On the Antitrust Economics of the Electronic Books Industry*

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Abstract

We show that the observed increase in prices charged for ebooks following Apple's entry into the market can be explained completely by Amazon's Kindle device losing its position as an essential component for reading ebooks. Simply put, when it became convenient for consumers to access ebooks sold by Amazon using third-party devices, such as the iPad, Amazon's incentive to hold down the retail prices of ebooks diminished. This explanation contrasts with the view, advocated by the U.S. Department of Justice and affirmed in a recent court decision, that the price increase stems from a switch in the industry from using *wholesale* contracts towards using *agency* contracts. Moreover, we show that, in the absence of an essential device, if contracts revert to wholesale form, as is stipulated by the court decision and related settlements, this will likely push ebook prices up *even further*.

Keywords: Electronic Books, Media Economics, Vertical Contracting, Wholesale vs. Agency Agreements, Antitrust in High-Tech Industries

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1 Introduction

Apple incited two shifts in the electronic books industry when it entered the market in 2010. It convinced book publishers to adopt so-called "agency" agreements with retailers, in lieu of traditional "wholesale" ones. It also introduced the iPad tablet computer, shaking up the market for ebook reading devices. Following these events, ebooks' retail prices rose by about 18 percent on average, and the price of *New York Times* bestsellers rose by about 40 percent (Cote, 2013, p. 94). In 2013, the U.S. Department of Justice sued Apple and a group of major publishers for illegally conspiring to raise prices, claiming that agency agreements played an instrumental role. The DOJ won the case, and further use of agency agreements was prohibited,[1] although, at the time of this writing, Apple is appealing the judgement.

In its defense, Apple argued that its introduction of the iPad represented a major innovation that should be taken into account.[2] The DOJ, however, successfully responded that, innovative as the iPad was, it did not justify efforts to raise ebook prices, and that agency agreements did this. Nevertheless, the DOJ clearly *did* acknowledge that pre-Apple pricing of ebooks fit into broader business plans that depended on multiple revenue streams, claiming that the dominant distributor of ebooks, Amazon, sold ebooks for very close to their wholesale price and, indeed, sometimes used them as a "loss leader" (U.S.A., The State of Texas, and The State of Connecticut, 2013, ¶19, ¶210). Thus, the fact that ebook prices were intrinsically linked to distributors' broader strategies in complementary markets appears uncontroversial. The question of how such complementary market strategies *interact* with the use of agency agreements, if answered, could have significant bearing on the case, as well as on our understanding of numerous other digital media markets.

In this paper, we provide a stylized yet stark answer to this question. Consider

[1] Similar events unfolded in Europe. The European Commission initiated an antitrust proceeding in December 2011 (case COMP/39.847). Apple and the main publishers reached settlements with the Commission between December 2012 and July 2013, terminating agency agreements.

[2] Kevin M. Murphy, testifying on behalf of Apple, emphasizes the impact of Apple's software innovations and Amazon's compatibility decisions on consumer surplus following the switch to agency agreements and Apple's introduction of the iPad and the iBookstore (Gilbert, 2013, ¶250, ¶253). Daniel L. Rubinfeld, testifying on behalf of publisher Macmillan and Penguin Group, states that "there are good reasons to include the effects of the move to agency on sales of dedicated e-readers in the evaluation of competitive effects" (Gilbert, 2013, ¶216). To the best of our knowledge, professors Murphy and Rubinfeld's testimonies are not publicly available but excerpts are quoted in the "Direct Testimony of Richard J. Gilbert, Ph.D" (Gilbert, 2013), brought by the DOJ.

two settings in which an upstream firm distributes a good via a retailer. In the first, the retailer controls an essential access device necessary to consume the good. In the second, the good can be consumed without using such a device (or substitute devices are sold at marginal cost in a competitive market). We show that, when the device is necessary, a quite weak, general condition[3] leads prices under agency agreements to be higher than those under wholesale agreements. However, when the device is not necessary and all else remains unchanged, the opposite is true: precisely the same condition leads prices under wholesale to be higher than prices under agency.

Agency and wholesale agreements differ from one another in the following way. Under wholesale, the upstream firm sells its good to the downstream retailer who then resells it at a price of its own choosing. By contrast, under agency, the downstream firm delegates the decision of the good's final price to the upstream firm, while taking a commission that is a fraction of the revenue from each unit sold. The model we build in this paper captures the underlying forces that determine equilibrium prices under these two types of agreement, both in the presence and in the absence of an essential device sold be the retailer.

We believe our model to be a useful tool for understanding certain major recent developments in the ebooks industry. Between 2007 and 2010, Amazon, via its Kindle platform, was a virtual monopolist retailer of ebooks,[4] which it purchased from publishers, each of whom was a monopolist copyright holder for a set of titles. During most of this time, the sole way to read a Kindle ebook was by using a Kindle electronic reading device.

Following Apple's entry, Amazon remained the dominant ebook distributor, but, around this time, two crucial changes occurred in the market. One change was that publishers insisted (allegedly in coordination with Apple) on henceforth dealing with Amazon through agency agreements rather than wholesale ones. The second change was that Amazon released free software that would allow for ebooks sold via the Kindle platform to be read on the iPad as well as on PCs and on various mobile devices that were quickly proliferating and becoming cheaper.

Thus, to a first approximation, the pre-2010 industry can be represented by the version of our model in which the retailer controls an essential device and contracts

[3]This condition is Marshall's Second Law of Demand. See Assumption 1.

[4]Amazon's share of revenue in the US electronic books market was 80% in the first quarter of 2010 (Gilbert, 2013, Table 2, p. 10).

are of the wholesale variety. In the meantime, the post-2010 industry corresponds to the version of our model in which there is no essential device, and the firms use agency agreements. As we show, such a "two-dimensional" shift, in both contract form and necessity of a particular device, offers a very straightforward potential explanation for why the price of ebooks rose that does not rely on any anticompetitive behavior of the sort alleged in the trial.

We recognize that our argument focuses on a specific subset of the issues that are relevant to the case and do not wish to claim that it necessarily refutes the entire argument made by the DOJ. We do, however, think that our model illustrates, in a concrete way, (a) why agency contracts might have been adopted at that particular juncture in the industry's history, and (b) that their prohibition in favor of wholesale contracts may harm consumers in the future. If, over time, it became clear that Amazon could not sustainably maintain significant market power in selling devices (see Figure 1),[5] then, as this point revealed itself, it would also become clear that a switch from wholesale to agency contracts would boost the joint profits of Amazon and the publishers while also dampening a rise in ebook prices that would inevitably have occurred.

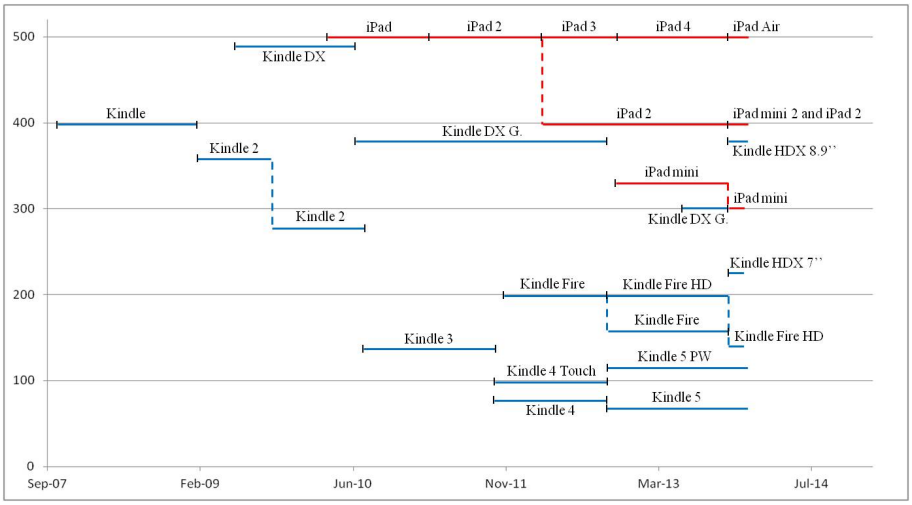

Figure 1: Kindle and iPad prices over time (current US$, without temporary promotions)

This last point raises particular concerns about the consequences of the ma-

[5]This view is supported, for example, by a 2012 quote from Amazon CEO, Jeff Bezos, who told the BBC, "We sell the hardware at cost (...) We want to make money when people use our devices, not when they buy them." See `http://www.bbc.com/news/technology-19873530`.

jor publishers' settlement with the DOJ, in which they agreed to no longer use agency agreements with any retailer, including Amazon.[6] It seems clear that the genie is out of the bottle, in that Amazon's ebooks can now be read on myriad devices.[7] Consequently, restricting publishers' ability to use of agency agreements with Amazon *now* would, according to the model, have the opposite effect of the one intended, as it would push ebook prices up even further. This is because, in reverting to wholesale agreements under the current circumstances, there will be an incentive for double marginalization, which would not be present if Amazon had market power in selling reading devices.

The rest of the paper is organized as follows. Section 1.1 discusses our paper's relationship to relevant literature. Section 2 introduces the model. Section 3 analyzes the case where the retailer controls an essential device, and Section 4 analyzes the case where it does not. Section 5 explains, in an intuitive way, the role of our key condition, Marshall's Second Law of Demand, and Section 6 discusses possible extensions. Section 7 discusses possible extensions and concludes.

1.1 Relationship to Existing Work

The intended contributions of this paper are (a) to point out that the comparison between agency and wholesale contracting modes hinges critically on whether one of the firms controls a complementary market, and (b), to identify Marshall's Second Law of Demand as a necessary and sufficient condition for this to flip in one direction rather than the other. While this may be of theoretical interest in its own right and/or applicable in other areas,[8] we believe this insight to be particularly relevant to the ebooks industry. Moreover, the 2013 suit that the DOJ won against Apple is of broad interest, both because of Apple's status as the world's most valuable company by market capitalization and because the case is structurally intriguing for several reasons. These reasons include the fact that the case involves

[6] All of the publishers in question reached pre-trial settlements with the DOJ, while Apple did not and lost in its trial.

[7] On its webpage, Amazon markets its ebooks books by stating, "You don't need to own a Kindle device to enjoy Kindle books. Download one of our free Kindle apps to start reading Kindle books on all your devices. The Kindle app is available for every major smartphone, tablet, and computer" (accessed November 10, 2013). Also see Figure 4 in Appendix B.

[8] For example, at the time it introduced the iPod and the iTunes store, Apple used wholesale arrangements, but it has used agency arrangements in its App Stores. Our model could potentially aid in understanding the logic behind these different outcomes. For more on a related set of issues, see, e.g. Hagiu and Wright (2013).

the prosecution a firm for price-fixing (i) at the time of its initial entry into a market (for ebooks), (ii) that apparently occurred in synchronization with its introduction of an unquestionably innovative, and some might say revolutionary product (the iPad), and (iii) in concert with undisputedly *vertically* related firms (publishers).

Several other recent papers have examined the ebooks market. In likely the most closely related works to ours, Johnson (2013a) compares wholesale and agency contracts in a model where consumers face switching costs when purchasing from a new distributor; Johnson (2013b) focuses on different aspect of the case, the use of "Most Favored Nation" clauses and their impact under both agency and wholesale agreements. Abhishek, Jerath, and Zhang (2013) study entry and compare equilibrium outcomes in wholesale and agency modes when a monopolist publisher sells online goods through two competing distributors. Note that none of the aforementioned papers consider ebook reading devices. Gans (2012), on the other hand, considers both media and devices but does not compare wholesale and agency agreements.

Foros, Kind, and Shaffer (2013) study the impact of market competition at both the retailing and publishing level. Condorelli, Galeotti, and Skreta (2013) study an upstream firm's endogenous choice between agency and wholesale arrangements when the retailer has private information about consumers' valuations. They compare double-marginalization distortions arising with wholesale arrangement to adverse-selection distortions arising in their model of agency arrangement. While Johnson (2013b) models the strategic aspects of agency agreements in the same way we do, Condorelli, Galeotti, and Skreta (2013) consider an specific agency fee (rather than a revenue share) that the upstream firm and the retailer bargain over.

The agency arrangement we study in this paper, whereby which the publisher is allowed to set the retail price is related to the literature on resale price maintenance (RPM). Whereas RPM is not *per se* forbidden in the U.S., it is still carefully scrutinized by competition authorities, notably because of its collusive power (see, e.g., Jullien and Rey (2007), Dobson and Waterson (2007), Rey and Vergé (2008, 2010), Asker and Bar-Isaac (forthcoming)). Note that the legal difference between "traditional" RPM and agency agreements is that, under agency, distributors do not sell any product (nor do they have any stock); they merely sell consumers a license to use the publishers' products (see Stoeppelwerth (2011)).

2 The Model

Consider a model with three types of agents: a publishing house, denoted by H, a retailer, R, and a unit mass of consumers. The publisher owns the exclusive rights to sell electronic books, but, in order to reach consumers, it must go through the distribution channel owned by the retailer.

The two forms of contracting agreement that we are interested in studying are the *wholesale* form and the *agency* form. Under a wholesale agreement, the publishing house sets a wholesale price, w, that the retailer must pay for each ebook it sells. The retailer sets the final ebook price, p_w. Under an agency agreement, the retailer sets the revenue share, $\alpha \in [0, 1)$,[9] that it will retain from the sale of each ebook, while passing the complementary share, $1 - \alpha$, on to the publisher. The publisher sets the final ebook price, p_α.

In particular, our goal is to compare, under two different circumstances, the equilibrium outcomes arising from these two contracting forms. The first circumstance, called the "essential case" is one in which the retailer sells, exclusively, a device that consumers must purchase in order to derive any benefit from owning ebooks. In the second circumstance, called the "non-essential case", the retailer does not control such an access bottleneck. This latter case arises when, for instance, there is a competitor (not modeled explicitly) who sells devices that can also display ebooks purchased via the retailer. In the essential case, the retailer thus sets a price for the device, denoted by T_w under a wholesale agreement and by T_α under an agency agreement. In the non-essential case, any potential rents stemming from the device are competed away, leaving its price to be zero. (See the assumptions on technology below.)

Throughout, we assume that consumers are homogeneous and that they have quasilinear preferences giving rise to an individual and aggregate demand curve

[9] We rule out the possibility that the retailer sets α equal to one, as allowing for this gives rise to a technical complication in the corresponding continuation game that we believe not to be of economic interest. Specifically, in cases where, for all finite values of p, $D(p) > 0$, if the retailer were to set $\alpha = 1$, then, in the second stage, the publisher's problem would have no solution, as the latter would prefer the smaller of any two quantities and would thus want to set price "as close to infinity as possible". Such an outcome would lead the retailer's profits to be arbitrarily close to zero, and, thus, it would never have an incentive to set $\alpha = 1$.

for ebooks, $D(p,T)$, that can be written

$$D(p,T) = \begin{cases} D(p) & \text{if } T \leq \int_p^\infty D(x)\,dx \\ 0 & \text{if } T > \int_p^\infty D(x)\,dx, \end{cases}$$

where p and T denote generic ebook and device prices, respectively. Intuitively, this says that, if the maximal surplus that a consumer can derive from purchasing a positive number of ebooks exceeds the price of a reading device, then he will buy a device as well as this maximizing number of ebooks. Otherwise, he will buy neither.

Regarding the function $D(\cdot) : \mathbb{R}_{++} \to \mathbb{R}_+$, we assume that, throughout the domain for which it takes on nonzero values, it is strictly decreasing and three times continuously differentiable. Let $P(q)$ denote the inverse function of $D(p)$, let $MR(q) \equiv P(q) + qP'(q)$ denote the *marginal revenue* curve, and let $\eta(q) \equiv -\frac{P(q)}{qP'(q)}$ denote the *elasticity of demand*. Our main results refer to the following version of *Marshall's Second Law of Demand*, stated in Assumption 1.

Assumption 1 (Marshall's Second Law of Demand)**.** *The elasticity of demand strictly decreases as quantity increases, up to the point where marginal revenue reaches zero. Formally, $\eta'(q) < 0$, for all q such that $MR(q) > 0$.*[10]

To interpret Marshall's Second Law, note, first, that it essentially limits the convexity of the demand. For example, any log-concave demand function satisfies it, while constant-elasticity functions, of the form $D(p) = kp^{-\gamma}$, which are convex, represent a limit case in that they violate it globally with equality. For further intuition, consider the following equivalent expression of this condition. Let $\rho(q) \equiv \frac{P'(q)}{MR'(q)}$ denote the *pass-through rate*, i.e., the rate at which a monopolist, facing $D(\cdot)$, optimally increases it price in response to an increase in its marginal cost. Assumption 1 can be expressed as $\rho(q) < \frac{P(q)}{MR(q)}$, for all q such that $MR(q) > 0$. Since, for all $q > 0$, $P > MR$, all demand functions with a pass-through rate

[10]Marshall expressed what he called "the law of the elasticity of demand" as the elasticity of demand being increasing in price: "The elasticity of demand is great for high prices, and great, or at least considerable, for medium prices; but it declines as the price falls; and gradually fades away if the fall goes so far that satiety level is reached;" and that this "appears to hold with regard to nearly all commodities and with regard to the demand of every class" (Marshall, 1920, Book III, Chapter IV, §2, pp. 103–104). This translates into $\eta'(p) > 0$, with $\eta(p) \equiv -D'(p)\,p/D(p)$, and Assumption 1 simply expresses this condition in units of quanitity, for any price such that $p + \frac{D(p)}{D'(p)} > 0 \Leftrightarrow \eta(p) > 1$.

bounded by one, i.e., all log-concave demand functions, as well as a non-trivial set with pass-through rates greater than unity, are compatible with this assumption.[11]

Regarding the firms' technology, the crucial parameter to account for is the publisher's marginal cost of selling ebooks. We denote this by $c \in (0, \overline{c})$, where $\overline{c} \equiv \lim_{q \to 0} P(q)$. This cost reflects, for instance, royalties that the publisher must pay for each copy sold, which we take to be exogenous. Note that, in the case where $c = 0$, the foregoing analysis becomes trivial, as, under agency, the price-setting incentives of the publisher are not distorted from those of a monopolist facing demand $D(p)$. The upper bound, $\overline{c}$, guarantees that it is always efficient for some positive quantity of ebooks to be sold, and, given the second-order conditions assumed below, this always occurs in equilibrium. Regarding other technological parameters, such as the retailer's marginal cost of distributing ebooks and producing devices, beyond the assumption that they are constant, they play no important role and we thus set them to zero.

Regarding other technological parameters, such as the retailer's marginal cost of distributing ebooks and producing devices, we assume them both to be zero. With respect to the former, this is a good approximation. With respect to the latter, provided that it is constant and not too large, this is without loss of generality.[12]

The timing is as follows under each of the two of contracting agreements:

- **Wholesale**
    1. The publishing house, H, sets the wholesale price, w.
    2. The retailer, R, sets the final ebook price, p_w.
    3. In the essential case, R sets the device price, T_w.
- **Agency**
    1. R sets the revenue share it will retain, α.
    2. H sets the final ebook price, p_α.
    3. In the essential case, R sets the device price, T_α.

[11] For example, linear demand functions exhibit a pass-through rate of 1/2. More generally, Amir, Maret, and Troege (2004) show that log-concavity of demand is equivalent to a pass-through rate bounded by one. See Bulow and Pfleiderer (1983), Weyl and Fabinger (2013), and Fabinger and Weyl (2012), who study the economic significance of the pass-through rate.

[12] See footnotes 16 and 19 for precise upper bounds in the essential and non-essential cases, respectively.

Before proceeding, one aspect of the timing merits discussion. This is the reversal, between wholesale and agency modes, in the order of the two firms' initial actions. A concern might be that this reversal potentially implies a shift, from one agreement to the other, in a dimension of "bargaining power" that is orthogonal to the dimension in which we desire to make a comparison. We believe, however, for the following reasons, that the approach we take is the one that is best-suited for the current analysis.

First, *the* crucial feature of any comparison between these two contracting agreements is that, under wholesale, the retailer sets the final price, whereas, under agency, the publisher does. Second, given this first point, among the "simple" timing arrangements (i.e. permutations of Stackelberg or simultaneous-move), the one that we have chosen for each agreement is the *only* one that leads to a reasonable equilibrium prediction.[13] The only feasible way to "hold fixed" the two firms' bargaining power while comparing the two modes would thus involve introducing significant additional machinery to the model (e.g., incorporating bargaining) at the cost of significant additional complication. Moreover, to the extent final prices are, in fact, easier to adjust on a rolling basis than inter-firm transfer arrangements, the timing we assume may indeed be quite realistic.[14]

We use the solution concept of subgame perfect Nash equilibrium, and, in order to ensure existence and uniqueness, we assume a relevant set of second-order conditions to be satisfied. These are specified in Appendix A. Note that these also imply that the function $(p-c)D(p)$ has a unique solution. In the subsequent analysis, we use, as a benchmark, $p_m \equiv \text{argmax}_p (p-c)D(p)$, the *monopoly price* for a single firm with marginal cost c, facing demand $D(p)$.

3 The Essential Case

First consider the case where the retailer exclusively sells an essential reading device. Under wholesale, the retailer does not have an incentive to mark up the ebook price, above whatever wholesale price it pays to the publisher. This is

[13]For example, if, under the agency agreement, the publisher moves first, then, assuming it chooses a price that is both itself nonzero and that leads to positive ebook sales, then the retailer will necessarily set α close to one. In anticipation of this, an optimal price for the publisher to set in the first stage would be any one that leads to zero sales of ebooks.

[14]Likely stemming from similar motivations, Johnson (2013b) adopts the same timing assumptions in his comparison of wholesale and agency pricing.

because it can use the price of the reading device to extract all available consumer surplus. Given the availability of this latter instrument, the retailer finds it optimal to set the ebook price equal to the marginal cost it perceives, namely, the wholesale price. In view of the above, the publisher's pricing incentives, when setting the wholesale price in the first stage, are *unaffected* by the presence of both the retailer and the device, compared to the hypothetical case where it was a conventional monopolist facing demand curve $D(\cdot)$, with marginal cost c. The publisher thus finds it optimal to sell quantity q_w satisfying $MR(q_w) = c$, and it does so by setting $w = p_w$. The retailer then sets $p_w = w$ and $T_w = \int_{p_m}^{\infty} D(x)\,dx$.

Under agency, when the publisher sets the final price for ebooks, for a given value of α, its profits are

$$((1-\alpha)p - c)D(p) = (p - (c + \alpha p))D(p).$$

Thus, provided that the retailer has chosen to retain a strictly positive share, α, of the revenue from ebook sales, the publisher faces incentives of a monopolist whose marginal cost is effectively *greater* than c. Therefore, if $\alpha > 0$, then $p_\alpha > p_m$.

Moreover, whenever Assumption 1 holds, for the retailer, the optimal value of α is indeed positive. To see the intuition underlying this latter point, consider the effect on R's profits of a small increase in α, beginning from zero. If R were to set $\alpha = 0$, H would respond by setting $p_\alpha = p_m$, and R's profits would be

$$\underbrace{\int_{p_m}^{\infty} D(x)\,dx}_{T_\alpha} \quad + \quad p_m D(p_m) \;\times\; \underbrace{0}_{\alpha}. \tag{1}$$

The derivative of (1), evaluated at $\alpha = 0$, is

$$\left(p_m - \frac{dp_\alpha}{d\alpha}\right) D(p_m), \tag{2}$$

where $\frac{dp_\alpha}{d\alpha}$ represents the endogenous increase in the final ebook price chosen by the publisher, as the retailer increases α. Expression (2) reflects two forces that affect the retailer's profits in conjunction with such an increase. The positive force, captured by $p_m D(p_m)$, is the slice of ebook revenue that R stands to withhold from H. The negative force, captured by $-\frac{dp_\alpha}{d\alpha} D(p_m)$, is the erosion in consumers' willingness to

pay for the device. As p_α increases by one dollar, this willingness diminishes by $D(p_m) = q_m$, since a consumer must pay one dollar more for each of the q_m ebooks purchased.

The rate at which p_α increases can be calculated by implicitly differentiating, with respect to α, H's first-order condition, which can be written as $(1-\alpha) MR(q_\alpha(\alpha)) = c$. Doing so yields

$$-MR(q_\alpha(\alpha)) + (1-\alpha)\frac{MR'(q_\alpha(\alpha))}{P'(q_\alpha(\alpha))}\frac{dp_\alpha}{d\alpha} = 0. \tag{3}$$

Evaluating equation (3) at $\alpha = 0$ and rearranging gives

$$\frac{dp_\alpha(q_m)}{d\alpha} = MR(q_m)\,\rho(q_m),$$

and thus expression (2) is strictly positive whenever $P(q_m) > MR(q_m)\,\rho(q_m) \Leftrightarrow \eta'(q_m) < 0$.

The following interpretation, framed in terms of the pass-through rate and the incidence of taxation, can be instructive. In general, when a small, *per-unit* tax is levied on a monopolist (or its marginal cost increases by one unit), the change in consumer surplus following the monopolist's optimal price adjustment is equal to $-\rho(q_m)\,q_m$.[15] Hence, if, under agency, the retailer were to increase α by an amount that prompted a reaction by the publisher equivalent to the one the latter would have exhibited in response to a one unit tax increase (holding α fixed), then consumer surplus derived from ebook purchases would fall by $\rho(q_m)\,q_m$, and T_α must fall by the same amount.[16]

It then remains to calculate $\frac{d\alpha}{dc}$, i.e., the change in α that would prompt the same response by the publisher as though a small, per-unit tax were introduced. This can be done by setting $d\alpha \cdot \frac{dp_\alpha(q_m)}{d\alpha} = dc \cdot \rho(q_m)$, which gives $\frac{d\alpha}{dc} = \frac{1}{MR(q_m)}$. Therefore, such a change would allow the retailer to retain $\frac{1}{MR(q_m)}$ "percent" of the revenue from ebook sales, and it will find this to be a beneficial move so long as $\frac{q_m P(q_m)}{MR(q_m)} > \rho(q_m)\,q_m$, which is equivalent to Marshall's Second Law of Demand holding locally at q_m. We

[15] See Weyl and Fabinger's (2013) "Principle of Incidence (Monopoly) 3".

[16] Note that, in the essential case, setting to zero the retailer's marginal cost of producing the device is without loss of generality, provided that this cost is smaller than the minimum revenue that the retailer would ever obtain, that is $\int_{p_m}^{\infty} D(x)\,dx$.

now formally summarize and extend the above discussion in Proposition 1.

Proposition 1. *When the retailer exclusively sells an essential reading device, the equilibrium price of ebooks is strictly greater under an agency contracting agreement than it is under a wholesale agreement. Formally, $p_\alpha > p_w = p_m$, where the first inequality holds for any positive marginal cost, if and only if Assumption 1 is satisfied.*

Proof. The argument given above establishes that, under wholesale, q_w satisfies $c = MR(q_w)$. Under agency, the publisher best-responds to the retailer's choice of α by setting, if feasible,[17] a final ebook price leading to quantity, $q_\alpha(\alpha)$, satisfying $(1-\alpha)\,MR(q_\alpha(\alpha)) = c$, which is equivalent to $(1-\alpha) = \frac{c}{MR(q_\alpha(\alpha))}$. Since, for a given pair (p, α), the retailer's profits are

$$\int_p^\infty D(x)\,dx + \alpha p D(p) = \int_0^q P(x)\,dx - qP(q) + \alpha P(q)\,q = \int_0^q P(x)\,dx - (1-\alpha)\,P(q)\,q,$$

in setting α, the retailer acts as if were choosing q to maximize total surplus, with perceived production costs determined by the *input price* per ebook sold of $(1-\alpha)\,P(q)$ that it pays to the publisher. The publisher's best-response equation implies that this input price is equal to $\frac{cP(q)}{MR(q)}$. Therefore, the retailer's problem, in the first stage, can be written as

$$\max_q \int_0^q P(x)\,dx - \frac{cP(q)}{MR(q)}q, \text{ subject to } MR(q) \geq c, \tag{4}$$

where the constraint arises from the revenue share's lower bound, $\alpha \geq 0$. If interior, the solution to (4), q_α, satisfies $c = MR(q_\alpha) / \left(1 - q_\alpha \frac{\eta'(q_\alpha)}{\eta(q_\alpha)(\eta(q_\alpha)-1)}\right) \equiv A_E(q_\alpha)$, where $A_E(q)$ is the retailer's *agency-adjusted marginal revenue curve*, for the essential case. In a corner solution, $c = MR(q_\alpha) = MR(q_m)$.

For any value of q such that $MR(q)$ takes on a positive value, $\eta(q) > 1$. Thus, Marshall's Second Law of Demand holding at q is equivalent to $MR(q) > A_E(q)$. Moreover, by SOC 1 and SOC 3, respectively, each of the functions $MR(q)$ and $A_E(q)$ is strictly downward sloping over the interval where it takes on a positive value. Therefore, if Assumption 1 holds, then $q_\alpha < q_w = q_m$ for all $c \in (0, \overline{c})$, and, if

[17] If the publisher were to face α equal to or above the threshold defined by $\overline{\alpha} \equiv \frac{\lim_{q\to 0} MR(q) - c}{\lim_{q\to 0} MR(q)}$, then it would make negative marginal profits on all units and would thus set a p high enough to lead the quantity of ebooks it sells to be zero. Consequently, the retailer always finds it optimal to set $\alpha < \overline{\alpha}$.

it is violated, there exists some $c \in (0, \bar{c})$ such that $q_\alpha = q_w = q_m$. □

Proposition 1 gives rise in a straightforward manner to the following implications, stated in Corollary 1, for the device price, total surplus, consumer surplus, and industry profits.

Corollary 1. *When the retailer exclusively sells an essential reading device and Assumption 1 is satisfied, (i) total surplus, (ii) industry profits and (iii) the device price are greater under a wholesale than under agency. Moreover, (iv) consumers receive zero surplus under both arrangements.*

To see this, consider the following. As consumers have no intrinsic valuation for the device, total surplus depends only on ebook sales. We know from Proposition 1 that $q_m = q_w > q_\alpha$, implying that total surplus is higher under wholesale than under agency. Moreover, when the retailer has monopoly power over an essential device, it extracts all residual consumer surplus using the device price, setting $T = \int_p^\infty D(x)\,dx$. Thus, the lower ebook price under wholesale than agency agreement leads to a higher device price in the wholesale case: $T_w > T_\alpha$.

4 The Non-Essential Case

We now turn to the case where the retailer does not exclusively control an essential reading device. Under wholesale, the arrangement is a classic one of vertical monopoly.[18] As such, the equilibrium ebook price, p_w, is greater than the monopoly price, p_m, reflecting the well known phenomenon of double marginalization. This contrasts sharply with the results from wholesale contracting in the essential case, discussed above. The crucial point of comparison is that, whereas in the essential case, the retailer has an incentive to maximize consumers' and its *joint* surplus using the ebook price and then to extract consumers' surplus using the device price, here, it has only a single pricing instrument.

In the meantime, under agency, the forces exerting upward pressure on ebook prices that we discuss above are still in place. Namely, when the retailer takes a positive share of ebook revenue by setting $\alpha > 0$, this pushes in the same direction as an increase in marginal cost, pushing p_α above p_m. Furthermore, in the non-essential case, the retailer's incentive to increase α is strengthened, relative to the

[18] See, for example, chapter IX of Cournot (1838), and Spengler (1950).

essential case, as it perceives no opportunity cost in the form of a lower device price.[19]

Thus, while it is straightforward to see that, compared to monopoly, both agency and wholesale arrangements lead to restrained quantity, it is, *a priori*, not obvious which one does so more strongly. To address this issue, we frame the first-stage decision, under each agreement, as a choice of optimal quantity, taking into account optimal reactions in the second stage. This approach gives rise to two "adjusted" marginal revenue curves, whose intersection with the marginal cost curve determines the equilibrium quantity (see Figure 2). As we show in Proposition 2, the crucial condition for the ebook price to be *lower* under agency than under wholesale, in the non-essential case, is that Marshall's Second Law of Demand holds.

Proposition 2. *When the retailer does not exclusively control an essential reading device, the equilibrium price of ebooks is strictly greater under a wholesale contracting agreement than it is under an agency agreement. Formally, $p_w > p_\alpha > p_m$, where the first inequality holds for any positive marginal cost, if and only if Assumption 1 is satisfied.*

Proof. Under wholesale, the retailer best-responds to the publisher's choice of w by setting a final ebook price that leads to quantity, $q_w(w)$, satisfying $MR(q_w(w)) = w$. Thus, the marginal revenue curve represents the schedule of quantity-wholesale price pairs available to the publisher, i.e., its perceived inverse demand curve, when setting w in the first stage. Therefore, the publisher's problem can be written as $\max_q (MR(q) - c)\, q$, implying solution, q_w, such that $c = MR(q_w) + q_w MR'(q_w) \equiv W(q_w)$, where $W(q)$ is the publisher's *wholesale-adjusted marginal revenue curve*.

Under agency, the publisher best-responds to the retailer's choice of α by setting a final ebook price that leads to quantity, $q_\alpha(\alpha)$, satisfying $(1-\alpha)\, MR(q_\alpha(\alpha)) = c$, which is equivalent to $(1-\alpha) = \frac{c}{MR(q_\alpha(\alpha))}$. Since, for a given pair (p, α), the retailer's profits are equal to $(p - (1-\alpha)\, p)\, D(p)$, the publisher's best-response equation implies that the retailer's perceived *input price* per ebook sold, $(1-\alpha)\, p$, can be written, as a function of q, as $\frac{cP(q)}{MR(q)}$. Therefore, the retailer's problem, in the first stage, can

[19] In the non-essential case, the assumption of zero marginal cost for the device is without loss of generality provided that this cost is smaller than the consumer surplus obtained under $\max\{p_w, p_\alpha\}$. This is condition is more restrictive than the one pertaining to the essential case (see footnote 16), but it is also an uncontroversial point that, as the device market has become more competitive, their productions costs have declined.

be written as

$$\max_{q}\left(P(q)-\frac{cP(q)}{MR(q)}\right)q. \tag{5}$$

The solution to (5), q_α, satisfies $c = MR(q_\alpha)\left(1-\frac{1}{\eta(q_\alpha)}\right)/\left(1-q_\alpha\frac{\eta'(q_\alpha)}{\eta(q_\alpha)(\eta(q_\alpha)-1)}\right) \equiv A_N(q_\alpha)$, where $A_N(q)$ is the retailer's *agency-adjusted marginal revenue curve*, for the non-essential case.

Note (i) that $W(q)$ can be expressed as $W(q) = MR(q)\left(1-\frac{1}{\eta(q)}+q\frac{\eta'(q)}{\eta(q)(\eta(q)-1)}\right)$ and (ii) that for any value of q such that $MR(q)$ takes on a positive value, $\eta(q) > 1$. Thus, Marshall's Second Law of Demand holding at q is equivalent to $A_N(q) > W(q)$. Moreover, given SOC 1 that $MR'(q) < 0$, it can be verified that $MR(q) > \max\{A_N(q), W(q)\}$. Finally, by SOC 2 and SOC 4, respectively, each of the functions $W(q)$ and $A_N(q)$ is strictly downward sloping over the interval where it takes on a positive value. Therefore, if Assumption 1 holds, then $q_w < q_\alpha < q_m$ for all $c \in (0, \overline{c})$, and, if it is violated, there exists some $c \in (0, \overline{c})$ such that $q_\alpha < q_w < q_m$. □

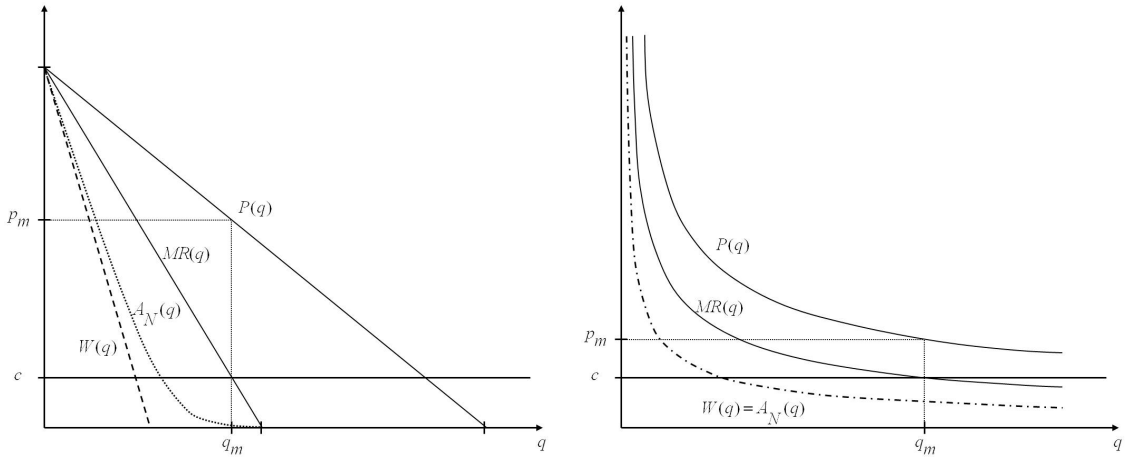

Figure 2: Wholesale-adjusted and agency-adjusted marginal revenue curves, $W(q)$ and $A_N(q)$ and their intersections with c. Under linear demand (left), which satisfies Assumption 1, $q_\alpha > q_w$. Under constant-elasticity demand (right), which is the limit case, $q_\alpha = q_w$.

Another way to represent equilibrium under each arrangement involves drawing adjusted cost curves, and their intersections with the standard marginal revenue curve. Under wholesale, the equilibrium quantity, q_w, satisfies $MR(q) = c/\left(1-\frac{1}{\eta(q)}+q\frac{\eta'(q)}{\eta(q)(\eta(q)-1)}\right) \equiv c_W(q_w)$, where $c_W(q_w)$ is the *wholesale-adjusted marginal cost curve*. Analogously, under agency, the equilibrium quantity, q_α, satisfies

$MR(q_\alpha) = c\left(1 - q_\alpha \frac{\eta'(q_\alpha)}{\eta(q_\alpha)(\eta(q_\alpha)-1)}\right) / \left(1 - \frac{1}{\eta(q_\alpha)}\right) \equiv c_A(q_\alpha)$, where $c_A(q_\alpha)$ is the *agency-adjusted marginal cost curve*, for the non-essential case. These curves are represented in Figure 3, both in the linear demand case and in the constant-elasticity case.

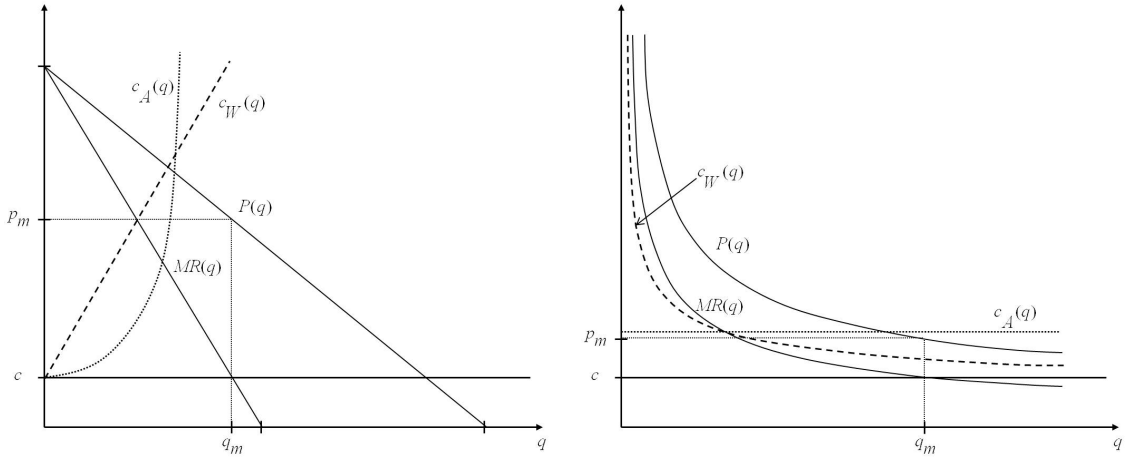

Figure 3: Wholesale-adjusted and agency-adjusted marginal cost curves, $c_W(q)$ and $c_A(q)$, and their intersections with $MR(q)$.

Proposition 2 gives rise in a straightforward manner to the following implications, stated in Corollary 2, for the device price, total surplus, consumer surplus, and industry profits.

Corollary 2. *When the retailer does not exclusively control an essential reading device and Assumption 1 is satisfied, (i) total surplus, (ii) consumer surplus, and (iii) industry profits are greater under agency than under wholesale.*

To see this, note, first, that as consumers have no intrinsic valuation for the device, total surplus depends only on ebook sales. From Proposition 2, it holds that $q_\alpha > q_w$, and, thus, total surplus is greater under agency. Second, consumer surplus is equal to $\int_p^\infty D(x)\,dx$, which is decreasing in the ebook price, p, which, in turn, is greater under wholesale. Finally, given SOC 1 (see Appendix A), total profits are concave in p, and since $p_w > p_\alpha > p_m \equiv \text{argmax}_p (p-c) D(p)$, they are greater under agency.

5 The Role of Marshall's Second Law of Demand

[To be added: intution for our results in terms of consumer surplus extraction versus extraction of profits from the opposing firm, and the role that Marshall's Second Law plays in determining the weight of these forces.]

6 Discussion

[To be added: informal discussion of (1) consumer heterogeneity. Note the the results in the non-essential case are totally general, whereas, in the essential case, they depend to some degree on the assumption of consumer homogeneity. (2) Possible implications of competition between publishers/retailers and the role of Most Favored Nation clauses – this may help the DOJ's case stand up against this paper's theory, but it does not seem to counteract the prediction that, in the current market, wholesale risks leading to double marginalization. (3) Dynamic considerations. How does the fact that, when Apple entered, a large pool of "early adopters" were already ensconced in the Kindle ecosystem. This seems to fit with our story: Amazon realized that many of those people were going to buy iPads and stop buying new Kindles, leading it to create an iPad app. (4) Industry profits. Joint profit maximization would lead to wholesale agreement arising when the device is essential, but to agency agreement when it is not.]

Further references to discuss: Baye, De los Santos, and Wildenbeest (2013) (data on ebook prices), Anderson, de Palma, and Kreider (2001) (regarding parallel to ad valorem versus specific taxes)

7 Conclusion

This paper shows that the relationship between agency and wholesale agreements between vertically related firms hinges crucially on whether one of the firms controls a complementary market. Moreover, it establishes that a version of Marshall's Second Law of Demand is the necessary and sufficient condition for the following statements to be true. When the retailer has monopolistic control over a complementary market, then equilibrium prices under agency are higher than under wholesale. When the retailer exerts no such control, then prices are higher under

wholesale.

Using these results, we construct a simple theory to explain recent events in the electronic books industry. Our theory offers a simple explanation for the observed rise in ebook prices that occurred around the time that Apple entered the market. This theory does not depend on any claim of anticompetitive behavior on the part of Apple or of publishers. Furthermore, it is consistent with the rapid decrease in the price of Amazon's Kindle device and the proliferation of alternative devices that could be used to read ebooks sold by Amazon, both of which took place around the same period. A particularly relevant implication of this theory is that the imposed remedy of prohibiting agency agreements is liable to cause ebook prices to rise even further than they already have, as the market for tablets and other devices that can display ebooks has become very competitive.

Appendices

A Second-Order Conditions

In this appendix, we specify second-order conditions that guarantee, in each of the environments we consider, the existence and uniqueness of subgame-perfect equilibrium. We take all of the assumptions listed below to hold throughout the analysis.

In the essential case, under wholesale, the retailer chooses the ebook price as if it were maximizing total surplus and the marginal cost of producing ebooks were w. This gives first-order condition $P(q) = w$, which is sufficient, as demand is strictly decreasing. The publisher's optimization problem in the first stage is equivalent to that of a conventional monopolist, giving first-order condition $MR(q) = c$. This is sufficient for all $c \in (0, \overline{c})$ if and only if SOC 1 is satisfied.

SOC 1 (Decreasing Marginal Revenue)**.** *$MR'(q) < 0$ for all q such that $MR(q) > 0$.*[20]

Furthermore, in the non-essential case, under wholesale, the retailer's first-order condition in the second stage is $MR(q) = w$, and, thus, SOC 1 guarantees that this is sufficient. In the first stage, the publisher's first-order condition can be written $W(q) \equiv MR(q) + qMR'(q) = c$, and this is sufficient for all $c \in (0, \overline{c})$ if and only if SOC 2 holds.

SOC 2 (Decreasing Wholesale-Adjusted Marginal Revenue)**.** *$W'(q) = 2MR'(q) + qMR''(q) < 0$ for all q such that $W(q) > 0$.*

Under agency, in both the essential and the non-essential case, the publisher's choice of the ebook price, in the second stage, gives first-order condition $(1 - \alpha) MR(q) = c$. This is sufficient, provided that $\alpha < 1$, if and only if Assumption 1 holds. In the essential case, the first-order condition associated with the retailers' choice of revenue share, α, in the first stage, can be written $A_E(q) \equiv MR(q) / \left(1 - q\frac{\eta'(q)}{\eta(q)(\eta(q)-1)}\right) = c$. This is sufficient, for all $c \in (0, \overline{c})$, if and only if SOC 3 is satisfied.

SOC 3 (Decreasing Agency-Adjusted Marginal Revenue (Essential))**.** *$A_E'(q) < 0$ for all q such that $A_E(q) > 0$.*

[20] Note that SOC 1 is strictly weaker than Marshall's Second Law of Demand, posited by Assumption 1. Positing SOC 1 allows us, in Propositions 1 and 2, to consider the counterfactual whereby Assumption 1 is violated while still ensuring that the game in question has a unique equilibrium.

In the non-essential case, the analogous first-order condition is given by $A_N(q) \equiv MR(q)\left(1-\frac{1}{\eta(q)}\right)/\left(1-q\frac{\eta'(q)}{\eta(q)(\eta(q)-1)}\right) = c$. This is sufficient, for all $c \in (0, \overline{c})$, if and only if SOC 4 is satisfied.

SOC 4 (Decreasing Agency-Adjusted Marginal Revenue (Non-Essential))**.** $A_N'(q) < 0$ *for all* q *such that* $A_N(q) > 0$.

B Additional Figures

Figure 4: Currently, Amazon's marketing of its ebooks emphasizes the fact that they can be accessed on a wide range of devices sold by other firms (accessed November 10, 2013).

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