in certain markets.

[35] Data providers with specialized offers for the video game industry include Informa (https://technology.informa.com/602823/games-publisher-performance-database) and Nielsen (https://games.nielsen.com/).

I show how a simple method of structural estimation can be used to estimate the model. While the estimation procedure could be improved by collecting additional data from the companies directly, our estimation based on publicly available data illustrates that these methods need not be complicated. A structural estimation of model parameters can match the observed moments. Based on the data used at the time, I conclude that market entry by EGS was likely unprofitable (at least not immediately) but it has likely increased consumer welfare.

Competition lawyers and practitioners should be aware of the importance of case-specific analysis especially in complex markets, such as online marketplaces with multi-sided aspects. There is now a rich literature of models describing a variety of industries. This article shows approaches to deal with industry- and case-specific features in a modeling framework that is derived from state-of-the-art models of two-sided markets. The estimation procedure in this paper can be applied flexibly to any available source of data. Thus, I demonstrate a simple, yet powerful tool for analyzing effects in future ED cases.

Tables and Figures

Table 1 Data moments and corresponding simulated moments

Moment	p^I no ED	p^I with ED	p^E no ED	$\frac{revenue\ incumbent\ no\ ED}{revenue\ entrant\ ED}$
Empirical data	0.3	[0.22, 0.23, 0.24, 0.25]	0.12	4.3/0.68≈ 6.33
Model analogue	$\frac{2-D(\theta)}{3}$	$\frac{2(1-N(\theta))-D(\theta)}{3}$	$\frac{2D(\theta)-(1-N(\theta))}{3}$	$\left(\frac{2-D(\theta)}{3}\right)^2 / \left(\frac{2D(\theta)-(1-N(\theta))}{3}\right)^2$

Table 2 SMM results

Assumption	$\mu_{d,2}=0.22$	$\mu_{d,2}=0.23$	$\mu_{d,2}=0.24$	$\mu_{d,2}=0.25$
θ^*	[0.24, 0.33, 0.80]	[0.24, 0.30, 0.79]	[0.24, 0.28, 0.81]	[0.24, 0.27, 0.83]
Error given θ^*	0.0305	0.0296	0.0287	0.0278

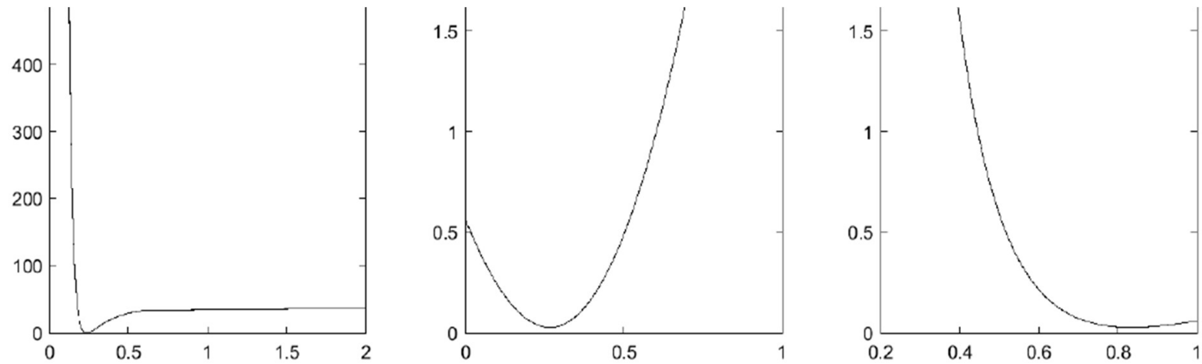

Figure 1 Sensitivity of the loss function around the optimal values of t, γ, π