Personalization, data portability and competitive dynamics*

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Abstract

We study data portability in a model of dynamic price competition where product quality improves for each customer as personal data accumulates with usage. This can reflect AI-driven personalization based on customer data or customers embedding their own data into the firm's product through usage. We show that when consumers are forward looking and firms can personalize their prices, each firm does best by offering data portability so that its customers can freely take their data to a rival. By contrast, when consumers are myopic, firms no longer always benefit by offering portability, and there are equilibria where neither firm offers data portability. A data portability mandate is therefore redundant when consumers are forward looking, but becomes potentially relevant when consumers are myopic. However, with myopic consumers, a data portability mandate can also cause a complete market breakdown if consumers' initial willingness to pay for firms' products is below cost. We extend these results to a setting without personalized prices.

Keywords: artificial intelligence, algorithms, learning, data, personalization

1 Introduction

Personalization has become a central source of competitive advantage for firms that employ AI models in their products. Such products improve for each individual customer as usage generates data that can be leveraged to better satisfy customer needs. For instance, AI chatbots can learn from repeated interactions with the same user, using that user's context to tailor their responses. In such settings, accumulated data create a form of endogenous

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switching cost: a customer who stays benefits from improved personalization, while a customer who switches forfeits those gains unless their data can be transferred. Similarly, many software services become more valuable with usage as customers embed their specific data, applications and workflows.

This raises a fundamental strategic question, which is our focus: should firms enable consumers to take their data to a rival when they decide to switch? We refer to this as data portability. By that, we mean effective portability, so data can be transferred in a form that allows the rival to preserve the productive value of that data. Some firms, particularly providers of business software (e.g., Salesforce, WordPress, Figma), voluntarily provide robust export tools and APIs that help customers port their data and thereby switch. Apple, Google and Meta are founding members of the Data Transfer Initiative, through which they promote data portability for some of their products.[1] Yet in many other cases, effective portability remains limited.

Existing laws such as the General Data Protection Regulation (GDPR) in Europe already give individuals a partial portability right over personal data, while the EU Data Act, applicable from 2025, extends these rights to business users. These rules create an important regulatory baseline, but they do not fully answer whether firms should offer more effective portability through richer data, metadata, APIs, or firm-generated outputs that go beyond minimum legal compliance, including in countries outside the EU. We expect this issue, along with the question of whether data portability needs to be mandated more broadly, to become even more central with the advance of AI-driven services.

A common intuition is that regulatory mandates for data portability are necessary to protect consumer interests. Portability weakens lock-in, benefits consumers, and hurts incumbent firms, so market participants would not readily offer it. However, our analysis shows that this answer is incomplete when consumers are forward-looking and firms compete for the initial relationship.

We develop a dynamic model of price competition with two firms and two periods, in which a firm that serves a given consumer in period 1 obtains data on that consumer and therefore can offer them a higher quality product in period 2. Data portability allows a consumer that switches firms in period 2 to transfer this data to the rival, effectively neutralizing any incumbent data advantage for that individual. The two firms can have different product qualities to begin with and the increase in product quality due to customer data is also allowed to be different across the two firms (e.g., one may have a better algorithm than the other). In this context, we ask two main questions: (1) should firms voluntarily adopt

[1] Most active in this regard is Google, as evidenced by its comprehensive list of data portability options in Google Takeout: https://takeout.google.com/.

data portability? (2) if they don't, should they be required to do so?

Our key finding is that when consumers are forward looking and firms can personalize their products, firms should voluntarily commit to offering data portability. In particular, the firm that would win the initial relationship absent data portability is strictly better off adopting it precisely when consumers would switch to the rival under data portability. This occurs when data portability increases future total surplus because it enables the initially inferior rival to offer a superior product once it has access to the consumer's data (e.g., due to a better algorithm). Otherwise, if future total surplus is not increased, the firm is indifferent to adopting data portability.

This surprising result reflects an intertemporal unbundling effect: data portability separates the firm that has the initial advantage in terms of consumer willingness-to-pay from the firm that can generate the highest data-enabled surplus later. This benefits the firm with the initial advantage precisely when that advantage is reversed by data, as the firm no longer has to compensate for its future disadvantage when competing initially. Specifically, it no longer has to compete with a rival that needs to subsidize users upfront in order to have a chance to make better use of the data in the future. Nor does it need to compensate consumers who anticipate their data would otherwise be tied to a firm where it is less valuable in the future. These effects make portability privately attractive to the adopting firm because it reduces the strategic value of winning the initial relationship. For the same reason, consumers may end up worse off.

We then identify conditions under which firms would no longer voluntarily adopt data portability. When consumers are myopic and fail to account for how today's choice affects future personalization and pricing, it is no longer true that firms should always adopt data portability. When consumers do not account for the future benefits of being able to take their data to the rival under data portability, or for the implications for future competition, the advantages of a firm adopting data portability are diminished. In this case, what matters is not future total surplus but whether data portability increases future joint profits. As a result, data portability may or may not be profitable to offer, and the consumer welfare effects of a data portability mandate become ambiguous. In some cases, especially when one firm is clearly superior to the other both with and without data, data portability lowers future joint profits, and so would not be voluntarily offered by the firms even though consumers would be better off if it were offered. This provides a rationale for mandating data portability. But in other cases with myopic consumers, data portability can still reduce consumer surplus. For instance, when firms need data-driven improvements for their products to become viable (i.e., for consumers' willingness-to-pay to exceed costs), mandating portability can eliminate each firm's incentive to subsidize consumers initially and lead to complete market breakdown.

We extend the analysis to environments without personalized pricing and with horizontal and vertical differentiation. We show that our results largely continue to hold. In the case with forward-looking consumers, firms should adopt data portability when it increases future total surplus, which parallels the baseline case. However, whether data portability increases future total surplus is no longer guaranteed because product differentiation introduces additional forces that can dampen or overturn the incentive for firms to adopt data portability. On the other hand, with myopic consumers, consistent with our results with personalized pricing, firms should adopt data portability whenever it increases their future joint profits, meaning firms should generally be less willing to adopt data portability with myopic consumers than with forward-looking consumers.

Finally, we provide managerial and policy guidance grounded in these mechanisms, clarifying when firms should voluntarily commit to portability and when regulatory intervention may be warranted.

2 Related literature

Relatively few economics papers study data portability. Krämer and Stüdlein (2019) develop a two-period model to study porting data from the incumbent content provider to a rival content provider that enters in the second period, showing that data portability makes customers of the entrant worse off and customers of the incumbent better off. Their mechanism operates through the effect of data portability on how much information the incumbent discloses in the first period, and how that affects price competition in the second period. In a similar two-period setup, Lam and Liu (2020) look at whether a data portability policy that only applies to consumer-provided data facilitates entry, showing that it can actually hinder entry. This happens when the policy leads consumers to provide more data, thereby strengthening the incumbent through a data network effect. Because portability applies only to consumer-provided data and not to data derived by the firm through analytics, entry can become harder for a rival. In addition to other differences, which we discuss further below, these papers diverge from ours by not capturing full dynamic price competition given they assume the rival is only present in the second period.

Two more recent papers on data portability do model full dynamic price competition. Jeon et al. (2023) consider system competition in each of two periods, and focus mostly on firms' decisions to make their products compatible or incompatible. If one firm chooses incompatibility, then consumers can only obtain the system of products from one of the firms. They study how a data portability policy, by reducing switching costs, can induce a change in the compatibility regime from incompatibility to compatibility. Jeon and Menicucci

(2024) study data portability in a two-period model in which they also incorporate consumer switching costs, and show that when firms cannot price below zero (but can offer less efficient freebies tied to the sale of their product or service), it is possible that a data portability regime that reduces switching costs can increase firms' profits and benefit consumers.

In contrast to these papers, we focus on whether an individual firm should adopt data portability as a unilateral strategic choice rather than on a policy that reduces switching costs. Furthermore, we model data portability as increasing a consumer's willingness to pay for a rival firm's product when the consumer switches (given the rival has access to the consumer's data) rather than a common reduction in switching costs for both firms. Thus, we allow the effects of data portability to be asymmetric across firms, reflecting that data may be more valuable to one firm than to the other and may even reverse which firm has the advantage.

Our paper also relates more broadly to the switching cost literature (for example, see the seminal work of Klemperer, 1987a and 1987b). Relative to this literature, there are two key differences. First, standard models treat switching costs as exogenous and common across firms, rather than allowing each firm to unilaterally lower its customers' cost of switching to a rival firm, which would be more akin to the unilateral adoption of data portability that we consider. Second, in standard switching-cost models, a consumer's past purchase gives the incumbent an advantage over that same consumer in the future. Lowering switching costs weakens this advantage, but it does not provide an efficiency-reason for the consumer to switch. In our setting, by contrast, the data generated through use of one firm's product may be more valuable in the rival's product. Data portability can therefore make switching efficient, rather than merely reducing an exogenous impediment to switching. For this reason, the intertemporal unbundling effect at the center of our paper is absent from a standard switching-cost model.

Reflecting these distinctions, applying a standard switching-cost interpretation to our baseline setting would miss the central mechanism driving our results. In the two-period Bertrand competition setting we focus on, reducing an exogenous and common switching cost increases first-period prices and decreases second-period prices, so that firms and consumers are left no better or worse off. By contrast, we show that if data portability is modeled in terms of product improvements, it is unambiguously good for firms and bad for consumers when it induces consumers to switch in equilibrium.

Finally, our paper relates to recent work on data sharing in which firms share data with competitors. Hagiu and Wright (2023) study an infinite-period model in which customer usage improves firms' products, but analyze a symmetric data-sharing policy and its consumer-surplus effects rather than firms' unilateral incentives. Bhargava et al. (2026)

show that a specialist firm may share data with a generalist entrant in an interdependent market in order to make the entrant less aggressive. Their paper shares our point that giving a rival access to data can soften direct competition, but it studies data sharing across markets rather than data portability across time.

3 Baseline model

Two firms A and B compete in prices over two periods 1 and 2 to sell to a unit mass of consumers. We start by describing what determines an individual consumer's willingness to pay.

For a given consumer, the net value created by firm i's product in period 1 is v_i, with $i \in \{A, B\}$. We assume firms have a constant marginal cost c, so the corresponding gross value obtained by the consumer (i.e., their total willingness to pay) is just $v_i + c$. If the consumer buys from firm i in period 1, then the data obtained from the consumer allows firm i to increase the net value of its product for the same consumer in period 2 to v_i', where $v_i' > v_i$ (e.g., via AI-enabled personalization). Consumers have an outside option available in each period valued at zero.

Firms are assumed to have full pricing flexibility, so they can set personalized prices. Specifically, they are able to set a different price for each different consumer (perfect price discrimination) in each period, which they will want to do if consumers are heterogeneous, which we allow. That is, if we define a consumer's configuration of net values as $\overline{v} = (v_A, v_B, v_A', v_B')$, we allow $\overline{v}$ to be different for each consumer. We allow prices to be negative, which is only relevant in period 1, although with sufficiently high c, negative prices will not arise. We will refer to the firms' prices for a particular consumer in period 1 as p_A and p_B.

The timing is as follows. In the unregulated environment, the game starts with period 0, in which the two firms independently and simultaneously decide whether or not to commit to data portability. A firm that commits to data portability in period 0 will allow all consumers who buy from it in period 1 to take the data obtained on them to the rival firm if they switch in period 2. Assuming a consumer chooses to transfer their data to the rival firm when switching, the rival firm then gets to use all the consumer's relevant data to improve its product for that consumer (e.g., by applying its own algorithm to the data). In this case, if firm i wins a consumer in period 1 and has committed to data portability, the relevant net value of rival firm j's product in period 2 for the same consumer is v_j', as opposed to just v_j when firm i has not committed to data portability. That is, when firm i commits to data portability and a consumer switches to firm j in period 2, in terms of the net value firm j can offer in period 2, it is as if the consumer had purchased from firm j in period 1. Put differently, we assume data portability is fully effective. Alternatively, if data portability is mandated by a regulator in period 0, then both firms are required to provide data portability to consumers who buy from them, meaning the net value created by the respective firms will be v_i' and v_j' in period 2, provided the consumer has purchased from one of the firms in period 1. Either way, the two firms compete for consumers in each period. In our baseline model consumers are forward looking, with a common discount factor $0 < \delta < 1$. Firms are assumed to be forward looking throughout the paper, with the same discount factor.

The discounted net value generated by firm i from the perspective of the start of period 1, assuming it obtains the benefits of data to use in period 2, is then

$$V_i \equiv v_i + \delta v_i'.$$

To rule out uninteresting cases, we impose some restrictions on the consumer configurations we consider. Thus, we assume throughout that

$$\min\{v_A', v_B'\} \geq 0,$$

so both firms are always relevant for a consumer. If firm i has $v_i' < 0$, then it is not relevant for the consumer in either period, even if it benefits from data portability, and so the other firm would hold a monopoly position, which makes the choice of data portability irrelevant for the consumer. For expositional reasons, we will focus mainly on the simpler case where $v_A \geq 0$ and $v_B \geq 0$, so both firms offer non-negative net value even if they do not learn from the new data. However, we will also provide results for the case in which $v_A < 0$ and/or $v_B < 0$, i.e., one or both of the firms do not create positive value unless they learn from new data. Finally, we assume

$$\max\{V_A, V_B\} \geq 0,$$

which ensures that at least one of the two firms generates non-negative discounted net value relative to the outside option for the consumer. Otherwise, neither firm would ever find it profitable to attract the consumer in any period. Note that under the stronger assumption that $v_A \geq 0$ and $v_B \geq 0$, which we sometimes adopt, we have $V_A > 0$ and $V_B > 0$.

3.1 Discussion of model assumptions

Our assumption of personalized pricing is partly motivated by our focus on personalized products. In a world in which products become personalized via AI, it is natural to allow firms also to personalize their prices. Reflecting the potential for such pricing, there has been growing interest in the economics literature in characterizing what happens under personalized prices (e.g., Rhodes and Zhou, 2024). An important advantage of allowing for personalized pricing is that we can fully characterize the equilibrium outcome for any arbitrary consumer configuration $\overline{v}$. With this approach, the results for data portability decisions made at the individual consumer level follow immediately from our results. Moreover, even if a firm's data portability policy applies to all consumers served by the firm, which is our working assumption, we can still obtain strong results for our baseline setting that hold for any distribution of consumer configurations. More generally, personalized pricing allows us to isolate cleanly the intertemporal unbundling effect of data portability, and to distinguish its two channels: the rival's reduced incentive to win the consumer initially in order to obtain the data, and the forward-looking consumer's higher expected continuation surplus. In Section 6, we explore what happens if firms cannot personalize their prices, showing that the main strategic effects still apply and the results are largely the same.

We assume data portability is fully effective. If, instead, data portability is only partially effective, so the net value of rival firm j's product in period 2 for the same consumer is $\alpha v_j'$, where $0 < \alpha < 1$, then the main findings of our baseline setting continue to hold. In particular, it is still the case that the unique equilibrium is that both firms commit to data portability. The same conclusion also holds when the effect of data on second-period values is stochastic, as shown in Online Appendix A. Specifically, the dominance logic used in our baseline analysis extends to this case when the deterministic surplus comparisons are replaced by their expected counterparts.

While the baseline model assumes consumers are forward-looking, in Section 5 we analyze the case in which consumers are myopic, i.e., they ignore future payoffs when deciding which firm to buy from in period 1. This allows us to show which part of the intertemporal unbundling mechanism survives when consumers are myopic. Furthermore, the analysis with myopic consumers is arguably a better fit for applications in which the relevant users are individuals, rather than business users who are more likely to be forward-looking.

An implicit assumption when one or both firms choose to offer data portability is that they can credibly commit to such a policy. This is important because, in period 1, firm pricing and consumer adoption decisions depend on the firms' data portability announcements made in period 0. These announcements are assumed to be honored in period 2, even though at that time each firm would be tempted to renege on its data portability commitment to make it harder for consumers to switch. Thus, we assume that firms can resist the temptation to change their respective data portability policies. This may be facilitated by making the policies public so that reversing them carries a significant reputational cost. We discuss strategic implications of this commitment problem in Section 7.

Related to this commitment problem, our analysis assumes that any data portability policy only applies to new data collected after the policy is introduced. Obviously, when firms decide whether to implement data portability, they will never want to do so retroactively. On the other hand, policymakers may want data portability to apply retroactively. We also discuss this tension in Section 7.

4 Baseline results

The main result of this section is that each firm always wants to commit to data portability. Indeed, we show that the unique equilibrium involves both firms offering data portability. Moreover, this unique equilibrium outcome (equivalent to a situation in which policymakers mandate data portability for both firms) makes consumers worse off. Since the result is quite surprising, it is useful to first sketch how it arises in the most interesting cases, before stating and proving the more general result that holds for all consumer configurations.

Given that we allow for personalized pricing, we can do the equilibrium analysis for each individual consumer separately. Price competition for an individual consumer involves one firm winning the consumer provided at least one firm can profitably offer the consumer non-negative value. For the exposition that follows, we focus on a consumer configuration where $\min \{v_A, v_B\} \geq 0$, so the outside option is not relevant. In particular, this guarantees that one of the two firms wins the consumer in period 1.

To show the logic for the formal results, it is useful first to do the analysis with general profit expressions for period 2 (these expressions turn out to be useful throughout the paper). We denote by $\pi_i(j)$ firm i's profit from a consumer in period 2 when firm j has won the consumer in period 1, where $i, j \in \{A, B\}$. Similarly, let $u(j)$ denote the net surplus obtained by the consumer in period 2 when firm j wins in period 1. In our baseline model, these second-period payoffs are determined by standard asymmetric Bertrand competition between the two firms, with the firm offering the higher net value winning and extracting the difference in net values, and the consumer obtaining the net value offered by the losing firm. For example, if $v'_A \geq v_B$ and $v'_B \geq v_A$, then in the absence of data portability: $\pi_A(A) = v'_A - v_B$, $\pi_B(A) = 0$, $u(A) = v_B$, $\pi_A(B) = 0$, $\pi_B(B) = v'_B - v_A$, and $u(B) = v_A$. Then define the joint profits of the two firms in period 2 when firm j wins in period 1 as $\pi(j) = \pi_A(j) + \pi_B(j)$, and the corresponding total surplus $S(j) = \pi(j) + u(j)$. All these expressions are in the absence of any data portability.

Consider first the case without data portability. The maximum subsidy (i.e., price below cost) that firm i is willing to offer the consumer in period 1 in order to win is the amount that makes the firm indifferent between winning and losing in period 1, so

$p_i - c = \delta(\pi_i(j) - \pi_i(i)) \leq 0$, where $i \neq j \in \{A, B\}$.[2] A forward-looking consumer also takes into account the discounted net surplus it expects to get over both periods from choosing each of the firms in period 1, which is $v_A + c - p_A + \delta u(A)$ from choosing firm A and $v_B + c - p_B + \delta u(B)$ from choosing firm B.

Firm A then wins in period 1 if and only if

$$v_A - p_A + \delta u(A) \geq v_B - p_B + \delta u(B) \tag{1}$$

and firm B wins otherwise. Substituting in $p_i - c = \delta(\pi_i(j) - \pi_i(i))$, A wins in period 1 if and only if

$$v_A + \delta S(A) \geq v_B + \delta S(B). \tag{2}$$

In our asymmetric Bertrand competition framework with $\min\{v_A, v_B\} \geq 0$, it is easy to verify that this condition simplifies to

$$V_A \geq V_B.$$

Thus, A wins if and only if the present discounted value of the total surplus it creates across the two periods is higher than that created by B.

If (2) holds, B loses and prices at $p_B - c = \delta(\pi_B(A) - \pi_B(B))$, while A does best pricing so (1) just binds, which is at $p_A = v_A - v_B + p_B + \delta(u(A) - u(B))$. Using this price, and the expression for $p_B - c$, A's total profit (i.e., the discounted sum across the two periods) is

$$p_A - c + \delta\pi_A(A) = v_A - v_B + \delta(\pi_A(A) + \pi_B(A) + u(A) - \pi_B(B) - u(B)).$$

Combining this with the condition for A to win, i.e., (2), A's total profit without data portability is

$$\max\{v_A - v_B + \delta(S(A) - S(B)), 0\} + \delta\pi_A(B). \tag{3}$$

In the asymmetric Bertrand competition framework with $\min\{v_A, v_B\} \geq 0$, this simplifies to

$$\max\{V_A - V_B, 0\}.$$

Now consider the case in which A commits to data portability while B does not. A's commitment affects the continuation outcome only if A wins the consumer in period 1. In

[2]This subsidy could involve a negative price if c is low enough. In Online Appendix B, we show that the main conclusion (each firm weakly prefers to commit to data portability regardless of what the other does) remains true even when firms are subject to a non-negative price constraint. We also show that the non-negative price constraint can lead to higher consumer surplus under bilateral data portability relative to no portability, consistent with Jeon and Menicucci (2024).

that case, both firms have access to the consumer's data in period 2 and we can follow the same steps as above but replace $\pi_A(A)$ with π_A^P and $\pi_B(A)$ with π_B^P, where these denote the two firms' profits in period 2 when both firms have access to the data. Also, the consumer's utility in period 2 is now denoted u^P instead of $u(A)$, reflecting that both firms have access to the data. We also adopt analogous notation for joint profits and total surplus in period 2, with $\pi^P = \pi_A^P + \pi_B^P$ and $S^P = \pi^P + u^P$. Then, replacing $S(A)$ with S^P in (3), A's total profit when it commits to data portability is

$$\max\left\{v_A - v_B + \delta\left(S^P - S(B)\right), 0\right\} + \delta\pi_A(B). \tag{4}$$

In the asymmetric Bertrand competition framework with $\min\{v_A, v_B\} \geq 0$, this simplifies to

$$\max\{v_A + \delta \max\{v'_A, v'_B\} - V_B, 0\}.$$

Comparing A's profit in (4) with its profit in (3), the key difference is that S^P replaces $S(A)$. Thus, A's adoption of data portability matters through the change in second-period total surplus (joint profits plus consumer surplus) when A wins and B has access to the consumer's data in period 2 rather than when A wins and B does not have such access. Giving B access to the period-1 data weakly increases total surplus in period 2, so we always have[3]

$$S^P \geq S(A). \tag{5}$$

This means that, with forward-looking consumers, a firm always weakly prefers to unilaterally commit to data portability when the other does not.

To better understand the mechanism underlying the key condition (5), it is useful to focus on the two scenarios in which unilateral data portability strictly increases A's profits.

First, suppose A has the overall advantage without data portability, $V_A > V_B$, so it wins both periods, but access to data reverses its initial advantage, i.e. $v_A > v_B$ and $v'_A < v'_B$. In this case, data portability strictly increases total surplus in period 2, because it allows the firm that generates more surplus from the data (firm B) to win in period 2. As a result, by committing to offer data portability, A no longer has to compensate for its period-2 disadvantage when competing in period 1. Indeed, from (4), A's profit when it offers data portability is $v_A - v_B > 0$, which is strictly higher than $V_A - V_B > 0$, the profit obtained by A in the absence of data portability from (3).

Second, suppose A has the advantage in period 1, $v_A > v_B$, but is at a sufficiently large disadvantage in period 2 that, without data portability, B wins in both periods, i.e. $v'_A < v'_B$

[3]To see this, note $S^P = \max\{v'_A, v'_B\}$ and $S(A) = \max\{v'_A, v_B\}$.

and $V_A < V_B$. In this case, A's data portability commitment does not change the period-2 winner (firm B), but it acts as a credible commitment to allow B to win in period 2 even after A wins period 1. Thus, B no longer has to make up for its period-1 disadvantage to win in period 2, and is content to allow A to win period 1.

In all other scenarios, A is indifferent about offering data portability, either because it is at such an overall disadvantage that it earns zero profit either way, or because it already has the advantage with data ($v'_A > v'_B$), so the only thing that can be achieved by offering data portability is to shift profit from the second period to the first period (it cannot help A take advantage of B's superior offering with data in period 2).

While our explanations so far have focused on A's incentive to offer data portability when B does not, its incentive to offer data portability is independent of whether or not B offers data portability. This is because B's commitment changes the continuation surplus associated with the path in which B wins in period 1, but A's own commitment still determines whether the path in which A wins generates $S(A)$ or S^P.

The following result formalizes the above logic that a firm prefers to offer data portability, showing it is true for both firms regardless of what the other firm does, and the result holds even in the more complicated case in which we allow v_A and/or v_B to be negative.

Proposition 1. *If each firm can decide whether or not to commit to unilateral data portability, each firm is always weakly better off committing regardless of what the other firm does. Moreover, if each firm's data portability decision applies to all its customers, and provided there are some consumer configurations for which $v_A > v_B$ and $v'_A < v'_B$, and some consumer configurations for which $v_A < v_B$ and $v'_A > v'_B$, the unique equilibrium has both firms choosing to commit.*

The proposition says each firm is weakly better off committing to allow consumers who buy from it to take their data to a rival firm regardless of whether the rival reciprocates. The weak preference becomes strict only for consumers whose initial and data-enabled rankings differ. Thus, provided such consumers exist for each firm, each firm will strictly prefer to commit. This is why, in general, bilateral data portability becomes the unique equilibrium.

The logic of Proposition 1 is not simply that data portability relaxes first-period competition. Rather, data portability creates an intertemporal unbundling effect: it separates the firm that has the initial advantage from the firm that can create the greatest data-enabled value in period 2.

When A wins without data portability ($V_A > V_B$), but B has the advantage with the data ($v'_B > v'_A$), A's period-1 price is constrained by its period-2 disadvantage. By committing to data portability, A removes B's incentive to subsidize consumers in period 1 to obtain the data advantage, and it removes the need to compensate forward-looking consumers for the lower continuation surplus they would otherwise anticipate when A's period-1 win leaves the data tied to A. Thus, by committing to data portability, A's disadvantage in period 2 no longer prevents it from extracting its full period-1 advantage, and it earns higher discounted profit over the two periods as a result. A similar intertemporal unbundling logic is at work when A loses without data portability ($V_A < V_B$), but has the initial advantage ($v_A > v_B$).

In both cases above, B is also made strictly better off by A's adoption of data portability. B either goes from making zero profit to positive profit (winning in period 2), or from positive profit (winning both periods without data portability) to even higher profit (winning in period 2 without having to price below cost in period 1).

Given that firms adopt data portability in equilibrium, there is no reason for a regulator ever to want to mandate data portability when consumers are forward looking. Such a policy would be redundant. Even if firms lack commitment power and so do not offer data portability, there is no reason to mandate it in this setting. This is because mandating data portability can never increase consumer surplus. The reason consumers are weakly better off without data portability is that forward-looking price competition then results in consumers obtaining the full surplus that the initial losing firm could offer in the future if it won in each period. The period-by-period competition under data portability leaves weakly less surplus for consumers. Denoting consumer surplus without any data portability by CS and with mandated data portability by CS^P, under the assumption $\min\{v_A, v_B\} \geq 0$, it is easily seen that

$$\begin{aligned} CS^P &= \min\{v_A, v_B\} + \delta \min\{v_A', v_B'\} \\ &\leq \min\{v_A + \delta v_A', v_B + \delta v_B'\} = CS. \end{aligned}$$

The inequality is strict whenever the consumer would switch firms under data portability. Thus, consumer surplus is strictly lower with mandated data portability if and only if data portability induces the consumer to switch firms in equilibrium.[4]

Of course, in reality, there are factors not captured in our baseline model that dampen firms' enthusiasm for voluntarily offering data portability. The most obvious such factor is the ability to credibly commit to data portability. Firms might wish to claim ex-ante that they will allow their customers to move their data, but ex-post they have a clear incentive not to follow through on that promise and to make portability as difficult as possible. That in turn limits the credibility of data portability claims and commitments, especially for firms

[4] In the general case, in which v_A and v_B can be negative, we still have $CS^P \leq CS$, and the necessary and sufficient condition for consumer surplus to be strictly lower is $\min\{v_A, v_B\} + \delta \min\{v_A', v_B'\} \geq 0$ and $sign\{v_A' - v_B'\} \neq sign\{v_A - v_B\}$.

that lack the reputation necessary to make any public claims credible. Such cases might tempt regulators to mandate data portability, but as we noted above, such a policy cannot raise consumer surplus, and may lower it, if consumers are forward looking.

Another key factor is that consumers may not be forward-looking, as we have assumed here. Accordingly, in the next section we analyze how things change with myopic consumers. And in Section 6, we explore how the baseline results change when firms are no longer able to perfectly price discriminate among consumers, which also raises the possibility that firms may not always want to adopt data portability.

5 Myopic consumers

The assumption of forward-looking consumers plays a key role in Proposition 1, where profits are higher with data portability. Specifically, we assumed consumers take into account that the firm they buy from today will improve its product for them in the future via the data it obtains from them, and future price competition will adjust accordingly. In reality, however, consumers may not anticipate the value of this increased personalization or its consequences for competitive pricing. This seems especially true for individual users making modest expenditures, as opposed to business users making large purchases who may be more sophisticated.

When $\min\{v_A, v_B\} \geq 0$, the logic of the analysis with myopic consumers closely follows that with forward-looking consumers. The only difference is that consumers no longer take into account their expected future surplus (i.e., $\delta u(A)$ if buying from A or $\delta u(B)$ if buying from B) when making their period-1 choice. As a result, A's total profit when neither firm offers data portability is the same as in (3), but without the $u(A)$ and $u(B)$ terms in $S(A)$ and $S(B)$, i.e.,

$$\Pi_A = \max\{v_A - v_B + \delta(\pi(A) - \pi(B)), 0\} + \delta\pi_A(B) \tag{6}$$

Similarly, A's total profit when it commits to data portability and B does not is the same as in (4) but without the u^P and $u(B)$ terms in S^P and $S(B)$, i.e.,

$$\Pi_A^{PA} = \max\left\{v_A - v_B + \delta\left(\pi^P - \pi(B)\right), 0\right\} + \delta\pi_A(B).$$

Thus, if B doesn't commit to data portability, A weakly prefers to commit if and only if

$$\pi^P \geq \pi(A). \tag{7}$$

This means that, with myopic consumers, a firm weakly prefers to commit unilaterally to data portability whenever doing so raises the two firms' joint profits in period 2.

Suppose

$$v_A - v_B + \delta\left(\pi\left(A\right) - \pi\left(B\right)\right) > 0,$$

so A wins the consumer in the absence of data portability. In this case, A strictly prefers to commit to data portability if and only if doing so raises period-2 joint profits. When data portability diminishes A's advantage in period 2, and thereby lowers the firms' joint profits in period 2, A will not want to offer data portability to myopic consumers. For example, this happens when A is better than B with and without the data, i.e., $v_A > v_B$ and $v'_A > v'_B$. In this case, firm A wins without data portability and

$$\pi\left(A\right) = v'_A - v_B > v'_A - v'_B = \pi^P,$$

so data portability only makes B more competitive in period 2 and thereby reduces A's profit. Thus, A is strictly worse off if it offers data portability.

However, data portability can sometimes flip which firm has the advantage after gaining access to period-1 data to such an extent that it raises joint profits. Suppose A offers more value than B without the data and B's product is better once both firms have access to the data, i.e., $v_A > v_B$ and $v'_B > v'_A$, but we still have

$$v_A - v_B + \delta\left(\pi\left(A\right) - \pi\left(B\right)\right) = \left(1 + \delta\right)\left(v_A - v_B\right) + \delta\left(v'_A - v'_B\right) > 0,$$

so A still wins without data portability. In this case, $\pi\left(A\right) = v'_A - v_B$ and $\pi^P = v'_B - v'_A$, so A wants to offer data portability if and only if $v'_B - v'_A > v'_A - v_B$. This happens only if the data is much more valuable for B: it allows B to extract more in period 2 under data portability than the amount A could extract absent data portability.

It is also possible that A loses both periods without data portability and committing to data portability allows it to make positive profits. That requires

$$v_A - v_B + \delta\left(\pi\left(A\right) - \pi\left(B\right)\right) < 0 < v_A - v_B + \delta\left(\pi^P - \pi\left(B\right)\right),$$

so data portability increases joint profits in period 2 to such an extent that A swings from zero to positive profits. The logic for when that happens and when it doesn't is the same as above: it depends on whether data portability simply diminishes A's period-2 advantage when it wins period 1, or whether it flips the advantage to B to such an extent that joint profits increase.

We can now ask the same question we asked under forward-looking consumers. Should firms offer data portability, and what is the equilibrium when they can each choose whether to offer it? We obtain the following formal results for the case $\min\{v_A, v_B\} \geq 0$.

Proposition 2. *Suppose consumers are myopic,* $\min\{v_A, v_B\} \geq 0$ *and each firm can decide whether or not to offer unilateral data portability. If A has the advantage over B both with and without data, i.e., if* $v_A \geq v_B$ *and* $v'_A \geq v'_B$ *with at least one of the inequalities strict, then firm A strictly prefers not to offer data portability, while B is indifferent (its profits are zero in either case). If access to data switches the advantage from A to B, i.e., if* $v_A \geq v_B$ *and* $v'_A \leq v'_B$*, then all four possible equilibrium configurations can arise (as characterized in the proof): neither firm offers data portability, only one offers it, and both offer it. In this case, A offers data portability in equilibrium if and only if A's disadvantage with data is sufficiently large, specifically if and only if* $v'_B - v'_A \geq \min\left\{\frac{v'_B - v_B}{2}, \frac{(1+\delta)(v_A - v_B)}{\delta}\right\}$*. The results are symmetric when B has the advantage over A in the first period, i.e., when* $v_B \geq v_A$*.*

To understand why firms no longer always prefer offering data portability, recall that with forward-looking consumers, the intertemporal unbundling effect generally has two channels. First, the rival may compete less aggressively in period 1 when portability raises the payoff it obtains after losing in period 1; in that case, it need not win the consumer initially to benefit from its data advantage in period 2. Second, the adopting firm can charge more in period 1 because forward-looking consumers anticipate higher continuation surplus when their data can be used by the firm that creates greater value with it. With myopic consumers, the second channel disappears. The private incentive to offer data portability therefore depends on whether the softer-rival effect in period 1, when present, is large enough to offset the loss from strengthening the rival in period 2. This is equivalent to whether future joint profits are higher with portability, because each firm is willing to offer a period-1 subsidy equal to its discounted profit gain in period 2.

The cases in Proposition 2 reflect this logic. Focusing on the case $v_A \geq v_B$, when A is better both without and with the data (so $v'_A \geq v'_B$), data portability strengthens B's offering in period 2 and lowers future joint profits. Even if $v'_B > v_A$, so B would subsidize the consumer in period 1 in order to win the data advantage absent portability, A's commitment to portability does not remove that incentive. Under A's portability commitment, if B loses to A, both firms have the data in period 2 and A remains stronger. Hence the softer-rival effect in period 1 is absent in this case, and A prefers not to offer portability, while B is indifferent.

The more interesting case is when the advantage reverses across periods, i.e., $v_A > v_B$ and $v'_B > v'_A$. Then A has the initial advantage, while B is better able to use the data in the future. In this case, A's commitment to portability does reduce B's incentive to win the consumer initially, because B can obtain the data and win in period 2 even after losing the consumer in period 1. If A's disadvantage with the data is only moderate, A still prefers not to offer data portability. In this case, the softer-rival effect in period 1 is still not enough to offset the stronger-rival effect in period 2, and future joint profits are still lower. If A's disadvantage with the data is large enough, however, the balance between these two effects shifts, and A prefers to offer portability. When A already wins absent data portability, this occurs if and only if $v'_A \leq \frac{v_B + v'_B}{2}$. For both firms to offer portability, A's period-1 advantage must also be large enough to prevent B from profitably withholding portability in order to win the consumer outright. And if A does not win absent data portability (which happens when $v'_B - v'_A \geq \frac{(1+\delta)(v_A - v_B)}{\delta}$), then offering data portability is weakly better.

Unlike with forward-looking consumers, when consumers are myopic, mandating data portability by policy may play a meaningful role, particularly in cases where at least one of the two firms does not commit to data portability in the unregulated equilibrium. The question is then whether mandatory data portability can improve consumer welfare.

Proposition 3. *Suppose consumers are myopic and* $\min\{v_A, v_B\} \geq 0$. *If* $v_A > v_B$ *and* $v'_A > v'_B$*, then mandating data portability increases consumer surplus. If* $v_A > v_B$ *and* $v'_A < v'_B$*, then mandating data portability may increase or decrease consumer surplus, depending on parameter values and equilibrium selection. Results are symmetric when* $v_A < v_B$*.*

As discussed after Proposition 2, when one firm has the advantage both with and without data (e.g., $v_A > v_B$ and $v'_A > v'_B$), that firm has no incentive to offer data portability because it would decrease joint profits in period 2, and hence the profit that firm can extract. For the same reason, mandating data portability in that case will increase consumer surplus. That is no longer necessarily the case when access to data changes which firm has the advantage (e.g., $v_A > v_B$ and $v'_A < v'_B$). As explained above, it can increase joint profits in period 2 and allow the winning firm to extract more. This explains why the overall effect of imposing data portability on consumer surplus can go either way in general.

The complete characterization of the equilibrium (provided in the proof of Proposition 3) contains many cases, so here we highlight one interesting range of consumer configurations. For example, if $v_A > v_B$, $v'_A < v'_B$ and

$$(1+\delta)\, v_A + \delta v'_A < (1+\delta)\, v_B + \delta v'_B \text{ and } v_A - v_B < \delta\,(v'_A - v_A)\,,$$

then there are two possible equilibria. If the prevailing equilibrium is the one with neither firm offering data portability, then B wins in both periods, and mandating data portability makes the consumer worse off by raising the discounted sum of prices paid across the two periods. If, on the other hand, the prevailing equilibrium is the one where A offers data portability and B does not, then B still wins in both periods but now a data portability policy makes the consumer better off by making A more competitive in the second period, which lowers the discounted sum of prices paid across the two periods. Of course, in the range of consumer configurations in which the equilibrium with both firms offering data portability exists and prevails, a data portability policy has no impact.

Finally, it is important to point out that with myopic consumers, if both v_A and v_B are negative, that is, if the firms need learning from customer data to offer positive value, then mandating data portability may lead to a complete market breakdown. To see this in the simplest possible way, suppose $v_B < v_A < 0$ and $v'_A = v'_B > 0$. Without data portability, A wins both periods and its profit is $V_A - V_B > 0$, provided $V_B > 0$, which we also assume. Consumer surplus is V_B. If data portability is mandated, however, period-2 profits are zero for both firms no matter who wins period 1 (they are also zero if neither firm wins period 1). This implies that neither firm is willing to subsidize consumers in period 1. Such a subsidy is necessary to attract consumers when $\max\{v_A, v_B\} < 0$, so neither firm makes any sales in either period. Thus, in this situation, mandating data portability makes firms and consumers worse off.

The same logic continues to hold when $v'_A \neq v'_B$, provided the two terms are sufficiently close to one another. In that case, the firm that subsidizes consumers in period 1 cannot fully recoup that subsidy in period 2 when consumers are myopic, so the market still breaks down. This logic can be formalized as follows.

Proposition 4. *Suppose consumers are myopic,* $\min\{V_A, V_B\} > 0$ *and* $\max\{v_A, v_B\} < 0$*. If* $\max\{v_A, v_B\} + \delta\,|v'_A - v'_B| < 0$*, then mandating data portability leads to a complete market breakdown, with both firms obtaining zero profit (instead of one obtaining positive profit and the other obtaining zero profit) and consumer surplus being zero (instead of being positive).*

Such a market breakdown would not occur with forward-looking consumers, because such consumers would anticipate the benefit of intense period-2 competition, allowing the firm with the overall advantage to extract positive total profit.

6 Non-personalized pricing

In this section, we extend our model to the case in which firms cannot set personalized prices for each individual consumer. In period 1, each firm must set a single price for all consumers. In period 2, firms may condition prices on which firm the consumer bought from in period 1, but they cannot personalize prices within each such customer group. To do so, we use a general model of differentiation between the two firms, that allows for both horizontal and vertical differentiation.

Specifically, in period 1, consumers' valuations for the two firms are $v_A - \alpha_A x$ for firm A and $v_B - \alpha_B (1 - x)$ for firm B, where consumers differ in x, which is distributed on $[0, 1]$ with a continuously differentiable cumulative distribution function $F(.)$. We assume both $F(.)$ and $1 - F(.)$ are log-concave functions[5] and

$$\begin{aligned} \alpha_A &> 0 \\ \alpha_A + \alpha_B &> 0 \\ v_A &> v_B - \alpha_B. \end{aligned}$$

These assumptions imply that firm A is more likely to be preferred by low x consumers, firm B is more likely to be preferred by high x consumers, and A is preferred by at least some consumers at equal prices. We also assume v_A and v_B are large enough that the market is always covered, meaning that all consumers buy from one firm or the other. Note that the assumptions allow α_B to be negative, provided $\alpha_A + \alpha_B$ is still positive.

This formulation generalizes Schmutzler (2025) by allowing for non-linear $F(.)$. As in Schmutzler (2025), it encompasses both horizontal differentiation (when $v_A - \alpha_A < v_B$, so at least some consumers prefer B over A) and vertical differentiation (when $v_A - \alpha_A > v_B$, so all consumers prefer A over B).

Each firm sets a single price (i.e., p_A and p_B) in period 1. We assume parameters are such that each firm sells to a positive share of consumers in period 1 in equilibrium, regardless of the nature of data portability, if any. Let firm A's share be denoted s_A and firm B's share be denoted $s_B = 1 - s_A$.

In period 2, each firm can set a different price for consumers who purchased from firm A in period 1 than for consumers who purchased from firm B in period 1. Thus, competition between the firms is separate for the s_A consumers who purchased from firm A in period 1 and for the s_B consumers who purchased from firm B in period 1. This competition generates per-consumer profit for each firm in period 2 along with corresponding expected per-consumer surplus, for each of these groups of consumers. These payoffs depend on whether the data A obtains about a consumer when it wins that consumer in period 1 is shared with firm B, and vice versa. Thus, for the group of s_A consumers that bought from A in period 1, period-2 per-consumer profits and expected consumer surplus are either $\pi_A(A)$, $\pi_B(A)$ and

[5] A sufficient condition for both $F(.)$ and $1 - F(.)$ to be log-concave is that the density function f is log-concave.

$u(A)$ if A does not offer data portability, or π_A^P, π_B^P and u^P if A does offer data portability. Similarly, for the group of $s_B = 1 - s_A$ consumers that bought from B in period 1, period-2 per-consumer profits and expected consumer surplus are either $\pi_A(B)$, $\pi_B(B)$ and $u(B)$ if B does not offer data portability, or π_A^P, π_B^P and u^P if B does offer data portability.

A key simplifying assumption is that the per-consumer period-2 payoff in each case above is independent of the prices set in period 1, regardless of the nature of data portability, if any. Thus, period-1 prices affect continuation payoffs only by changing the measure of consumers won by each firm and hence the customer data they may have access to. For instance, this would be true if valuations are determined in the same way as in period 1, except that v_A and v_B are shifted up by any learning by the respective firms, and x is drawn again for each consumer, independently of the period-1 draw.[6] The new draws of x could come from a different distribution and could be such that one firm takes the whole market in period 2. As a special case, it could be that $\alpha_A = \alpha_B = 0$ in period 2, so competition in period 2 is determined by asymmetric Bertrand competition. This case illustrates the possibility that x just captures perceived brand differences in period 1, but after all consumers become informed, their period-2 decision is driven entirely by the value of the product itself and not any brand differences.

To provide a sense of how the analysis is conducted, suppose neither firm offers data portability (the analysis for the other three possible cases is very similar). Consider period 1. Since consumers are forward looking, the indifferent consumer x is defined by

$$v_A - \alpha_A x - p_A + \delta u(A) = v_B - \alpha_B(1-x) - p_B + \delta u(B).$$

Assuming parameters are such that market shares are always interior, the two firms' respective market shares in period 1 are then

$$\begin{aligned} s_A &= F\left(\frac{v_A - v_B + \alpha_B + p_B - p_A + \delta(u(A) - u(B))}{\alpha_A + \alpha_B}\right) \\ s_B &= 1 - s_A. \end{aligned}$$

This implies that firm A's discounted profit at the start of period 1 is

$$\begin{aligned} & (p_A - c)s_A + \delta(\pi_A(A)s_A + \pi_A(B)s_B) \\ = \; & (p_A - c + \delta(\pi_A(A) - \pi_A(B)))s_A + \delta\pi_A(B), \end{aligned}$$

[6]The approach of assuming independent draws of consumer location across periods has also been used in the switching cost literature, including Cabral (2016), Rhodes (2014) and Lam (2017).

which A maximizes over p_A. Meanwhile, firm B's discounted profit is

$$(p_B - c + \delta (\pi_B (B) - \pi_B (A))) (1 - s_A) + \delta \pi_B (A),$$

which B maximizes over p_B.

The discounted profit expressions for the other three cases, in which one firm offers data portability and the other does not, or both firms offer it, are very similar. The only difference when firm $i \in \{A, B\}$ offers data portability is that $\pi_A (i)$, $\pi_B (i)$ and $u (i)$ are replaced by π_A^P, π_B^P and u^P. Assuming the two firms' optimization problems result in interior solutions in period 1 in all cases, and recalling our earlier notation $S (i) = \pi_A (i) + \pi_B (i) + u (i)$ and $S^P = \pi_A^P + \pi_B^P + u^P$, we can prove the following lemma.

Lemma 1. *The firms' discounted profits from the perspective of period 1 can be written*

$$\begin{aligned} \Pi_A &= H_A (\Omega^c) + \delta \pi_A^c \\ \Pi_B &= H_B (\Omega^c) + \delta \pi_B^c, \end{aligned}$$

where $H_A (.)$ is an increasing function, $H_B (.)$ is a decreasing function, and $\Omega^c = v_A - v_B + \delta (S^c (A) - S^c (B))$, with $S^c (j) = S (j)$ and $\pi_i^c = \pi_i (j)$ if firm j does not offer data portability, and $S^c (j) = S^P$ and $\pi_i^c = \pi_i^P$ if firm j offers data portability, for $i \neq j \in \{A, B\}$.

For example, if $F (.)$ is the uniform distribution on $[0, 1]$ and $-2\alpha_B - \alpha_A < \Omega^c < 2\alpha_A + \alpha_B$ (which ensures interior solutions), then

$$\begin{aligned} \Pi_A &= \frac{(2\alpha_B + \alpha_A + \Omega^c)^2}{9 (\alpha_A + \alpha_B)} + \delta \pi_A^c \\ \Pi_B &= \frac{(2\alpha_A + \alpha_B - \Omega^c)^2}{9 (\alpha_A + \alpha_B)} + \delta \pi_B^c. \end{aligned}$$

The general profit expressions above show that comparing each firm's incentive to offer data portability comes down to comparing the corresponding values of Ω^c. This incentive does not depend on what the other firm does. This leads directly to the following proposition.

Proposition 5. *When consumers are forward-looking, firm A should offer data portability if and only if*

$$S^P \geq S (A)$$

and firm B should offer data portability if and only if

$$S^P \geq S (B).$$

The economic interpretation is similar to that in the baseline model, but with one additional channel. First, as before, data portability changes the gross value generated from the consumer's data, that is, the continuation surplus associated with the adopting firm winning the consumer in period 1. In the baseline model, due to personalized pricing, this immediately determines whether portability raises or lowers total surplus for each individual consumer.

With non-personalized pricing, however, there is also a second effect: portability changes how heterogeneous consumers are allocated across the two firms in equilibrium. These two effects can reinforce or offset each other. When horizontal differentiation is strong, the reallocation of demand is limited, so the direct value effect is more likely to dominate. By contrast, when differentiation is more moderate, portability can substantially change firms' relative prices and continuation values, leading too many consumers to buy from the firm that is less well matched to them in order to obtain a lower price. In that case, the allocation effect can dominate the direct value effect, so portability can reduce second-period total surplus even though it improves the rival's data-enabled value.

For example, suppose period-2 competition takes the same form as in period 1, so a consumer who bought from A in period 1 is willing to pay $v_A' - \alpha_A x$ for firm A in period 2 and $\widetilde{v}_B - \alpha_B (1-x)$ for firm B, where $\widetilde{v}_B = v_B'$ if A has chosen data portability, and $\widetilde{v}_B = v_B$ if it has not. Similarly, a consumer who bought from B in period 1 is willing to pay $v_B' - \alpha_B (1-x)$ for firm B in period 2 and $\widetilde{v}_A - \alpha_A x$ for firm A, where $\widetilde{v}_A = v_A'$ if B has chosen data portability, and $\widetilde{v}_A = v_A$ if it has not. If x is uniformly distributed on $[0,1]$, then straightforward calculations (outlined in the Online Appendix C) establish that A prefers to offer data portability if

$$v_A' - v_B' < v_A' - v_B \leq \frac{7\alpha_A + 2\alpha_B}{5}$$

and prefers not to offer it if

$$\frac{7\alpha_A + 2\alpha_B}{5} < v_A' - v_B' < v_A' - v_B < 2\alpha_A + \alpha_B,$$

even though all relevant market shares are interior.

When consumers are myopic, the same analysis applies, except that the expressions for Ω^c no longer include the consumer utility terms. Thus, $\widetilde{\Omega}^c = v_A - v_B + \delta (\pi^c (A) - \pi^c (B))$, where $\pi^c (j) = \pi_A (j) + \pi_B (j)$ if firm j does not offer data portability and $\pi^c (j) = \pi_A^P + \pi_B^P$ if firm j does. We then obtain the following proposition.

Proposition 6. *When consumers are myopic, firm A should offer data portability if and only if*

$$\pi^P \geq \pi (A)$$

and firm B should offer data portability if and only if

$$\pi^P \geq \pi(B).$$

Thus, with myopic consumers, a firm's decision whether to offer data portability is driven by its effect on period-2 joint profits after the firm wins in period 1. With forward-looking consumers, by contrast, the decision is driven by the effect of data portability on period-2 total surplus. The effect of data portability on the rival's period-2 profit remains relevant, as in the case with forward-looking consumers: if offering data portability increases the rival's period-2 profit, the rival will compete less aggressively in period 1. However, myopic consumers do not take into account the effect of data portability on their period-2 payoffs, which explains the absence of the consumer net utility terms from the expression for $\widetilde{\Omega}^c$. This suggests that, as with our results from Sections 4 and 5, firms will be less willing to adopt data portability with myopic consumers than with forward-looking consumers, at least if we are in the somewhat standard situation where data portability increases second-period total surplus but decreases second-period joint profits.

Using the same linear example of differentiation as above for competition in period 2, we obtain that with myopic consumers, A offers data portability if and only if

$$v'_A \leq \frac{v_B + v'_B + \alpha_A - \alpha_B}{2}$$

and B offers data portability if and only if

$$v'_B \leq \frac{v_A + v'_A + \alpha_B - \alpha_A}{2}.$$

These two inequalities cannot be satisfied at the same time because $v'_A + v'_B > v_A + v_B$. Thus, the equilibrium in which both firms offer data portability does not exist. This contrasts with the case with forward-looking consumers, where there is a range of parameter values for which the equilibrium exists. However, more generally, for non-linear differentiation (i.e., non-linear F), it is possible to construct numerical counterexamples, where second-period joint profits are maximized by bilateral data portability, and firms could both want to offer data portability in equilibrium.

7 Managerial implications

We organize the managerial implications around four key questions.

7.1 When to offer data portability?

Our model provides some clear managerial guidance on when firms should adopt data portability. When launching a new product, firms should offer data portability if the consumers they target are forward-looking. This is particularly relevant for business customers, such as purchasers of B2B software, where decisions often involve substantial expenditures and relatively sophisticated decision-makers, such as procurement officers. By contrast, if consumers are myopic, meaning they do not take into account the future implications of their current choice of firm (e.g. the risk of lock-in as the product they purchase becomes increasingly customized to their needs), the implications may reverse. We find firms should not offer data portability when one firm has a clear advantage in the value it provides (both with and without data). In other settings with myopic consumers, a firm's optimal portability decision depends on additional conditions, as characterized in Section 5.

More generally, when facing forward-looking consumers, each firm should adopt data portability if doing so increases future total surplus (industry profit plus consumer surplus), whereas when facing myopic consumers, each firm should adopt data portability only if doing so increases future industry profit.

While our model is most relevant to firms introducing a new product and choosing whether to adopt data portability from the outset, firms may also want to consider implementing data portability despite already serving customers and holding their associated data. They must therefore decide how portability should apply to their existing user base. If firms can implement different portability regimes across consumers, they should offer data portability to new (forward-looking) consumers while withholding it from existing customers, provided that doing so does not undermine the credibility of the data portability offered to new consumers. One way to operationalize this approach, without explicitly discriminating across consumers, is to apply portability only to data collected after the introduction of the policy, so the policy is not applied retroactively. If instead firms must adopt a uniform portability regime across all consumers and all data types, firms should adopt data portability when the share of new (forward-looking) consumers is sufficiently large relative to locked-in consumers, and not adopt it otherwise.

7.2 How to commit to data portability?

Many firms already provide some form of limited data portability, which partly reflects existing regulation. The GDPR, for example, gives individuals a right to receive personal data they have provided to a firm in a structured, commonly used, machine-readable format within one month of the request. The more recent EU Data Act (2025) adds business-facing access and switching rights in specific contexts, including connected products and data processing services. Thus, inside Europe, the managerial question is not whether a firm should provide a minimal export function, but whether it should make a credible commitment to effective portability beyond baseline regulatory compliance. This might include offering a real-time API for immediate data transfer and providing configuration or customization metadata that goes beyond raw user-generated data.

Outside the EU, the regulatory baseline is more uneven. Many jurisdictions do not impose a general requirement to offer data portability to business users, and portability rights for individuals are usually limited to personal data, as is the case in California. But it is costly for global firms to maintain separate EU and non-EU portability regimes. Our results suggest that there can be strategic benefits for firms from offering data portability, especially when they serve business users. These benefits may tip the cost-benefit tradeoff in favor of standardizing on a more generous data portability offering globally.

For a firm to benefit from offering such data portability, it must announce the policy ex ante and stick to it. In reality, as in our model, firms have an incentive to promise portability, but then to renege ex post when consumers actually seek to switch. The key managerial question is how a firm can sufficiently raise its own cost of reneging to make the commitment believable.

Public disclosure of a portability policy can contribute to its credibility. Announcing the policy clearly on the firm's website, in user-facing documentation, and through marketing communications increases awareness and thus the reputational cost of reversal. Embedding portability within the firm's stated mission, for example, by emphasizing consumer control and ownership of data, can further elevate the reputational stakes. Firms may also join industry initiatives that standardize data transfer processes, such as the Data Transfer Initiative, founded by Apple, Google, Meta, and Microsoft. Participation in such initiatives typically requires firms to define the scope of transferable data and the mechanisms by which it can be accessed, which increases transparency. While membership does not legally prevent reversal, it can raise both the reputational and coordination costs of deviating from the stated commitment.

A stronger approach is contractual commitment. Firms can incorporate explicit data portability provisions into their user agreements, specifying the categories of data covered, the format of delivery, and any applicable timelines. Clear contractual language increases legal exposure if the firm later restricts portability. Indeed, firms could go further and try to lobby regulators to mandate data portability at the industry level. However, given the general tension highlighted by our analysis between firms' and consumers' interests regarding data portability, this strategy would only succeed if regulators do not appreciate the tradeoffs identified in this paper. Indeed, regulations that penalize firms for not following through on their data portability promises would help protect consumers from paying higher prices ex-ante for benefits that are not provided ex-post. However, such regulations may also have a negative indirect effect on forward-looking consumers by facilitating data portability commitments and thereby raising initial prices and reducing consumer surplus.

Finally, firms can create partial technological commitments. The weakest version is to provide EU users with downloadable files in widely used, machine-readable formats, such as JSON, CSV, or XML. This may amount to little more than baseline compliance where data portability regulation applies. A stronger commitment would be to make portability operationally useful and applicable globally, for example, by offering well-documented real-time APIs, recurring exports, or direct transfer tools that allow users anywhere to move data without relying on slow manual requests. Such measures do not make the commitment irreversible—APIs can be deprecated, formats changed, or access restricted—but they raise the engineering and reputational costs of withdrawal and make the portability promise more credible.

7.3 How to handle different types of data?

In principle, our model covers a spectrum of applications, depending on the source of the improvement in a firm's product for consumers. At one end of the spectrum are products whose improvement for each consumer is mainly driven by that consumer adding more and more data, and therefore making the product more useful to that consumer over time, even though the underlying product stays largely unchanged. Examples include B2B software products, such as Salesforce, whose customer-relationship management software can be customized to the workflows of business users. For such products, meaningful data portability requires more than a download of the business records stored in the system. Enterprise customers also need the structure that makes those records useful in another system: custom objects and fields, page layouts, reports, workflows, permissions, and other configuration metadata. Salesforce allows customers to export Salesforce data as CSV files, either manually or on a recurring schedule, and its Metadata API allows customization information, such as custom object definitions and page layouts, to be retrieved.[7] These tools go beyond mere regulatory compliance. Large enterprise customers are especially aware of lock-in risk and may require vendors to demonstrate that exit rights are operationally meaningful rather than merely contractual. In this sense, Salesforce's portability tools can be interpreted as a strategic commitment: by making both customer records and key configuration metadata

[7] See, for example, https://developer.salesforce.com/docs/atlas.en-us.api_meta.meta/api_meta/meta_intro.htm (accessed May 5, 2026).

exportable, the firm reduces the risk of the enterprise's data being stranded if it wants to switch, thereby making adoption more attractive ex ante.

At the other end of the spectrum are products that use data on an individual consumer to improve the product's performance for that individual over time, often through AI-driven personalization. Eight Sleep provides an example. Its smart bed dynamically adjusts mattress temperature throughout the night to optimize sleep. Over time, the system learns which temperature adjustments are most effective for a given user under varying physiological and environmental signals, including body movements, heart rate, respiratory rate, snoring, room temperature, and sleep stages. The more the product is used by the individual, the more data it collects to refine these adjustments.

For this type of product, meaningful data portability would require exporting the full data history, including both user data (e.g., sleep metrics, the underlying physiological and environmental inputs) and data generated by the firm (the corresponding sequence of temperature adjustments generated by its algorithm). This would go beyond the standard GDPR baseline by encompassing not just user-provided data, but also firm-generated outputs that may reflect proprietary optimization logic. While Eight Sleep allows users to view a broad set of sleep and environmental metrics through its app, it does not provide access to the algorithm's historical temperature adjustments, nor does it offer a simple mechanism for downloading comprehensive machine-readable datasets. Accordingly, although users can access substantial user-facing information (consistent with GDPR requirements), Eight Sleep has not committed to portability with respect to inferred data, which would be required to enable a rival to replicate individualized temperature optimization for a switching consumer.

In addition to not being required to provide inferred data under GDPR and not wanting to do so for strategic reasons (e.g., if consumers are mostly myopic with respect to the future competition implications), another reason firms such as Eight Sleep may be reluctant to apply data portability to such data is that providing access to the outputs generated by their proprietary algorithms may reveal information about their optimization processes, beyond what is strictly necessary to serve the switching user. A similar issue arises for AI-based services. For example, ChatGPT allows individual users to export their conversation history. In principle, a rival service could use that history to reconstruct conversational context and provide continuity for a switching user. However, detailed interaction logs may also contain information that facilitates broader model improvement or fine-tuning, potentially benefiting the rival beyond the individual user who ports the data.[8]

[8]For example, it is alleged that this is in part how DeepSeek was able to train its model at a fraction of the training cost of its U.S. rivals. See https://www.reuters.com/world/china/openai-accuses-deepseek-distilling-us-models-gain-advantage-bloomberg-news-2026-02-12/

For its large enterprise customers, OpenAI provides many additional tools that may be helpful if they switch model providers. For example, it allows workspace administrators to access, export, and audit a broad set of workspace data, including prompts, uploaded files, generated outputs, conversation history, shared workspace content, usage metadata, and workspace configuration information.[9] For U.S. enterprise customers, this is not simply a narrow GDPR-style right to receive personal data provided by the data subject. Customers can preserve a richer record of how employees have used the system, including outputs and configuration information that help sustain organizational workflows after switching.

More generally, the key managerial issue is the extent to which portability would require disclosing data that reflect the firm's own proprietary processes, rather than solely the user's contributions. When it is technically or economically difficult to separate user-specific data (needed to preserve service continuity) from firm-generated data (which may confer broader competitive advantages), firms should be more conservative in adopting data portability.

7.4 Should data portability be mandated?

Existing regulation in Europe already mandates some forms of data portability. The GDPR gives individuals portability rights over certain personal data, while the EU Data Act adds business-facing access and switching rules in specific contexts, including connected products and data processing services. From a global regulatory perspective, the question is whether EU-style regulations should be adopted elsewhere, and whether Europe should consider further strengthening or perhaps softening its existing regulations.

Our analysis implies that data portability mandates are most clearly worth considering when consumers are myopic. When consumers are forward-looking, firms may already have incentives to offer effective data portability voluntarily, and mandating portability can reduce consumer surplus by enabling firms to charge higher initial prices. Even with myopic consumers, however, the consumer welfare effects of a data portability mandate are ambiguous. As shown in our model, one case in which a portability requirement likely benefits consumers is when one firm is clearly ahead of its rival and offers value to its customers in excess of cost, even without access to user data.

A different and less drastic regulatory intervention is to police firms that promise to offer data portability but then renege. Such behavior is harmful because consumers end up paying more upfront but do not obtain the full promised benefits when actually attempting to port their data. As shown in our model, such bait-and-switch practices transfer surplus from consumers and rivals to the firm that engages in them, so policing them should be beneficial

[9]See OpenAI, "New compliance and administrative tools for ChatGPT Enterprise" (July 18, 2024), and OpenAI Help Center, "Data access for your managed ChatGPT account" (accessed May 13, 2026).

for consumers. At the same time, however, policing these practices may have a subtle negative effect: increasing the punishment firms incur when reneging on their data portability commitments makes it easier for firms to credibly commit to data portability, which may actually reduce consumer surplus when consumers are forward looking, as discussed earlier.

8 Concluding remarks

This paper shows that data portability has more subtle competitive and strategic implications than is often assumed. With forward-looking consumers, firms should commit to data portability when it separates the firm that is best placed to serve the consumer initially from the firm that can generate the greatest data-enabled surplus later. When the rival is the more efficient future user of the data, this intertemporal unbundling effect benefits the adopting firm by neutralizing the data advantage from winning the initial relationship. The rival no longer subsidizes consumers initially to try to obtain that advantage, and the adopting firm no longer needs to compensate forward-looking consumers for the lower continuation surplus they would otherwise expect if their data remained tied to the adopting firm. In this case, portability is privately attractive precisely when it raises future total surplus, although consumers may be worse off as a result.

With myopic consumers, by contrast, consumers ignore the future downside of having their data tied to the firm they initially choose, and so do not require compensation for the lock-in that non-portability creates. This weakens the firm's incentive to offer portability: because the firm can no longer charge consumers more for removing future data lock-in, voluntary portability is no longer necessarily profitable, even when it would be efficient.

The managerial and policy implications therefore diverge across markets. Firms have the strongest private reason to make portability operationally meaningful for users who take future switching options into account, such as large enterprise customers evaluating adoption and lock-in risk ex ante. By contrast, in markets dominated by individual consumers who are less likely to account for future portability benefits, firms may have weaker incentives to offer broad portability voluntarily beyond what regulation requires. This creates a natural rationale for focusing portability requirements on individual-consumer settings, as existing regulation largely does. However, our analysis also identifies cases in which mandated portability can reduce consumer surplus and may even undermine market participation.

Our analysis suggests several promising directions for future research. One would be to study the impact of data portability on firms' incentives to invest in improving their ability to extract value from customer data (e.g., via better algorithms). This becomes particularly interesting in the context of AI markets if data portability inherently carries some risk of leaking proprietary information to rival firms. Another important direction is to endogenize the credibility of portability commitments. In practice, firms may promise portability ex ante while degrading it ex post through cumbersome export processes, weakened APIs, incompatible formats, delayed transfers, or the withholding of important metadata. This raises the question of whether repeated interactions with successive cohorts of users could allow endogenous reputational concerns to substitute for regulatory enforcement of portability commitments.

9 Appendix

This appendix contains proofs not covered in the text. For brevity, we replace "data portability" with "DP" throughout the proofs.

9.1 Proof of Proposition 1

Here we complete the proof of Proposition 1 under the assumption $\min\{v_A, v_B\} \geq 0$. In Online Appendix D, we provide the more general proof that also covers the case where v_A and/or v_B can be negative. That proof is considerably longer and more complicated because the zero outside option may be binding in one or both periods. For the reader only interested in the case v_A and v_B are non-negative, there is no need to consider it.

In the main text, we have already proven that if B does not offer DP, then A weakly prefers to offer DP. And comparing (3) with (4), the preference is strict if and only if $v'_A < v'_B$ (which ensures $S^P > S(A)$) and $v_A > v_B$ (which ensures we do not have $\Pi_A^P = \Pi_A^{PB} = \delta\pi_A(B)$).

Suppose now B offers DP and A does not. Following the same logic as in the main text, A wins in period 1 if and only if

$$v_A + \delta S(A) \geq v_B + \delta S^P,$$

and A's total profit in this case is

$$\Pi_A^{PB} = \max\left\{v_A - v_B + \delta\left(S(A) - S^P\right), 0\right\} + \delta\pi_A^P.$$

Next, suppose both B and A offer DP. The same reasoning, replacing $S(A)$ with S^P implies that A's total profit when both firms have commited to data portability is

$$\Pi_A^P = \max\{v_A - v_B, 0\} + \delta\pi_A^P.$$

Comparing the two expressions Π_A^{PB} and Π_A^P, A prefers to offer DP when B does if and only if $S^P \geq S(A)$, which always holds, because

$$\begin{aligned} S^P &= u^P + \pi_A^P + \pi_B^P = \min\{v'_A, v'_B\} + \max\{v'_A - v'_B, 0\} + \max\{v'_B - v'_A, 0\} \\ &= \max\{v'_A, v'_B\} \geq \max\{v'_A, v_B\} = S(A). \end{aligned}$$

And the preference is strict (i.e., $\Pi_A^P > \Pi_A^{PB}$) if and only if $v'_A < v'_B$ (which ensures $S^P > S(A)$) and $v_A > v_B$ (which ensures we do not have $\Pi_A^P = \Pi_A^{PB} = \delta\pi_A^P$).

Finally, given symmetry in A and B, we can conclude that each firm weakly prefers to offer DP regardless of what the other does, strictly so whenever it has the advantage without the data but loses it when both firms have the data. Thus, provided there is a positive measure of consumers with $v_A > v_B$ and $v'_A < v'_B$ and a positive measure with $v_A < v_B$ and $v'_A > v'_B$, the unique equilibrium has both firms choosing to commit to DP.

9.2 Proof of Proposition 2

Using the same methodology and notation as in the baseline, the firms' respective profits with myopic consumers when neither has committed to DP are

$$\begin{aligned} \Pi_A &= \max\{v_A - v_B + \delta(\pi(A) - \pi(B)), 0\} + \delta\pi_A(B) \\ \Pi_B &= \max\{v_B - v_A + \delta(\pi(B) - \pi(A)), 0\} + \delta\pi_B(A) \end{aligned}$$

If firm A commits to DP but firm B does not, the firms' respective profits are

$$\begin{aligned} \Pi_A^{PA} &= \max\left\{v_A - v_B + \delta\left(\pi^P - \pi(B)\right), 0\right\} + \delta\pi_A(B) \\ \Pi_B^{PA} &= \max\left\{v_B - v_A + \delta\left(\pi(B) - \pi^P\right), 0\right\} + \delta\pi_B^P \end{aligned}$$

Conversely, if firm B commits to DP but firm A does not, the firms' respective profits are

$$\begin{aligned} \Pi_A^{PB} &= \max\left\{v_A - v_B + \delta\left(\pi(A) - \pi^P\right), 0\right\} + \delta\pi_A^P \\ \Pi_B^{PB} &= \max\left\{v_B - v_A + \delta\left(\pi^P - \pi(A)\right), 0\right\} + \delta\pi_B(A). \end{aligned}$$

Finally, if both firms commit to DP, then the firms' respective profits are

$$\begin{aligned} \Pi_A^P &= \max\{v_A - v_B, 0\} + \delta\pi_A^P \\ \Pi_B^P &= \max\{v_B - v_A, 0\} + \delta\pi_B^P \end{aligned}$$

Start with the case when firm A completely dominates firm B, i.e., $v_A \geq v'_B$. Then $\pi_B(B) = \pi_B(A) = \pi_B^P = 0$, $\pi_A(A) = v'_A - v_B > 0$, $\pi_A(B) = v_A - v'_B \geq 0$ and $\pi_A^P = v'_A - v'_B \geq 0$, so

$$\begin{aligned}\Pi_A &= \Pi_A^{PB} = v_A - v_B + \delta\left(v'_A - v_B\right) > \Pi_A^{PA} = \Pi_A^P = v_A - v_B + \delta\left(v'_A - v'_B\right) > 0 \\ \Pi_B &= \Pi_B^{PB} = \Pi_B^{PA} = \Pi_B^P = 0.\end{aligned}$$

Thus, firm A strictly prefers not to commit to DP in this case regardless of what firm B does. And firm B is indifferent between committing or not.

Symmetrically, if $v_B \geq v'_A$, then in equilibrium firm B does not commit to DP, whereas firm A is indifferent between committing or not.

From now on, we assume neither firm completely dominates, i.e., $v_A < v'_B$ and $v_B < v'_A$, so

$$\begin{aligned}\pi_A(A) &= v'_A - v_B \text{ and } \pi_B(B) = v'_B - v_A \\ \pi_B(A) &= \pi_A(B) = 0 \\ \pi_A^P &= \max\left\{v'_A - v'_B, 0\right\} \text{ and } \pi_B^P = \max\left\{v'_B - v'_A, 0\right\}.\end{aligned}$$

This implies

$$\begin{aligned}\Pi_A &= \max\left\{(1+\delta)v_A + \delta v'_A - (1+\delta)v_B - \delta v'_B, 0\right\} \\ \Pi_B &= \max\left\{(1+\delta)v_B + \delta v'_B - (1+\delta)v_A - \delta v'_A, 0\right\}.\end{aligned}$$

Thus, either $\Pi_A = 0$ or $\Pi_B = 0$.

Now suppose $v_A \geq v_B$ and $v'_A \geq v'_B$, with one strict inequality, so A is better than B both when neither firm has the data and when both have it. Then

$$\begin{aligned}\Pi_A &= (1+\delta)v_A + \delta v'_A - (1+\delta)v_B - \delta v'_B > 0 \\ \Pi_A^{PA} &= \max\left\{v_A - v_B + \delta\left(v'_A + v_A - 2v'_B\right), 0\right\} < \Pi_A\end{aligned}$$

$$\begin{aligned}\Pi_B &= 0 \\ \Pi_B^{PB} &= \max\left\{v_B - v_A + \delta\left(v_B - v'_B\right), 0\right\} = 0\end{aligned}$$

and

$$\begin{aligned}\Pi_A^{PB} &= v_A - v_B + \delta\left(v_A' - v_B\right) \\ \Pi_A^{P} &= v_A - v_B + \delta\left(v_A' - v_B'\right) < \Pi_A^{PB}.\end{aligned}$$

Thus, once again, firm A strictly prefers not to commit to DP regardless of what firm B does. And firm B is indifferent between committing or not.

Symmetrically, if $v_A \leq v_B$ and $v_A' \leq v_B'$, with one strict inequality, then B strictly prefers not committing to DP regardless of what firm A does, and A is indifferent between committing or not.

Suppose now A has the advantage without the data, whereas B has the advantage with the data, i.e., $v_A \geq v_B$ and $v_A' \leq v_B'$.

Consider first the possibility of an equilibrium in which neither firm commits to DP. This equilibrium exists iff $\Pi_A \geq \Pi_A^{PA}$ and $\Pi_B \geq \Pi_B^{PB}$. As pointed out above, either $\Pi_A = 0$ or $\Pi_B = 0$. Suppose we are in the case $\Pi_B = 0$, so

$$\Pi_A = (1+\delta)\, v_A + \delta v_A' - (1+\delta)\, v_B - \delta v_B' \geq 0. \tag{8}$$

Then $\Pi_A \geq \Pi_A^{PA}$ is equivalent to $\pi_A(A) + \pi_B(A) \geq \pi_A^P + \pi_B^P$, which, given $v_A' \leq v_B'$, is equivalent to

$$v_A' \geq \frac{v_B + v_B'}{2}. \tag{9}$$

Meanwhile, $\Pi_B \geq \Pi_B^{PB}$ is equivalent to $\Pi_B^{PB} = 0$, i.e.,

$$v_B - v_A + \delta\left(v_B' + v_B - 2v_A'\right) \leq 0,$$

which is implied by $v_A \geq v_B$ and (9).

Now suppose we are in the case $\Pi_A = 0$, so

$$\Pi_B = (1+\delta)\, v_B + \delta v_B' - (1+\delta)\, v_A - \delta v_A' \geq 0.$$

Then $\Pi_A \geq \Pi_A^{PA}$ is equivalent to $\Pi_A^{PA} = 0$, i.e.,

$$v_A - v_B + \delta\left(\pi^P - \pi(B)\right) \leq 0,$$

which in this case comes down to

$$v_A - v_B \leq \delta\left(v_A' - v_A\right).$$

Meanwhile, $\Pi_B \geq \Pi_B^{PB}$ is equivalent to $\pi(B) \geq \pi^P$, i.e.,

$$v'_B - v_A \geq v'_B - v'_A,$$

which is always true.

Thus, when $v_A \geq v_B$ and $v'_A \leq v'_B$, the equilibrium with neither firm committing to DP exists iff

$$(1+\delta)\, v_A + \delta v'_A - (1+\delta)\, v_B - \delta v'_B \geq 0$$
$$\text{and } v'_A \geq \frac{v_B + v'_B}{2}$$

or

$$(1+\delta)\, v_A + \delta v'_A - (1+\delta)\, v_B - \delta v'_B < 0$$
$$\text{and } v_A - v_B \leq \delta\, (v'_A - v_A)\,.$$

Next, consider the equilibrium with both firms committing to DP (still assuming $v_A \geq v_B$ and $v'_A \leq v'_B$). This equilibrium exists iff $\Pi_A^P \geq \Pi_A^{PB}$ and $\Pi_B^P \geq \Pi_B^{PA}$. We have $\Pi_A^P = v_A - v_B$ and $\Pi_B^P = \delta\,(v'_B - v'_A)$. So $\Pi_A^P \geq \Pi_A^{PB}$ is equivalent to $\pi(A) \leq \pi^P$, i.e.,

$$v'_A \leq \frac{v_B + v'_B}{2}.$$

And $\Pi_B^P \geq \Pi_B^{PA}$ is equivalent to

$$v_B - v_A + \delta\left(\pi(B) - \pi^P\right) \leq 0,$$

i.e.,

$$v_A - v_B \geq \delta\,(v'_A - v_A)\,.$$

Next, consider the equilibrium with firm A committing to DP and firm B not committing (still assuming $v_A \geq v_B$ and $v'_A \leq v'_B$). This equilibrium exists iff $\Pi_A^{PA} \geq \Pi_A$ and $\Pi_B^{PA} \geq \Pi_B^P$. From the analysis above, $\Pi_A^{PA} \geq \Pi_A$ iff

$$(1+\delta)\, v_A + \delta v'_A - (1+\delta)\, v_B - \delta v'_B > 0$$
$$\text{and } v'_A \leq \frac{v_B + v'_B}{2}$$

or

$$(1+\delta)\, v_A + \delta v'_A - (1+\delta)\, v_B - \delta v'_B \leq 0.$$

Meanwhile, $\Pi_B^{PA} \geq \Pi_B^P$ must hold because $v_A \geq v_B$ implies

$$\begin{aligned}
\Pi_B^P &= \delta \pi_B^P \\
&\leq \max\left\{v_B - v_A + \delta\left(\pi(B) - \pi^P\right), 0\right\} + \delta \pi_B^P \\
&= \Pi_B^{PA}.
\end{aligned}$$

Finally, consider the equilibrium with firm B committing to DP and firm A not committing (still assuming $v_A \geq v_B$ and $v_A' \leq v_B'$). This equilibrium exists iff $\Pi_A^{PB} \geq \Pi_A^P$ and $\Pi_B^{PB} \geq \Pi_B$. From the analysis above, $\Pi_A^{PB} \geq \Pi_A^P$ iff

$$v_A' \geq \frac{v_B + v_B'}{2}.$$

Meanwhile, also from the analysis above, $\Pi_B^{PB} \geq \Pi_B$ is equivalent to

$$(1+\delta) v_A + \delta v_A' - (1+\delta) v_B - \delta v_B' \geq 0$$

or

$$(1+\delta) v_A + \delta v_A' - (1+\delta) v_B - \delta v_B' < 0$$

and

$$v_B' - v_A \leq v_B' - v_A'.$$

Because the last inequality cannot hold when $v_A' > v_A$, the equilibrium with firm B committing to DP and firm A not committing exists iff

$$v_A' \geq \frac{v_B + v_B'}{2}$$

and

$$(1+\delta) v_A + \delta v_A' - (1+\delta) v_B - \delta v_B' \geq 0.$$

The characterization of the equilibria when $v_A \leq v_B$ and $v_A' \geq v_B'$ is obtained by symmetry in A and B.

9.3 Proof of Proposition 3

Suppose first A has the advantage over B, both without and with the data, i.e., $v_A \geq v_B$ and $v_A' \geq v_B'$. Then we know from Proposition 2 that in equilibrium, A does not offer DP and wins the consumer in both periods. Firm profits are

$$\begin{aligned}\Pi_A &= v_A - v_B + \delta\left(v'_A - v_B\right) - \delta \max\left\{v'_B - v_A, 0\right\} \\ \Pi_B &= 0.\end{aligned}$$

We can then infer equilibrium consumer surplus

$$CS = v_B + \delta \max\left\{v'_B - v_A, 0\right\} + \delta v_B.$$

If bilateral DP is imposed by policy, then firm A still wins in both periods, resulting in profits

$$\begin{aligned}\Pi_A^P &= v_A - v_B + \delta\left(v'_A - v'_B\right) \\ \Pi_B^P &= 0\end{aligned}$$

and consumer surplus

$$CS^P = v_B + \delta v'_B.$$

Clearly, $CS^P > CS$, so in this range of consumer configurations, DP clearly increases consumer surplus. The same holds when B has the advantage with and without the data, i.e., when $v_A \leq v_B$ and $v'_A \leq v'_B$.

Suppose now A has the advantage without the data and B has the advantage with the data, i.e., $v_A > v_B$ and $v'_A < v'_B$. We use the characterization of the various equilibria from Proposition 2 to compare equilibrium consumer surplus with the consumer surplus that would result if DP was imposed by policy. The latter is equal to

$$CS^P = v_B + \delta v'_A,$$

because under bilateral DP, A wins in period 1 and B wins in period 2.

If

$$(1+\delta)\, v_A + \delta v'_A \geq (1+\delta)\, v_B + \delta v'_B \text{ and } v'_A \geq \frac{v_B + v'_B}{2},$$

then there are two possible equilibria:

- If the prevailing equilibrium is the one with neither firm offering DP, then we have

$$\begin{aligned}\Pi_A &= (1+\delta)\, v_A + \delta v'_A - (1+\delta)\, v_B - \delta v'_B \geq 0 \\ \Pi_B &= 0,\end{aligned}$$

and therefore

$$CS = v_B + \delta\left(v'_B - v_A\right) + \delta v_B.$$

This implies that we have $CS^P \geq CS$ iff

$$v_A + v'_A \geq v_B + v'_B,$$

which is compatible with $(1+\delta)\, v_A + \delta v'_A \geq (1+\delta)\, v_B + \delta v'_B$ and $v'_A \geq \frac{v_B + v'_B}{2}$.

- If the prevailing equilibrium is the one where B offers DP but A does not, then we have

$$\begin{aligned} \Pi_A^{PB} &= v_A - v_B + \delta\left(2v'_A - v_B - v'_B\right) > 0 \\ \Pi_B^{PB} &= 0, \end{aligned}$$

and therefore

$$CS^{PB} = v_B + \delta\left(v'_B - v'_A\right) + \delta v_B.$$

And since $v'_A \geq \frac{v_B + v'_B}{2}$, we have $CS^P > CS^{PB}$.

If

$$(1+\delta)\, v_A + \delta v'_A \geq (1+\delta)\, v_B + \delta v'_B \text{ and } v'_A < \frac{v_B + v'_B}{2},$$

then we also have

$$v_A - v_B \geq \delta\left(v'_A - v_A\right)$$

and therefore there are two possible equilibria:

- If the prevailing equilibrium is the one with both firms offering DP, then the DP policy has no effect.

- If the prevailing equilibrium is the one where A offers DP but B does not, then we have

$$\begin{aligned} \Pi_A^{PA} &= v_A - v_B - \delta\left(v'_A - v_A\right) > 0 \\ \Pi_B^{PA} &= \delta\left(v'_B - v'_A\right), \end{aligned}$$

and therefore

$$\begin{aligned} CS^{PA} &= v_B + \delta\left(v'_A - v_A\right) + \delta v'_A \\ &> CS^P = v_B + \delta v'_A. \end{aligned}$$

If

$$(1+\delta)\,v_A+\delta v_A'<(1+\delta)\,v_B+\delta v_B' \text{ and } v_A-v_B<\delta\,(v_A'-v_A)\,,$$

then there are two possible equilibria:

- If the prevailing equilibrium is the one with neither firm offering DP, then we have

  $$\begin{aligned}\Pi_A &= 0\\ \Pi_B &= (1+\delta)\,v_B+\delta v_B'-(1+\delta)\,v_A-\delta v_A',\end{aligned}$$

  and therefore

  $$CS=v_A+\delta\,(v_A'-v_B)+\delta v_A.$$

  In this case, we have $CS^P<CS$ because $v_A>v_B$.

- If the prevailing equilibrium is the one where A offers DP and B does not, then we have

  $$\begin{aligned}\Pi_A^{PA} &= 0\\ \Pi_B^{PA} &= v_B-v_A+\delta\,(v_B'-v_A)\,,\end{aligned}$$

so

$$CS^{PA}=v_A+\delta v_A<CS^P,$$

because $v_A-v_B<\delta\,(v_A'-v_A)$.

Finally, if

$$(1+\delta)\,v_A+\delta v_A'<(1+\delta)\,v_B+\delta v_B' \text{ and } v_A-v_B\geq\delta\,(v_A'-v_A)\,,$$

then we also have

$$v_A'<\frac{v_B+v_B'}{2},$$

so there are two possible equilibria:

- If the prevailing equilibrium is the one with both firms offering DP, then the DP policy has no effect.

- If the prevailing equilibrium is the one where A offers DP and B does not, then we know from above

  $$CS^{PA}<CS^P.$$

9.4 Proof of Lemma 1

Recall that when neither firm offers DP, the firms simultaneously solve

$$\begin{aligned}\Pi_A &= \max_{p_A}\left\{\left(p_A - c + \delta\left(\pi_A\left(A\right) - \pi_A\left(B\right)\right)\right)s_A + \delta\pi_A\left(B\right)\right\}\\ \Pi_B &= \max_{p_B}\left\{\left(p_B - c + \delta\left(\pi_B\left(B\right) - \pi_B\left(A\right)\right)\right)\left(1 - s_A\right) + \delta\pi_B\left(A\right)\right\},\end{aligned}$$

where

$$s_A = F\left(\frac{v_A - v_B + \alpha_B + p_B - p_A + \delta\left(u\left(A\right) - u\left(B\right)\right)}{\alpha_A + \alpha_B}\right).$$

Let

$$\begin{aligned}q_A &\equiv p_A - c + \delta\left(\pi_A\left(A\right) - \pi_A\left(B\right)\right)\\ q_B &\equiv p_B - c + \delta\left(\pi_B\left(B\right) - \pi_B\left(A\right)\right).\end{aligned}$$

Then firm A's market share can be rewritten

$$s_A = G\left(\Omega + q_B - q_A\right),$$

where

$$\Omega \equiv v_A - v_B + \delta\left(S\left(A\right) - S\left(B\right)\right)$$

and

$$G\left(x\right) = F\left(\frac{x + \alpha_B}{\alpha_A + \alpha_B}\right).$$

Then the two firms' discounted profits (Π_A, Π_B) in period 1 are the solution to the following simultaneous optimization game

$$\begin{aligned}\Pi_A &= \max_{q_A}\left\{q_A G\left(\Omega + q_B - q_A\right) + \delta\pi_A\left(B\right)\right\}\\ \Pi_B &= \max_{q_B}\left\{q_B\left(1 - G\left(\Omega + q_B - q_A\right)\right) + \delta\pi_B\left(A\right)\right\}.\end{aligned}$$

Since $G(.)$ and $1 - G(.)$ are log-concave (by inheriting those properties from $F(.)$ and $1-F(.)$), standard results from Bertrand models of imperfect competition where we interpret q_A and q_B as the prices set by two competing firms (see Caplin–Nalebuff, 1991, and Vives, 1999) imply there exists a unique stable equilibrium (q_A^*, q_B^*), with pass-through rates that are between 0 and 1 in magnitude. The envelope theorem then implies

$$\begin{aligned}\frac{d\Pi_A}{d\Omega} &= q_A^* \left(1 + \frac{dq_B^*}{d\Omega}\right) g\left(\Omega + q_B^* - q_A^*\right) > 0 \\ \frac{d\Pi_B}{d\Omega} &= -q_B^* \left(1 - \frac{dq_A^*}{d\Omega}\right) g\left(\Omega + q_B^* - q_A^*\right) < 0.\end{aligned}$$

10 References

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Online Appendix

Andrei Hagiu[1] and Julian Wright[2]

A Uncertainty about second-period values

We extend our baseline model with forward-looking consumers by assuming there is uncertainty about the two firms' net values in the second period (with data). Specifically, suppose that from the perspective of period 1, v'_A is distributed with c.d.f. $F_A(.)$ and v'_B is distributed with c.d.f. $F_B(.)$. Their realizations only become known in period 2.

Start with the case without data portability. Following the analysis from the baseline, firm A wins in period 1 iff

$$v_A - p_A + \delta E[u(A)] \geq v_B - p_B + \delta E[u(B)],$$

where

$$\begin{aligned} E[u(A)] &= E[\min\{v'_A, v_B\}] \\ E[u(B)] &= E[\min\{v_A, v'_B\}]. \end{aligned}$$

The maximum subsidy (i.e., price below cost) that firm i is willing to offer the consumer in period 1 in order to win is

$$\begin{aligned} p_i - c &= \delta(E[\pi_i(j)] - E[\pi_i(i)]) \\ &= \delta\left(E\left[\max\left\{v_i - v'_j, 0\right\}\right] - E[\max\{v'_i - v_j, 0\}]\right), \end{aligned}$$

where $i \neq j \in \{A, B\}$.

Thus, A wins in period 1 iff

$$v_A + \delta E[S(A)] \geq v_B + \delta E[S(B)],$$

where recall

$$\begin{aligned} S(A) &= \pi_A(A) + \pi_B(A) + u(A) = \max\{v'_A, v_B\} \\ S(B) &= \max\{v_A, v'_B\}. \end{aligned}$$

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Thus, A's total profits are

$$\max\left\{v_A - v_B + \delta E\left[S\left(A\right) - S\left(B\right)\right], 0\right\} + \delta E\left[\pi_A\left(B\right)\right].$$

By the same logic, A's profits when it offers data portability and B does not are

$$\max\left\{v_A - v_B + \delta E\left[S^P - S\left(B\right)\right], 0\right\} + \delta E\left[\pi_A\left(B\right)\right].$$

Similarly, A's total profits when it does not offer data portability and B does is

$$\max\left\{v_A - v_B + \delta E\left[S\left(A\right) - S^P\right], 0\right\} + \delta E\left[\pi_A^P\right].$$

And A's profits when it offers data portability and B does are

$$\max\left\{v_A - v_B + \delta E\left[S^P - S^P\right], 0\right\} + \delta E\left[\pi_A^P\right].$$

Thus, regardless of whether B offers data portability or not, A prefers to commit to data portability iff

$$E\left[S^P\right] \geq E\left[S\left(A\right)\right],$$

which is equivalent to

$$E\left[\max\left\{v'_A, v'_B\right\}\right] \geq E\left[\max\left\{v'_A, v_B\right\}\right].$$

Similarly, B prefers to commit to data portability iff

$$E\left[\max\left\{v'_A, v'_B\right\}\right] \geq E\left[\max\left\{v_A, v'_B\right\}\right].$$

Note that, under independence of the draws v'_A and v'_B, simple sufficient conditions for these inequalities to hold are $E\left[v'_B\right] \geq v_B$ and $E\left[v'_A\right] \geq v_A$.

B Non-negative price constraint

In this section, we assume $\min\{v_A, v_B\} \geq 0$ and impose a non-negative price constraint on both firms. First, we show that each firm still weakly prefer to commit to data portability regardless of what the other firm does, and strictly so when the advantage switches with data and an additional condition is satisfied. Second, we also show that now bilateral data portability can increase consumer surplus (unlike in the baseline).

B.1 Equilibrium analysis

Suppose first $v'_A > v_A > v'_B > v_B$. The price constraint does not bind because firm A always wins both periods and firm B is never willing to subsidize. Thus, nothing changes in this case relative to the baseline analysis. Both A and B are still indifferent about offering data portability. By symmetry, the same is true when $v'_B > v_B > v'_A > v_A$.

Next, suppose $v'_A > v'_B > v_A > v_B$. Without data portability, the unconstrained minimum period-1 prices the two firms are willing to offer are

$$\begin{aligned} p_A^m &= c + \delta\left(\pi_A(B) - \pi_A(A)\right) = c - \delta\left(v'_A - v_B\right) \\ p_B^m &= c + \delta\left(\pi_B(A) - \pi_B(B)\right) = c - \delta\left(v'_B - v_A\right). \end{aligned}$$

Since $v'_A - v_B > v'_B - v_A$, there are only two cases in which the constraint binds. Either (i) $\delta\left(v'_A - v_B\right) > c > \delta\left(v'_B - v_A\right)$, so $p_A^m = 0$ and $p_B^m = c - \delta\left(v'_B - v_A\right) > 0$ or (ii) $\delta\left(v'_A - v_B\right) > \delta\left(v'_B - v_A\right) \geq c$, so $p_A^m = p_B^m = 0$. Combining the two cases, if the constraint binds, then

$$\begin{aligned} p_A^m &= 0 \\ p_B^m &= \max\left\{c - \delta\left(v'_B - v_A\right), 0\right\}. \end{aligned}$$

Recall that firm A wins iff

$$v_A - p_A^m + \delta u(A) \geq v_B - p_B^m + \delta u(B),$$

which, when the constraint binds, is equivalent to

$$(1-\delta)\left(v_A - v_B\right) + p_B^m \geq 0.$$

This is always true because $v_A > v_B$ and $p_B^m \geq 0$. Thus, A will always win. The period-1 prices are then

$$\begin{aligned} p_B &= p_B^m \\ p_A &= v_A - v_B + p_B^m + \delta\left(u(A) - u(B)\right) = (1-\delta)\left(v_A - v_B\right) + p_B^m > 0, \end{aligned}$$

so A's discounted sum of profits across the two periods is

$$\begin{aligned} \Pi_A &= p_A - c + \delta\pi_A(A) \\ &= (1-\delta)\left(v_A - v_B\right) + p_B^m - c + \delta\left(v'_A - v_B\right) \\ &= (1-\delta)\left(v_A - v_B\right) + \max\left\{c - \delta\left(v'_B - v_A\right), 0\right\} - c + \delta\left(v'_A - v_B\right). \end{aligned}$$

Firm B makes zero profits.

Now suppose A offers data portability. The unconstrained minimum period-1 prices the two firms are willing to offer are

$$\begin{aligned} p_A^m &= c + \delta\left(\pi_A(B) - \pi_A^P\right) = c - \delta\left(v_A' - v_B'\right) \\ p_B^m &= c + \delta\left(\pi_B^P - \pi_B(B)\right) = c - \delta\left(v_B' - v_A\right). \end{aligned}$$

Recall case (i) arises when $\delta(v_A' - v_B) > c > \delta(v_B' - v_A)$. In this case, $p_A^m = \max\{c - \delta(v_A' - v_B'), 0\}$ and $p_B^m = c - \delta(v_B' - v_A) > 0$, while in case (ii) we have $\delta(v_B' - v_A) \geq c$, so $p_A^m = \max\{c - \delta(v_A' - v_B'), 0\}$ and $p_B^m = 0$. Firm A always wins period 2 regardless of who wins in period 1, because $v_A' > v_B'$. And firm A also wins period 1 iff

$$v_A - p_A^m + \delta u^P \geq v_B - p_B^m + \delta u(B).$$

In case (i), this becomes

$$v_A - \max\{c - \delta(v_A' - v_B'), 0\} + \delta v_B' \geq v_B - (c - \delta(v_B' - v_A)) + \delta v_A.$$

Even if $c - \delta(v_A' - v_B') \geq 0$, this inequality holds, so A always wins in case (i).

In case (ii), firm A wins period 1 iff

$$v_A - \max\{c - \delta(v_A' - v_B'), 0\} + \delta v_B' \geq v_B + \delta v_A.$$

Even if $c - \delta(v_A' - v_B') \geq 0$, this inequality holds (because the inequality for case (ii) $\delta(v_B' - v_A) \geq c$ implies $\delta(v_A' - v_A) \geq c$), so again A always wins in case (ii).

In case (i), the first-period prices are

$$\begin{aligned} p_B &= p_B^m = c - \delta(v_B' - v_A) \\ p_A &= v_A - v_B + p_B^m + \delta\left(u^P - u(B)\right) = v_A - v_B + c - \delta(v_B' - v_A) + \delta(v_B' - v_A) = c + v_A - v_B > 0, \end{aligned}$$

so A's discounted sum of profits across the two periods is

$$\Pi_A^P = p_A - c + \delta\pi_A^P = v_A - v_B + \delta(v_A' - v_B'),$$

which is identical to its profit in the case without data portability. Thus, firm A is indifferent about adopting data portability.

In case (ii), the first-period prices are

$$\begin{aligned} p_B &= p_B^m = 0 \\ p_A &= v_A - v_B + p_B^m + \delta\left(u^P - u(B)\right) = v_A - v_B + \delta\left(v_B' - v_A\right), \end{aligned}$$

so

$$\begin{aligned} \Pi_A^P &= p_A - c + \delta \pi_A^P \\ &= v_A - v_B + \delta\left(v_B' - v_A\right) - c + \delta\left(v_A' - v_B'\right) \\ &= v_A - v_B + \delta\left(v_A' - v_A\right) - c, \end{aligned}$$

which is also identical to the case without data portability. Firm B's profits are also identical and equal to zero.

Thus, firm A is indifferent about adopting data portability in this case. A similar analysis establishes that A is also indifferent about adopting data portability if B already offers it. And B is indifferent about adopting data portability regardless of what A does, because B earns zero profits in all scenarios. By symmetry in A and B, the same conclusion holds when $v_B' > v_A' > v_B > v_A$.

Next, suppose $v_B' > v_A' > v_A > v_B$. Without data portability, the unconstrained minimum period-1 prices the two firms are willing to offer are

$$\begin{aligned} p_A^m &= c + \delta\left(\pi_A(B) - \pi_A(A)\right) = c - \delta\left(v_A' - v_B\right) \\ p_B^m &= c + \delta\left(\pi_B(A) - \pi_B(B)\right) = c - \delta\left(v_B' - v_A\right). \end{aligned}$$

There are three cases where the non-negative price constraint binds: (i) $\delta\left(v_A' - v_B\right) > c > \delta\left(v_B' - v_A\right)$, so $p_A^m = 0$ and $p_B^m = c - \delta\left(v_B' - v_A\right) > 0$; (ii) $\delta\left(v_A' - v_B\right) \geq c$ and $\delta\left(v_B' - v_A\right) \geq c$, so $p_A^m = p_B^m = 0$; and (iii) $\delta\left(v_B' - v_A\right) > c > \delta\left(v_A' - v_B\right)$, so $p_A^m = c - \delta\left(v_A' - v_B\right) > 0$ and $p_B^m = 0$.

Cases (i) and (ii) lead to the same analysis as before, so A always wins in both cases and its profits are

$$\Pi_A = (1-\delta)\left(v_A - v_B\right) + \max\left\{c - \delta\left(v_B' - v_A\right), 0\right\} - c + \delta\left(v_A' - v_B\right).$$

Now consider case (iii). Firm A wins iff

$$v_A - p_A^m + \delta u(A) \geq v_B - p_B^m + \delta u(B),$$

which is equivalent to

$$(1-\delta)\, v_A + \delta v_A' \geq c + v_B.$$

If $(1-\delta) v_A + \delta v'_A \geq c + v_B$ then A wins, $p_B = 0$, $p_A = (1-\delta)(v_A - v_B)$, and

$$\begin{aligned}\Pi_A &= p_A - c + \delta \pi_A (A) = (1-\delta)(v_A - v_B) - c + \delta (v'_A - v_B) \\ &= (1-\delta) v_A - v_B - c + \delta v'_A.\end{aligned}$$

Otherwise, A's profit in both periods is zero. Combining the two cases, A's discounted sum of profits across the two periods is

$$\Pi_A = \max\{(1-\delta) v_A - v_B - c + \delta v'_A, 0\}.$$

Now suppose A offers data portability. The unconstrained minimum period-1 prices the two firms are willing to offer are

$$\begin{aligned}p_A^m &= c + \delta\left(\pi_A(B) - \pi_A^P\right) = c > 0 \\ p_B^m &= c + \delta\left(\pi_B^P - \pi_B(B)\right) = c + \delta\left(v'_B - v'_A - (v'_B - v_A)\right) = c - \delta\left(v'_A - v_A\right).\end{aligned}$$

Recall the three cases above in which the non-negative price constraint can bind:

- (i) $\delta(v'_A - v_B) > c > \delta(v'_B - v_A)$, so $p_B^m = c - \delta(v'_A - v_A) > 0$;
- (ii) $\delta(v'_A - v_B) \geq c$ and $\delta(v'_B - v_A) \geq c$, so $p_B^m = c - \delta(v'_A - v_A)$ is either positive or negative; and
- (iii) $\delta(v'_B - v_A) > c > \delta(v'_A - v_B)$, so $p_B^m = c - \delta(v'_A - v_A) > 0$.

Firm A wins period 1 iff $v_A - p_A^m + \delta u^P \geq v_B - \max\{p_B^m, 0\} + \delta u(B)$. If $p_B^m = c - \delta(v'_A - v_A) > 0$, this becomes

$$v_A - c + \delta v'_A \geq v_B - c + \delta(v'_A - v_A) + \delta v_A,$$

which is clearly true because $v_A > v_B$. And if $p_B^m = c - \delta(v'_A - v_A) \leq 0$, the condition for A to win becomes

$$v_A - c + \delta v'_A \geq v_B + \delta v_A,$$

which also holds because in this case $c \leq \delta(v'_A - v_A)$.

Thus, in all cases, A wins in period 1, consistent with the baseline analysis without the non-negative price constraint. And B always wins in period 2 due to data portability and $v'_B > v'_A$ in this region. So A's profits are

$$\Pi_A^{PA} = p_A - c = (1-\delta) v_A - v_B - c + \delta v'_A + \max\{c - \delta(v'_A - v_A), 0\},$$

which are positive and clearly weakly higher than profits without data portability,

$$\Pi_A = \max\left\{(1-\delta)\,v_A - v_B - c + \delta v'_A, 0\right\}.$$

A is indifferent if and only if $c \leq \delta\left(v'_A - v_A\right)$, otherwise A's preference for data portability is strict.

Meanwhile, B's profits when only A offers data portability are simply

$$\Pi_B^{PA} = \delta\left(v'_B - v'_A\right).$$

If both firms offer data portability, then neither firm is willing to subsidize in period 1, A wins period 1 and B wins period 2, leading to profits

$$\begin{aligned}\Pi_A^P &= v_A - v_B \\ \Pi_B^P &= \delta\left(v'_B - v'_A\right).\end{aligned}$$

This means that starting from a situation in which only A offers data portability, B is indifferent between offering it and not.

Finally, suppose only B has committed to data portability. The unconstrained minimum period-1 prices the two firms are willing to offer are

$$\begin{aligned}p_A^m &= c + \delta\left(\pi_A^P - \pi_A(A)\right) = c - \delta\left(v'_A - v_B\right) \\ p_B^m &= c + \delta\left(\pi_B(A) - \pi_B^P\right) = c - \delta\left(v'_B - v'_A\right).\end{aligned}$$

There are three cases where the non-negative price constraint binds: (i) $\delta\left(v'_A - v_B\right) > c > \delta\left(v'_B - v'_A\right)$, so $p_A^m = 0$ and $p_B^m = c - \delta\left(v'_B - v'_A\right) > 0$; (ii) $\delta\left(v'_A - v_B\right) \geq c$ and $\delta\left(v'_B - v'_A\right) \geq c$, so $p_A^m = p_B^m = 0$; and (iii) $\delta\left(v'_B - v'_A\right) > c > \delta\left(v'_A - v_B\right)$, so $p_A^m = c - \delta\left(v'_A - v_B\right) > 0$ and $p_B^m = 0$.

Firm A wins both periods iff

$$v_A - p_A^m + \delta u(A) \geq v_B - p_B^m + \delta u^P.$$

In case (i), this is equivalent to

$$v_A - v_B - \delta\left(v'_B - v_B\right) + c \geq 0.$$

If this holds, A's profits are

$$\Pi_A^{PB} = v_A - v_B - \delta\left(v'_B - v'_A\right).$$

Otherwise, A makes zero profits in case (i). In case (ii), the condition for A to win becomes

$$v_A + \delta v_B \geq v_B + \delta v'_A.$$

If it holds, then A's profits are

$$\Pi_A^{PB} = v_A - v_B - c.$$

Otherwise, A makes zero profits in case (ii). In case (iii), the condition for A to win becomes

$$v_A - v_B \geq c.$$

If it holds, then A's profits are

$$\Pi_A^{PB} = v_A - v_B - c.$$

Otherwise, A makes zero profits in case (iii).

Now suppose A offers data portability as well, in which case we already know that A's profits are simply

$$\Pi_A^{P} = v_A - v_B.$$

It follows that $\Pi_A^P > \Pi_A^{PB}$ in all cases provided $c > 0$.

In summary, A weakly prefers to offer data portability regardless of what B does and vice versa for B, with strict preference for some consumer configurations. This implies it is an equilibrium for both firms offer data portability. By symmetry in A and B, the same conclusion holds when $v'_A > v'_B > v_B > v_A$.

In conclusion, as in the baseline analysis, each firm weakly prefers to commit to data portability regardless of what the other firm does. The difference is that the preference is strict on a smaller range of consumer configurations than in the baseline without a non-negative price constraint.

B.2 Consumers could be better off

We now compare consumer surplus when data portability is ruled out with consumer surplus when both firms adopt data portability. In the baseline analysis without the non-negative price constraint, bilateral data portability makes consumers weakly worse off (sometimes strictly). With the non-negative price constraint, this conclusion no longer necessarily holds. The reason is that without data portability, the firm with the weaker initial product may be unable to offer a sufficiently low first-period price which passes on to the consumer the value it could generate in the future. In this case, data portability might make consumers better off.

To see this most simply, suppose

$$v'_A > v'_B > v_A > v_B.$$

In this case, A has the advantage both initially and with data. If both firms offer data portability, A wins in period 1 and also wins in period 2, but B has access to the consumer's data in period 2. In period 2, A therefore wins and the consumer obtains the net value offered by B, namely v'_B. Consumer surplus under bilateral data portability is

$$CS^P = v_B + \delta v'_B.$$

Now suppose data portability is ruled out. If A wins in period 1, then A wins in period 2 and the consumer obtains $u(A) = v_B$ in period 2. If B wins in period 1, then B wins in period 2 and the consumer obtains $u(B) = v_A$ in period 2. The incremental period-2 profit from winning rather than losing for B is therefore $v'_B - v_A$. Hence B's constrained minimum price in period 1 is

$$p_B^m = \max \{0, c - \delta (v'_B - v_A)\}.$$

At this price, the maximum utility B can offer the consumer is

$$v_B + c - p_B^m + \delta v_A = v_B + \delta v_A + \min \{c, \delta (v'_B - v_A)\}.$$

Since A wins both periods, it sets its period-1 price so that the consumer is just willing to choose A rather than B. Thus consumer surplus without data portability is

$$CS = v_B + \delta v_A + \min \{c, \delta (v'_B - v_A)\}.$$

It follows that

$$CS^P - CS = \delta (v'_B - v_A) - \min \{c, \delta (v'_B - v_A)\}.$$

Thus, bilateral data portability weakly increases consumer surplus in this case, and does so strictly whenever

$$c < \delta (v'_B - v_A).$$

The intuition is that without data portability, B would like to compensate the consumer for the future value it could create if it won in period 1. But if the required subsidy would involve a negative price, the non-negative price constraint prevents B from fully doing so. Bilateral data portability still improves B's period-2 competitive offering, so consumers can be better off.

The same possibility can arise in the intertemporal unbundling case

$$v'_B > v'_A > v_A > v_B.$$

If both firms offer data portability, A wins in period 1 and B wins in period 2. Neither firm has any reason to subsidize, so A sets its period 1 price equal to $v_A - v_B$, and B sets its period 2 price equal to $v'_B - v'_A$, leading to consumer surplus under bilateral data portability

$$CS^P = v_B + \delta v'_A.$$

Now suppose data portability is ruled out. A's constrained minimum price in period 1 is

$$p_A^m = \max\left\{0, c - \delta\left(v'_A - v_B\right)\right\}.$$

At this price, the maximum utility A can offer the consumer is

$$v_A + c - p_A^m + \delta v_B = v_A + \delta v_B + \min\left\{c, \delta\left(v'_A - v_B\right)\right\}$$

Similarly, the maximum utility B can offer the consumer is

$$v_B + \delta v_A + \min\left\{c, \delta\left(v'_B - v_A\right)\right\}.$$

The consumer obtains the lower of the two maximum utility offers, so

$$CS = \min\left\{v_A + \delta v_B + \min\left\{c, \delta\left(v'_A - v_B\right)\right\}, v_B + \delta v_A + \min\left\{c, \delta\left(v'_B - v_A\right)\right\}\right\}.$$

A simple sufficient condition for bilateral data portability to raise consumer surplus is then

$$c < \delta\left(v'_A - v_A\right).$$

To see this, note that the maximum utility B can offer without data portability is no greater than $v_B + \delta v_A + c$, and $c < \delta(v'_A - v_A)$ implies

$$v_B + \delta v_A + c < v_B + \delta v'_A = CS^P.$$

Since CS is no greater than B's maximum utility offer, it follows that $CS^P > CS$. Thus, once negative prices are ruled out, bilateral data portability can make forward-looking consumers better off relative to a regime in which data portability is unavailable.

C Non-personalized pricing example

Recall that we assume a consumer x who bought from A in period 1 is willing to pay $v'_A - \alpha_A x$ for firm A in period 2 and $\widetilde{v}_B - \alpha_B(1-x)$ for firm B, where $\widetilde{v}_B = v'_B$ if A has chosen data portability, and $\widetilde{v}_B = v_B$ if not. Similarly, a consumer who bought from B in period 1 is willing to pay $v'_B - \alpha_B(1-x)$ for firm B in period 2 and $\widetilde{v}_A - \alpha_A x$ for firm A, where $\widetilde{v}_A = v'_A$ if B has chosen data portability, and $\widetilde{v}_A = v_A$ if not. And we assume x is drawn from the uniform distribution over $[0,1]$ independently of which firm the consumer bought from in period 1.

Start with those consumers who bought from A in period 1 in the case A does not offer data portability, and normalize their total measure to one. Then period-2 demand for firm A from these consumers is

$$\frac{v'_A - v_B + \alpha_B + p_B - p_A}{\alpha_A + \alpha_B},$$

so the period-2 profits for the two firms from these consumers are

$$\begin{aligned}
\pi_A(A) &= \max_{p_A}\left\{(p_A - c)\frac{v'_A - v_B + \alpha_B + p_B - p_A}{\alpha_A + \alpha_B}\right\} \\
\pi_B(A) &= \max_{p_B}\left\{(p_B - c)\left(1 - \frac{v'_A - v_B + \alpha_B + p_B - p_A}{\alpha_A + \alpha_B}\right)\right\}.
\end{aligned}$$

Straightforward calculations lead to

$$\pi_A(A) = \pi_A(v'_A, v_B),\ \pi_B(A) = \pi_B(v'_A, v_B) \text{ and } u(A) = u(v'_A, v_B),$$

where

$$\begin{aligned}
\pi_A(\widetilde{v}_A, \widetilde{v}_B) &= \frac{(\alpha_A + 2\alpha_B + \widetilde{v}_A - \widetilde{v}_B)^2}{9(\alpha_A + \alpha_B)} \\
\pi_B(\widetilde{v}_A, \widetilde{v}_B) &= \frac{(2\alpha_A + \alpha_B - \widetilde{v}_A + \widetilde{v}_B)^2}{9(\alpha_A + \alpha_B)} \\
u(\widetilde{v}_A, \widetilde{v}_B) &= \frac{\widetilde{v}_A + \widetilde{v}_B}{2} - \frac{5}{8}(\alpha_A + \alpha_B) + \frac{(2(\widetilde{v}_A - \widetilde{v}_B) - (\alpha_A - \alpha_B))^2}{72(\alpha_A + \alpha_B)}.
\end{aligned}$$

Similarly,

$$\begin{aligned}
\pi_A(B) &= \pi_A(v_A, v'_B),\ \pi_B(B) = \pi_B(v_A, v'_B) \text{ and } u(B) = u(v_A, v'_B) \\
\pi_A^P &= \pi_A(v'_A, v'_B),\ \pi_B^P = \pi_B(v'_A, v'_B) \text{ and } u^P = u(v'_A, v'_B).
\end{aligned}$$

To ensure all of the relevant solutions are interior so that these expressions are valid, we need to assume

$$-\alpha_A - 2\alpha_B < v_A - v'_B < v'_A - v_B < 2\alpha_A + \alpha_B,$$

which also implies

$$-\alpha_A - 2\alpha_B < v'_A - v'_B < 2\alpha_A + \alpha_B.$$

With forward-looking consumers, we are interested in total surplus. We have

$$\begin{aligned} S(\widetilde{v}_A, \widetilde{v}_B) &\equiv \pi_A(\widetilde{v}_A, \widetilde{v}_B) + \pi_B(\widetilde{v}_A, \widetilde{v}_B) + u(\widetilde{v}_A, \widetilde{v}_B) \\ &= \frac{\widetilde{v}_A + \widetilde{v}_B}{2} - \frac{1}{8}(\alpha_A + \alpha_B) + \frac{5\left(2(\widetilde{v}_A - \widetilde{v}_B) - (\alpha_A - \alpha_B)\right)^2}{72(\alpha_A + \alpha_B)}. \end{aligned}$$

So A wants to offer data portability iff $S(v'_A, v'_B) > S(v'_A, v_B)$.

We have

$$\frac{\partial S(v'_A, v_B)}{\partial v_B} = \frac{1}{2} - \frac{5\left(2(v'_A - v_B) - (\alpha_A - \alpha_B)\right)}{18(\alpha_A + \alpha_B)},$$

so $\frac{\partial S(v'_A, v_B)}{\partial v_B}$ is increasing in v_B and $\frac{\partial S(v'_A, v_B)}{\partial v_B} \geq 0$ is equivalent to

$$v'_A - v_B \leq \frac{7\alpha_A + 2\alpha_B}{5}.$$

Thus, if $v'_A - v_B \leq \frac{7\alpha_A + 2\alpha_B}{5}$, then $S(v'_A, v)$ is increasing in v for $v_B \leq v \leq v'_B$, so $S(v'_A, v'_B) > S(v'_A, v_B)$.

If on the other hand

$$\frac{7\alpha_A + 2\alpha_B}{5} < v'_A - v'_B < v'_A - v_B < 2\alpha_A + \alpha_B,$$

then $S(v'_A, v)$ is decreasing in v for $v_B \leq v \leq v'_B$, so $S(v'_A, v'_B) < S(v'_A, v_B)$.

With myopic consumers, we are interested in joint profits, and it is straightforward to verify that

$$\pi_A(v'_A, v'_B) + \pi_B(v'_A, v'_B) > \pi_A(v'_A, v_B) + \pi_B(v'_A, v_B)$$

is equivalent to

$$v'_A < \frac{v_B + v'_B + \alpha_A - \alpha_B}{2}.$$

And

$$\pi_A(v'_A, v'_B) + \pi_B(v'_A, v'_B) > \pi_A(v_A, v'_B) + \pi_B(v_A, v'_B)$$

is equivalent to

$$v'_B < \frac{v_A + v'_A + \alpha_B - \alpha_A}{2}.$$

D General proof of Proposition 1

Here we provide a more general proof of Proposition 1, covering the possibility that v_A and/or v_B are negative.

Specifically, we prove that starting from a situation in which neither firm has committed to DP, each firm prefers to unilaterally deviate to DP, and that starting from a situation in which one firm has committed to DP but the other has not, the latter has an incentive to deviate to DP.

Lemma 2. *If $v_A \geq v'_B$, then $\Pi_A = V_A - \max\{V_B, 0\}$ and $\Pi_B = 0$, regardless of the DP regime. And if $v_B \geq v'_A$, then $\Pi_A = 0$ and $\Pi_B = V_B - \max\{V_A, 0\}$, regardless of the DP regime.*

Proof of Lemma 2 Suppose $v_A \geq v'_B$. This means A wins period 2 no matter the outcome in period 1, so we have $u(A) = \max\{v_B, 0\}$ and $u(B) = u^P = v'_B$.

Since B never wins in period 2, it is unwilling to subsidize in period 1, so the highest PDV of utility that B can offer the consumer in period 1 is $v_B + \delta v'_B$, by setting $p_B = c$. The outside option for the consumer in period 1 is to join neither firm, in which case she will end up joining firm A in period 2, obtaining a PDV of utility $\delta \max\{v_B, 0\}$. Note that $v'_B > 0$ implies that

$$\max\{v_B + \delta v'_B, \delta \max\{v_B, 0\}\} = \max\{v_B + \delta v'_B, 0\} = \max\{V_B, 0\}.$$

Thus, to win the consumer in period 1, A sets p_A such that

$$v_A - (p_A - c) + \delta u(A) = \max\{V_B, 0\},$$

leading to profits

$$\begin{aligned} \Pi_A &= (p_A - c) + \delta(v'_A - u(A)) \\ &= v_A + \delta u(A) - \max\{V_B, 0\} + \delta(v'_A - u(A)) \\ &= V_A - \max\{V_B, 0\} > 0. \end{aligned}$$

Since this is positive, A wins both periods and $\Pi_B = 0$.

The result for the case $v_B \geq v'_A$ follows by symmetry in A and B.

■

Thus, throughout the rest of this proof, we focus on the case $v'_A > v_B$ and $v'_B > v_A$. This means that if a firm does not offer DP and wins in period 1, it will also win in period 2.

We first determine the equilibrium for the case when neither firm has committed to DP.

Lemma 3. *Without DP, the equilibrium outcome is as follows. If $V_A \geq V_B$, then firm A attracts the consumer in both periods, resulting in profits and consumer surplus*

$$\begin{aligned}\Pi_A &= V_A - \max\{V_B, 0\}\\ \Pi_B &= 0.\end{aligned}$$

The results for the case when $V_B \geq V_A$ are obtained by symmetry in A and B.

Proof of Lemma 3. If $V_B \leq 0$, then B cannot exert any competitive pressure on A in either period, so the binding constraint is the outside option, meaning that $\Pi_A = V_A$. To see this, note that if B does not win the consumer in the first period, then B is irrelevant in the second period because $v_B < 0$. This implies that the lowest price p_B that B is willing to offer in the first period is such that $p_B - c = -\delta\left(v'_B - \max\{v_A, 0\}\right)$, which means the highest PDV of net utility that B can offer in the first period is

$$v_B + \delta\left(v'_B - \max\{v_A, 0\}\right) + \delta \max\{v_A, 0\} = V_B \leq 0.$$

Thus, B is also irrelevant in the first period.

Suppose then $V_A > V_B > 0$. First, we show that in equilibrium the consumer must join one of the two firms in period 1. Suppose she doesn't. Then her PDV of utility is $\delta \max\{\min\{v_A, v_B\}, 0\}$ and firm A makes zero profits. But firm A could attract the consumer in period 1 (and therefore also in period 2) by setting p_A such that

$$v_A - (p_A - c) + \delta \max\{v_B, 0\} = \delta \max\{\min\{v_A, v_B\}, 0\},$$

leading to total profits

$$p_A - c + \delta\left(v'_A - \max\{v_B, 0\}\right) = V_A - \delta \max\{\min\{v_A, v_B\}, 0\} > 0.$$

Second, the consumer cannot join firm B in equilibrium. If she did, then firm B attracts the consumer in both periods, so the utility derived by the consumer from the perspective of period 1 is $v_B - (p_B - c) + \delta \max\{v_A, 0\}$. Firm A's profits are zero and firm B's profits are $p_B - c + \delta\left(v'_B - \max\{v_A, 0\}\right)$, which must be non-negative. This implies

$$v_B - (p_B - c) + \delta \max\{v_A, 0\} \leq V_B.$$

But then firm A could attract the consumer in period 1 (and therefore also in period 2) by setting

p_A such that

$$v_A - (p_A - c) + \delta \max\{v_B, 0\} = V_B,$$

leading to total profits

$$p_A - c + \delta (v'_A - \max\{v_B, 0\}) = V_A - V_B \geq 0.$$

Thus, A must win the consumer in both periods and its price p_A in the first period must be such that

$$v_A - (p_A - c) + \delta \max\{v_B, 0\} = \max\{V_B, \delta \max\{\min\{v_A, v_B\}, 0\}\} = V_B.$$

This means A's profit is $\Pi_A = V_A - V_B$, while consumer surplus is V_B.

■

Now consider the case when both firms have committed to DP (or DP has been imposed by policy).

Lemma 4. *Suppose both firms have committed to DP. If $v'_A \geq v'_B$ and ($V_B < 0$ or $v_A \geq v_B$), then A wins both periods, resulting in profits and consumer surplus*

$$\begin{aligned} \Pi_A^P &= V_A - \max\{V_B, 0\} \\ \Pi_B^P &= 0. \end{aligned}$$

If $v'_A \geq v'_B$ and $V_B \geq 0$ and $v_B > v_A$, then B wins the first period and A wins the second period, resulting in profits and consumer surplus

$$\begin{aligned} \Pi_A^P &= \delta (v'_A - v'_B) \\ \Pi_B^P &= \min\{v_B - v_A, V_B\}. \end{aligned}$$

The results for the case $v'_A \leq v'_B$ are obtained by symmetry in A and B.

Proof of Lemma 4 Suppose both firms have committed to DP, and recall $v'_A > v_B$, $v'_B > v_A$. In equilibrium, the consumer must buy from one of the two firms in period 1. If not, then she would obtain PDV of utility $\delta \max\{\min\{v_A, v_B\}, 0\}$ and firm $i \in \{A, B\}$ such that $V_i > 0$ (recall this must be true for $i = A$ or $i = B$) could profitably deviate by setting its first-period price p_i such that

$$v_i - (p_i - c) + \delta \min\{v'_A, v'_B\} = \delta \max\{\min\{v_A, v_B\}, 0\},$$

yielding profits

$$p_i - c + \delta \max\left\{v_i' - v_j', 0\right\} = V_i - \delta \max\left\{\min\left\{v_A, v_B\right\}, 0\right\} > 0.$$

Since the outcome in period 2 (firm A wins if $v_A' \geq v_B'$ and firm B wins otherwise) does not depend on who wins in period 1, neither firm is willing to subsidize in period 1.

Suppose $v_A' \geq v_B'$, so A wins in period 2 regardless of who wins in period 1. If A also wins in period 1, then we must have

$$v_A - (p_A - c) + \delta v_B' = \max\left\{V_B, \max\left\{\min\left\{v_A, v_B\right\}, 0\right\}\right\} = \max\left\{V_B, 0\right\}.$$

This implies

$$\begin{aligned} \Pi_A^P &= V_A - \max\left\{V_B, 0\right\} \\ \Pi_B^P &= 0 \end{aligned}$$

and this solution is valid only if $V_A \geq \max\left\{V_B, 0\right\}$ and A does not want to deviate by slightly lowering p_A. This deviation can only be profitable if $V_B \geq 0$, in which case the deviation yields profits of $\delta\left(v_A' - v_B'\right)$. Thus, the deviation is not profitable if $V_B < 0$ or $v_A - v_B \geq 0$. So this solution is valid if and only if $V_B < 0$ or $v_A - v_B \geq 0$ (note indeed, that either one of these inequalities implies $V_A \geq \max\left\{V_B, 0\right\}$ because we are in the case $v_A' \geq v_B'$).

If B wins period 1, then we must have

$$v_B - (p_B - c) + \delta v_B' = \max\left\{v_A + \delta v_B', 0\right\},$$

so B's profits are $V_B - \max\left\{v_A + \delta v_B', 0\right\}$. This solution is therefore valid if and only if (iff) $V_B \geq 0$ and $v_B - v_A \geq 0$, in which case

$$\begin{aligned} \Pi_A^P &= \delta\left(v_A' - v_B'\right) \\ \Pi_B^P &= \min\left\{v_B - v_A, V_B\right\}. \end{aligned}$$

■

Finally, suppose only one firm (A) has committed to DP.

Lemma 5. *Suppose firm A has committed to DP, while firm B has not. If $v_A' \geq v_B'$, then the* *outcome is identical to the one without DP, so*

$$\begin{aligned}\Pi_A^{PA} &= \max\left\{V_A - \max\left\{V_B, 0\right\}, 0\right\} \\ \Pi_B^{PA} &= \max\left\{V_B - \max\left\{V_A, 0\right\}, 0\right\}.\end{aligned}$$

If $v'_B > v'_A$, then the outcome is the same as with bilateral DP, so

$$\begin{aligned}\Pi_A^{PA} &= 0 \\ \Pi_B^{PA} &= V_B - \max\left\{V_A, 0\right\}\end{aligned}$$

when $V_A \leq 0$ or $v_B - v_A \geq 0$, and

$$\begin{aligned}\Pi_A^{PA} &= \min\left\{v_A - v_B, V_A\right\} \\ \Pi_B^{PA} &= \delta\left(v'_B - v'_A\right)\end{aligned}$$

when $V_A \geq 0$ and $v_A - v_B \geq 0$.

Proof of Lemma 5 Suppose firm A has committed to DP, while firm B has not. In equilibrium, the consumer buys from one of the two firms in period 1. If not, then she would obtain PDV of utility $\delta \max\left\{\min\left\{v_A, v_B\right\}, 0\right\}$ and firm A could profitably deviate by setting its first-period price p_A such that

$$v_A - (p_A - c) + \delta \min\left\{v'_A, v'_B\right\} = \delta \max\left\{\min\left\{v_A, v_B\right\}, 0\right\},$$

yielding profits

$$p_A - c + \delta \max\left\{v'_A - v'_B, 0\right\} = V_A - \delta \max\left\{\min\left\{v_A, v_B\right\}, 0\right\} > 0.$$

If $v'_A \geq v'_B$, then whichever firm wins period 1 also wins period 2. In this case, the analysis is the same as with no DP, leading to

$$\begin{aligned}\Pi_A^{PA} &= \max\left\{V_A - \max\left\{V_B, 0\right\}, 0\right\} \\ \Pi_B^{PA} &= \max\left\{V_B - \max\left\{V_A, 0\right\}, 0\right\}.\end{aligned}$$

If $v'_B > v'_A$, then firm B wins period 2, regardless of who wins period 1. In this case, the analysis is the same as with bilateral DP, so profits and consumer surplus are the same as in Lemma 4 for the case $v'_B > v'_A$.

■

Start with no DP by either firm and suppose $V_A \geq \max\left\{V_B, 0\right\}$, so A wins in the absence of any DP and profits are

$$\begin{aligned}\Pi_A &= V_A - \max\{V_B, 0\} \\ \Pi_B &= 0.\end{aligned}$$

Then, from Lemma 5, if $v'_A \geq v'_B$, the outcome with unilateral DP by A is the same as without DP.

If $v'_A < v'_B$ then we must have $v_A > v_B$, so profits are

$$\begin{aligned}\Pi_A^{PA} &= \min\{v_A - v_B, V_A\} \\ \Pi_B^{PA} &= \delta(v'_B - v'_A)\end{aligned}$$

It is easily seen that B's profits are strictly higher than without DP. As for A, if $V_B < 0$, this implies

$$v_B + \delta v'_A < v_B + \delta v'_B < 0,$$

so A's profits are V_A in both cases. And if $V_B \geq 0$, then A's profits are strictly higher with unilateral DP by A because

$$\min\{v_A - v_B, V_A\} > V_A - V_B.$$

Thus, A has an incentive to offer unilateral DP, and strictly so provided $v'_A < v'_B$ and $V_B \geq 0$.

Now compare the profits under unilateral DP by A (lemma 5) to the profits under bilateral DP (lemma 4). If $v'_B > v'_A$, then the outcome and firm profits are the same under unilateral DP by A and bilateral DP.

If $v'_A \geq v'_B$, then profits under unilateral DP by A are

$$\begin{aligned}\Pi_A^{PA} &= V_A - \max\{V_B, 0\} \\ \Pi_B^{PA} &= 0.\end{aligned}$$

If $v'_A \geq v'_B$ and ($V_B < 0$ or $v_A \geq v_B$), these are also the profits under bilateral DP.

If $v'_A \geq v'_B$ and $V_B \geq 0$ and $v_B \geq v_A$, then profits under bilateral DP are

$$\begin{aligned}\Pi_A^{P} &= \delta(v'_A - v'_B) \\ \Pi_B^{P} &= \min\{v_B - v_A, V_B\}.\end{aligned}$$

Clearly, B's profits are higher, strictly so if $v'_A \geq v'_B$ and $V_B > 0$ and $v_B > v_A$. And A's profits are also higher in this case, because $\delta(v'_A - v'_B) \geq V_A - V_B$.

In summary, firm A does at least as well and in some cases strictly better by deviating to unilateral DP from the situation without any DP. And firm B does at least as well and in some cases strictly better by deviating from the case with unilateral DP by A to the case with bilateral DP. Thus, provided there is a positive measure of consumers with $v_A > v_B$ and $v'_A < v'_B$ and a positive measure with $v_A < v_B$ and $v'_A > v'_B$, the unique equilibrium has both firms choosing to commit to DP.

The result for the case $V_B \geq \max\{V_A, 0\}$ follows by symmetry in A and B.