ENDING PAY FOR PBM PERFORMANCE:
CONSEQUENCES FOR PRESCRIPTION DRUG PRICES,
UTILIZATION, AND GOVERNMENT SPENDING

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ABSTRACT

Proposed "delinking" legislation would prohibit Pharmacy Benefit Managers (PBMs) from being remunerated based on the rebates and discounts they negotiate for drug insurance plans serving Medicare beneficiaries. This policy would significantly change drug pricing and utilization and shift billions of dollars annually from patients and taxpayers to drug manufacturers and retail pharmacy companies. Annual federal spending on Medicare Part D premiums would increase $3 billion to $10 billion plus any concomitant increase in Medicare subsidies for out-of-pocket expenses. All of these consequences stem from the fact that PBMs are hired to obtain rebates and discounts but would no longer be compensated based on their results. The quantitative estimates utilize a large body of economic research showing how much "pay for performance" matters for economic outcomes. The price-theoretic models also account for various market frictions and imperfections including market power, coordination costs, tax distortions, and incomplete innovation incentives.

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Lawmakers are considering prohibiting any link between the remuneration of Pharmacy Benefit Managers (PBMs) and a drug's list price or other price benchmark. Without such a link, PBM fees would no longer be contingent on the rebates and discounts they negotiate for drug insurance plans. As a change to financial incentives for purchasers in the drug supply chain, this "delinking" policy has the potential to significantly (i) increase drug prices, (ii) reduce drug utilization, and (iii) redistribute billions of dollars annually from patients and taxpayers to pharmacy companies and drug manufacturers.

I.   The delinking proposal eliminates pay for performance

An important function of PBMs is to negotiate discounts from drug manufacturers and pharmacy companies on behalf of plan sponsors.[1] Plan sponsors compensate PBMs based on the amount of the discounts they obtain, often by allowing PBMs to retain a share of the rebates and discounts. Lawmakers are considering, among other things, prohibiting PBMs from being remunerated by Medicare Part D plans in this way. PBM remuneration must, under the proposed legislation, "be a flat dollar amount, rather than based or contingent upon the manufacturer list price or other related drug price benchmarks and factors."

In economic terms, the proposed legislation would eliminate pay for performance in the contracts between plan sponsors, PBMs, and manufacturers. PBMs would receive the same payment at the end of the plan year, regardless of the amount of discounts they obtained from manufacturers and pharmacies. Plans' only means of incentivizing PBM performance, short of undertaking benefit management on their own, would be to respond to poor performance by hiring a different PBM the next year that would also have no financial incentive to obtain discounts.

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[1] The negotiation discounts from drug manufacturers are known as "rebates," not to be confused with the rebates mandated by statute.

II. Delinking would increase net drug prices and reduce utilization of drugs and pharmacies

Incentives matter for PBMs just as they do for other market participants. A financial reward for greater rebates and discounts results in greater rebates and discounts. Conversely, eliminating pay for PBM performance would reduce PBM performance. Absent the financial incentives, plans would pay more to manufacturers and to pharmacies because plans would receive less manufacturer rebates and pharmacy discounts.

The advantages of pay for performance is one of the most cited conclusions in economics, where it is frequently noted that "incentives matter." Socialist communities have been criticized for failing to provide "high powered incentives" – pay for performance – which made it difficult for them to inspire effort and to retain and attract high-productivity members (Abramitzky 2018). The same principle, among other things, points to excise taxes for addressing externalities and highlights the unintended consequences of price regulations. Pay for performance is particularly advantageous in transactions, such as those between plans and PBMs, where the available remuneration metrics (rebates and pharmacy discounts) align closely with the outcomes desired by the transacting parties (Williamson 1985).

Regulations that eliminate pay for performance in contracts between plans and PBMs also put stand-alone PBMs at a disadvantage relative to vertically integrated PBMs.[2] This would increase drug prices to the extent that PBM entry is discouraged or other aspects of vertical integration reduce competition among PBMs (Gray, Alpert and Sood 2023).

Furthermore, eliminating pay for PBM performance would reduce drug and pharmacy utilization through a couple of channels. The most important is that manufacturer rebates and pharmacy

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[2] Oliver Williamson's Nobel Prize winning work on the "boundaries of the firm" distinguishes between "high-powered incentives" (pay for performance) associated with outside procurement and the allocation of resources in vertically-integrated enterprises with lower-powered incentives and bureaucratic mechanisms (Williamson 1985). Specifically, with high-powered incentives prohibited, plans that obtain PBM services via outside procurement would lose an advantage over vertically integrated business models.

discounts are contractually tied to drug and pharmacy utilization.[3] Fees tied to rebates and discounts encourage PBMs to find and implement contractual and administrative tools to encourage competition among manufacturers and among pharmacies.[4] The reduced competition that comes with flat-dollar PBM fees means higher prices and less quantity of pharmaceutical products and pharmacy services.

A second way that eliminating pay for PBM performance would reduce utilization is by reducing insurance coverage. As PBMs obtain less rebates and discounts for their client plans, the plans must increase premiums to finance drug benefits. Higher premiums discourage patients from maintaining coverage and selecting broader coverage.

Third, reduced competition among manufacturers may increase their list prices, which indirectly increases what patients pay out of pocket for prescriptions. In this case, financial incentives for both plans and patients would be in the direction of less utilization.

Arithmetically, rebates are the difference between the list price for a drug and its net price. It is sometimes claimed that, because they are compensated based on rebates, PBMs are responsible for higher list prices as manufacturers seek to comply with demands for larger rebates. But each drug's list price is set by its manufacturer and applies to all PBMs and all other purchasers including the uninsured (Burns 2022, p. 376). When a PBM seeks higher rebates from the manufacturer via increased list prices instead of reduced net prices, it enhances the fees its rivals earn, without offering added value to its client plans. In contrast, a PBM increasing rebates through lower net prices gains market share from competing PBMs because the rebates and net prices only apply to its own clients.[5]

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[3] More specifically, the rebate and discount contracts present plans with marginal cost schedules that decrease with utilization. That is why a variety of studies have concluded that the contracts encourage competition and efficiency (Danzon 2015, Murphy, Snyder and Topel 2014, Conti, et al. 2021, Mulligan 2023).

[4] Due to their contact with patients, pharmacies can be valuable partners with plans and PBMs in managing the drug benefit. Pharmacy contracts therefore specify performance goals as well as negotiated discounts. The contracts financially incentivize pharmacies for dispensing less-expensive generics, achieving adherence goals, and otherwise aligning with the plan's objectives (Mattingly and Bai 2021).

[5] One study finds a positive correlation between rebates and list prices, interpreted as a causal effect of negotiated rebates on list prices (Sood, et al. 2020). However, its interpretation fails to distinguish negotiated rebates from statutory rebates, both of which are combined in the study's rebate metric. The study also fails to account for the

Reducing the competition among manufacturers encouraged by rebate contracts might indirectly reduce list prices. The direction and magnitude of the effect depends on how the elasticity of manufacturer demand with respect to the list price is affected by the rebate contracts of manufacturers of competing drugs. Because patient cost sharing is tied to list prices, this possible indirect effect of delinking might appear to increase proper drug utilization. But this conclusion is incorrect because it fails to consider the incentives of plans and PBMs. Delinking may put the drug in a higher price tier or leave it uncovered altogether because PBMs and plans have less financial incentive to find and implement contractual and administrative tools that increase utilization. The result of reduced coverage would be a sharp increase in the cost sharing even though the list price is reduced. More generally, both theory and evidence suggest that regulations shifting utilization incentives from plans and PBMs to patients result in less utilization.[6] In other words, ending pay for PBM performance would reduce proper drug utilization even if it reduced list prices.[7] See also Appendix II.

III. Delinking would increase federal spending

The majority of Medicare Part D premiums, which would increase due to the decline in rebates and discounts caused by ending pay for PBM performance, are paid by the federal government. Through its reconciliation process, Medicare Part D also receives part of the manufacturer rebates and pharmacy discounts, which would be reduced by ending pay for PBM performance.

In considering the 2019 proposed "rebate rule," Medicare's Actuary (OACT), the Congressional Budget Office (CBO), and the White House Council of Economic Advisers (CEA) each independently concluded that manufacturer rebates in Medicare Part D reduce federal spending on

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causal effect of list prices on rebates – that PBMs react to list price increases by demanding a greater rebate in order to maintain the net prices paid by its clients. Indeed, a one-for-one reaction to list prices is commonly built into PBM contracts as a "price protection provision" (Burns 2022, pp. 387, 404), whose payments are considered manufacturer rebates by Medicare Part D (Polakowski, Johnson and Wanta 2017).

[6] Mulligan (2023) concludes that "both theory and evidence [show why] policies that reduce copays nonetheless reduce proper drug utilization when those policies reduce the financial incentives for plans and PBMs to achieve utilization goals."

[7] Another factor is that, as noted previously, delinking may result in higher list prices in which case patients, plans, and PBMs face reduced financial incentives for utilization.

the program.[8] They also concluded that the rebate rule would increase the net price paid by Part D plans for brand prescriptions by reducing the combined amount of rebates and at-the-counter discounts negotiated by PBMs on behalf of plans. Delinking has essentially the same economics, except that, unlike the rebate rule, delinking does not necessarily reallocate the manufacturer rebates and discounts that remain from plans to patients. Therefore, a rough (and conservative) estimate of the effects of delinking in Part D would be the effects of the rebate rule.[9]

CBO (2023) projected the budget effects of Section 2 of the bill "Modernizing and Ensuring PBM Accountability Act" under consideration by the Senate Finance Committee, which includes various PBM reporting and disclosure requirements as well as a delinking requirement. Their combined score shows a minor budget savings, but does not disaggregate the savings among the various provisions in Section 2.[10] The report does not indicate whether CBO has yet considered how eliminating pay for PBM performance would affect PBM performance and thereby have significant follow-on effects on the federal budget akin to the effects of the rebate rule.[11]

IV.   Quantitative Estimates

Because pay for performance has proven to be the solution of choice for contracts between PBMs and plans, a prohibition of pay for performance would introduce a new obstacle or friction in such contracting. As an alternative to analogizing with rebate and pharmacy-DIR regulations, the effects of delinking therefore can be estimated in two steps. The first is to estimate the magnitude

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[8] OACT concluded that the HHS rebate rule would increase drug-plan premiums by 25 percent (84 FR 2358) and federal Part D spending by $19.6 billion per year, largely by increasing net prices. See also CBO (2019) and Mulligan (2020).

[9] Delinking has an additional effect, though, because it also prohibits PBMs from being remunerated on the basis of the discounts they negotiate with retail pharmacies, which are distinct from manufacturer rebates and discounts. Because this additional effect is analogous to the effect of regulating Part D pharmacy Direct and Indirect Remuneration (DIR). Therefore a less conservative estimate of the effects of delinking in Part D would sum estimates of the effects of the rebate rule and of pharmacy DIR regulation, assuming that the latter properly considers the financial incentives associated with pharmacy DIR.

[10] CBO estimated average annual federal savings is less than $100 million, which is two orders of magnitude less than the amount of negotiated manufacturer rebates and pharmacy discounts in Medicare Part D. That is, if eliminating PBM performance reduced rebates and discounts by even one percent, that would exceed the budget effects cited in CBO (2023).

[11] On several other occasions, CBO has acknowledged that financial incentives affect market outcomes. Examples include CBO (2014, 2020).

of the contracting friction.   The second step translates the friction into outcome magnitudes using a previously developed quantitative model of PBM regulation.

The effects of pay for performance on performance (output) have been the subject of several econometric studies.   Studies across various industries consistently find "strong responses of output to the use of pay-for-performance contracts" as compared to flat-dollar compensation (Prendergast 1999, p. 8).   The smallest magnitude reported by the studies cited by Prendergast was a 9 percent increase in productivity from using pay for performance.   Lazear (2000) finds a 44 percent increase.   These estimates suggest that removing pay for performance would reduce productivity 8 to 31 percent.[12]

To be clear, the practical alternative to pay for performance is rarely zero financial incentive.[13]   But that is true in both the empirical studies and the PBM market, where participants will seek out alternative albeit inferior means of encouraging PBMs to obtain rebates and discounts from manufacturers and pharmacies.[14]   This is why I assume that rebates and discounts would continue but at 69 (high-impact scenario) to 92 percent (low-impact scenario) of what they would be if pay for PBM performance were allowed to continue.   That is, the low-impact scenario has an average manufacturer rebate rate of 27.5 rather than 30.0 percent and a pharmacy discount rate of 27.3 rather than 29.8 percent.[15]   For the high-impact scenario, the manufacturer and pharmacy rates are 20.8 and 20.7 percent, respectively.   These assumptions are reported in the bottom half of Table 1a.

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[12] $1 - 0.08 = 1/1.09$ and $1 - 0.31 = 1/1.44$.

[13] As Williamson (1985, p. 146) puts it, "The compensations of salaried managers and other employees who work for wages [instead of piece rates] are ostensibly disconnected from performance. That is superficial, however, if in fact salaries are adjusted at contract renewal intervals and promotions are made with reference to past or promised performance."

[14] Prendergast and Lazear explain that pay for performance increases productivity on both intensive margins (more effort by those receiving the pay) and extensive margin (pay tied to productivity attracts more productive employees), with the 9 to 44 percent estimates reflecting the combination of both margins.

[15] Manufacturer rebate rates are conventionally cited as a percentage of manufacturer list price. I express pharmacy discount rates as a percentage of the list price of pharmacy retail services, which is a different denominator than for manufacturer rebate rates.

Table 1a. Delinking Rules: Effects on Part D Market Performance

Outcome	Scenario	
	Low-impact	High-impact
Quantity effect		
Brands	-3.1%	-10.5%
Entire market	-0.5%	-1.7%
Net drug price effect		
Brands	7.1%	26.3%
Entire market	4.9%	17.9%
Rebate rate (brands)		
Baseline	30.0%	30.0%
Regulated	27.5%	20.8%
Pharmacy discount rate (all Rx)		
Baseline	29.8%	29.8%
Regulated	27.3%	20.7%

Notes: Each scenario is based on a different assumption about the extent that pay for PBM performance enhances PBM performance. Manufacturer rebate rates have gross drug spend as denominator. The pharmacy discount rate denominator is the list price for retail pharmacy services.

If the same productivity percentages reported by Prendergast and Lazear apply to pay for PBM performance, the Mulligan (2023) model projects that drug utilization by Medicare beneficiaries would fall between 3.1 to 10.5 percent for brands and 0.5 to 1.7 percent overall, which would increase nondrug health costs such as hospitalization. See the top half of Table 1a. Part D net prices would increase between 5 and 18 percent.

Table 1b estimates various costs and benefits that follow from Table 1a's market outcomes. The costs include monetary and resource costs as well as opportunity costs, which refer to the net value of goods and services not received as the result of regulation. Table 1b's first row shows that surplus aggregated between manufacturers, pharmacies, plans and patients falls between $2 billion and $6 billion. In other words, the costs of the rule to plans and patients exceeds the benefit to manufacturers and retail pharmacies. Although brand manufacturers would be producing 3 to 10 percent less, their remaining sales would occur at a 6 to 24 percent greater net price.[16]

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[16] The 6-24 percent is the manufacturer part of Table 1a's third row, which also includes effects of delinking PBM remuneration from pharmacy discounts.

Table 1b. Part D Delinking Rules: Regulatory Costs

$ billion per year	Scenario	
Outcome	Low-impact	High-impact
Net costs in the supply chain	**1.8**	**6.3**
Manufacturer losses (- is profit)	-3.1	-10.6
Pharmacy losses (- is profit)	-0.3	-1.0
Plan & patient lost value	5.2	18.0
External costs	**1.6**	**6.2**
3rd-party nondrug health costs	0.2	0.6
Tax distortions	0.9	3.8
Foregone drug innovation	0.5	1.7
Total net costs	**3.4**	**12.5**

Notes: Each scenario is based on a different assumption about the extent that pay for PBM performance enhances PBM performance. Dollar amounts assume annual Part D baseline manufacturer rebates of $31 billion and retail-pharmacy discounts of $9 billion.

Reduced prescription utilization by itself tends to reduce drug costs but increase nonpharmacy medical costs. Based on the findings of Kaestner et al (2019), I estimate that the reduced utilization shown in Table 1a would increase nonpharmaceutical health-plan costs $0.2 billion to $0.6 billion. Because plans and patients recognize connections between drug adherence and nonpharmaceutical health expenses, some of this extra cost is already reflected in the reduced surplus (cited above) accruing to patients and parties to rebate transactions. However, part of the nondrug effect is not reflected in the pharmaceutical-market demand curve due to drug plans' imperfect incentives to control nondrug costs. To avoid double-counting, only the second component of the nondrug medical costs is shown as a distinct category in Table 1b.

Industry-level additions to plan marginal costs, or subtractions from plan marginal revenues, are passed on to consumers as higher premiums. Ending pay for PBM performance thereby has several significant effects on health plan premiums, summarized in Table 2. The first two rows reflect the increased drug acquisition costs and pharmacy expenses as manufacturers and pharmacies offer

less volume discounts. These rows reflect the net price change shown in Table 1a, except that Table 1a divides the change by the baseline net price whereas Table 2 is expressed in billions of dollars. Partly offsetting the higher net prices is less brand utilization, as shown in the third row of Table 2.

Table 2. Delinking Increases Medicare Premiums
Impact on drug-plan premiums, $ billion per year

Source of premium effect	Low-impact	High-impact
Net price impact: brands	5.1	18.7
Net price impact: entire market	5.4	19.5
Utilization impact: brands	-2.3	-7.7
Utilization impact: generics	0.0	0.2
Utilization-price interaction	-0.1	-1.8
Added management costs	0.6	1.2
Added medical costs	0.4	1.4
Combined premium impact		
$ billion per year	4.0	12.8
% of baseline premium [a]	4.2%	13.5%

Note: Dollar amounts assume annual Part D baseline manufacturer rebates of $31 billion and retail-pharmacy discounts of $9 billion. [a] the denominator is the drug part of Medicare plan premiums.

Premiums also finance benefit-management costs and, for insurance plans that process claims from nonpharmacy providers, non-drug medical costs. Both costs are increased by regulations that hinder benefit management and reduce utilization. These additions to premiums are shown in Table 2's sixth and seventh rows. The seventh row exceeds the corresponding row in Table 1b because Table 2 counts the entire effect on nonpharmacy medical costs whereas Table 1b partitions that amount between plan/patient value and third-party value.

Overall, premiums increase by $4 billion to $13 billion annually; see the first "Combined premium impact" row. Expressed as a percentage change in drug-plan premiums from baseline to regulated, that is a 4-13 percent increase.

Because the federal government finances about three-fourths of Part D premiums, delinking would increase annual federal government spending $3 to $10 billion plus any concomitant increase in federal subsidies for out-of-pocket expenses.[17] The additional Medicare spending would require the federal government to tax more, spend less outside of Medicare, and/or borrow more, which has additional effects on the broader economy. This external cost of delinking regulation is shown in the "tax distortion" row of Table 1b.

By reducing the incentives of plans and PBMs to encourage adherence and proper drug utilization, delinking has two effects on the incentives of manufacturers to bring unique new drugs to market. The innovation incentive is reduced in the early patent phase after new drug launch, due to reduced brand sales. The incentive is increased in the late patent phase because plans and PBMs are unable to encourage as much competition between competing therapies. The former dominates the overall innovation incentive because of its size and its proximity in time to the introduction of the new drug.[18] I estimate that the social cost of this reduced innovation is $0.5 billion to $1.7 billion annually, as shown in the Table 1b's "foregone drug innovation" row. More details of the estimates are provided in Appendix III of Mulligan (2023).

The net cost of ending pay for PBM performance would be $3 billion to $13 billion (final row of Table 1b), reflecting the fact that patients and plans lose more than manufacturers and pharmacies benefit.

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[17] This budgetary effect of delinking is somewhat less than, although of the same order of magnitude as, the budgetary effect of the Part D rebate rule as estimated by OACT, CBO, and CEA. I estimate that the rebate rule and delinking have about the same effect on aggregate manufacturer rebates and discounts, but the rebate rule is unique in redistributing rebates from plans to the patient at the point of sale. The rebate rule's redistribution of rebates by itself increases premiums because plans would have to replace their lost rebate revenue. As previously noted, my estimate of the budgetary effect of delinking is of a different order of magnitude than CBO's score of Section 2 of "Modernizing and Ensuring PBM Accountability Act," which includes a delinking requirement.

[18] The latter dominates for the purposes of determining aggregate expenditure on branded drugs (see the first and third rows of Table 1a), because most of those drugs are beyond the early patent phase where benefit management is increasing profit through added utilization.

V. Delinking and Competition

A rhetorical starting point for much PBM regulation is that the combined market share of the three largest PBMs significantly exceeds fifty percent. While the degree of PBM competition affects prescription prices, utilization, and government spending, it is hardly relevant for assessing the effects of delinking and many other PBM regulations. Introducing a new friction or obstacle between buyers and sellers is unlikely to increase competition or consumer welfare in benefit management or any other market, regardless of whether the market is competitive, oligopolistic, monopolistic, or somewhere in between.

Making it more difficult for PBMs to serve their customers well, as delinking would do, has the optics of "punishing" PBMs. But punishment does not encourage more companies to get into the PBM business, which is the essence of competition. Delinking requirements would instead discourage competition among PBMs to the extent that larger incumbent PBMs are better able to adapt to them, although the primary effect of these regulations would be to discourage competition among drug manufacturers and among pharmacies.[19]

In principle, it is possible that consumers would benefit from carefully crafted regulation that discourages negative externalities, encourages positive externalities, or assists uninformed parties to the transactions. But in practice the parties to PBM contracts – drug manufacturers, retail pharmacy companies, and large health insurers – are highly sophisticated parties with industry knowledge that likely exceeds that of the regulators. PBM actions – particularly their negotiation of volume discounts from drug manufacturers and retail pharmacies – do have positive externalities by reducing government spending and encouraging drug innovation. But delinking regulation is not carefully designed to encourage any of these positive externalities. Indeed, delinking discourages the negotiation of discounts by removing financial incentives for PBMs to obtain, implement, and administer volume discounts.

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[19] Recall that "delinking" is a prohibition of how a health plan can remunerate its PBM. The prohibition may be less onerous when the health plan and PBM have the same owner. As Nobel Laureate Oliver Williamson put it, with high-powered incentives prohibited, businesses obtaining services via outside procurement would lose an advantage over vertically integrated business models.

Drug manufacturers agree to provide rebates to PBMs and plans in order to help achieve sales targets. What is frustrating to them is that their competitors also provide rebates to incentivize sales milestones. This is why Table 1b predicts that drug manufacturers would profit from delinking while proper drug utilization would be reduced.

Similarly, pharmacies agree to discounts and performance goals in order to compete with other pharmacies hoping to receive the preferential position in the plan's benefit structure in the face of competitors also discounting retail services and offering to partner in managing the drug benefit. Conversely, if there were less competition among pharmacies, the pharmacies could charge more and/or refuse to be remunerated based on patient results. This is why Table 1b predicts that retail pharmacies would profit from delinking while proper drug utilization would be reduced.

At the same time, delinking is an oblique tool for helping independent pharmacists earn more profit or suffer less financial loss. Table 1b's low-impact scenario shows a $0.3 billion annual benefit for pharmacy companies (many of which are chain pharmacies rather than independent pharmacies) at an aggregate net cost of $3.4 billion. That is, each $1 redistributed to independent pharmacies through delinking costs plans, patients, and others $12. The cost-redistribution ratio is even greater in the high-impact scenario.

Appendix I: Volume discounts (a.k.a., rebates) are a pro-competitive market outcome

From the perspective of consumer demand, a potential source of underutilization is the gap between list price and the marginal cost of producing, delivering, and administering the drug. This source is especially relevant for newer branded drugs that are still under patent and thereby available only from a single manufacturer, although other manufacturers may sell chemically different drugs that treat the same condition. Economics has long noted that such gaps open opportunities for mutually advantageous trade between seller and buyers where the buyers receive a discount for purchasing more than they would at list price (Oi 1971, Telser 1994, Lakdawalla and Sood 2013). PBMs arrange such trades by obtaining manufacturer rebates in exchange for placement in the plan's benefit structure that helps the manufacturer make additional sales to plan members. Figure 1 illustrates the joint value of manufacturer-rebate transactions as the area under the consumer (i.e., patient) demand curve between q_0 – the quantity that would be purchased without rebates – and q_1, which is the quantity expected to result from the favorable plan placement.

Rather than trading at list price, manufacturer and potential consumers could mutually agree to trade units beyond q_0 at net prices less than list. Some trade of this type, which Murphy, Topel, and Synder (2014) refer to as "quantity commitment discounts" is to be expected given the large gap between list price and marginal cost. On the other hand, trade at multiple prices and committing consumers to be off their demand curve introduces its own distortions, which I refer to as "contract compliance" or "benefit management" costs. These additional costs include imperfect allocation of the good among consumers, who differ in terms of willingness to pay, and resources spent by consumers as they attempt to trade or accumulate outside the quantity commitment agreement (Oi 1971, Stole 2007). Klein and Murphy (2008) emphasize that buyers' clubs such as insurance plans (or PBMs on their behalf) can facilitate the consumer commitments.

The marginal cost of producing, delivering, and administering the drug are shown as a horizontal dashed line in Figure 1. The marginal contract compliance costs, which rise with the gap between list price and marginal price (equivalently, with the gap between quantity and q_0), are in addition to those costs. Figure 1 shows the total marginal costs as a linear blue curve.

Figure 1. Benefit-management costs are increased by constraining management tools
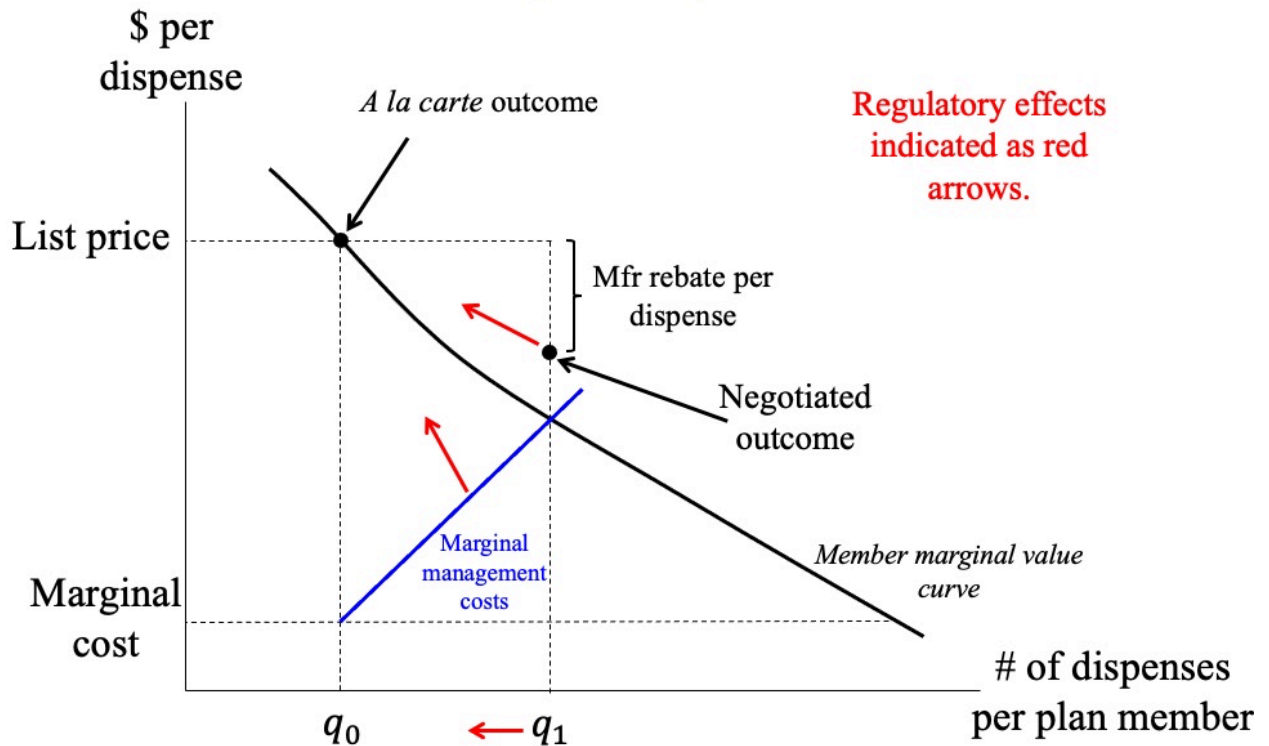
The blue curve is the sum of the marginal management costs with the other (and constant) marginal costs of manufacturing, delivery, etc.

Manufacturer volume discounts are paid as rewards for utilization. As such, all else the same, discounts received by patients encourage patients to obtain prescriptions. Discounts received by plans and PBMs incentivize those companies to encourage adherence and proper utilization. These are movements down Figure 1's demand curve away from q_0.

Rebates for plans and PBMs are important elements of benefit-management tools. They increase proper utilization because, among other things, the manufacturer and pharmacy counterparties agree only under the condition that utilization targets are reached or that the plan is designed to facilitate the achievement of sales targets. Regulations that constrain or obstruct the use of benefit-management tools thereby reduce the value created by benefit management. Specifically, they

would reduce utilization, the combined manufacturer discount received by patients and plans, and the productivity of benefit management resources. In terms of the market-level demand analysis, this corresponds to a leftward shift in the marginal management cost curve as shown in Figure 1. The more that the cost curve shifts, the more that utilization and rebate rates are reduced.

Figure 1, whose algebraic representation is provided in Appendix I of Mulligan (2023), is the core of the regulatory-impact model. It shows the brand-utilization effect of any given shift in the blue marginal management cost curve. The figure also shows the effect on the aggregate costs of benefit management, which may increase depending on how the vertical dimension of the marginal cost shift compares to the volume reduction. The brand-brand competition embedded in Figure 1 also permits estimation of the effect of regulation on net prices and manufacturer profits, which would increase in response to higher marginal-management costs as long as the equilibrium point is not shifted beyond the monopoly point on the demand curve.[20]

Additional outcomes are assessed by combining Figure 1 with additional information. Adding information on competition between brands and generics permits assessment of the overall quantity effect, combining both brands and generics. Effects on nonpharmacy medical claims are derived from this quantity effect. Premiums paid for drug and other health insurance plans depend on net price, quantity, regulatory shifts of funds along the supply chain, nonpharmacy medical claims, and the costs of benefit management. Because government subsidizes premiums for drug and other health plans, the premium increases ripple into the wider economy as governments must increase taxes, increase debt, or reduce other government spending.

Mulligan (2022) shows how to derive effects on drug innovation by using different versions of Figure 1 to model the (negative) effect of benefit-management costs on the profits of monopoly brands and the (potentially positive) effect of the profits of manufacturers in markets with brand-brand competition.

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[20] While each manufacturer offers rebates in the baseline in order to increase its own profits, its profits are reduced by the rebates offered by competing manufacturers. PBM regulations can increase aggregate manufacturer profits by suppressing this important means of competition among manufacturers.

Appendix II: Marginal prices drive utilization and are distinct from net and list prices

Consider Figure 1 again. Utilization is driven by the equilibrium marginal price, which is the height where the demand curve crosses the marginal cost curve inclusive of management costs. The marginal price is distinct from (and less than) the net price, which is the height of the negotiated outcome. Algebraically,

$$net\ price * q = [1 - r(q)]Lq$$

(1)

where q is the brand quantity purchased by the plan, L is the list price, and $r(q)$ is the rebate rate as a function of utilization. From (1) we find the plan's marginal cost m of utilization by differentiating net drug spending with respect to q:

$$m = \frac{d}{dq}\{[1 - r(q)]Lq\} = [1 - r(q)]L - r'(q)Lq < [1 - r(q)]L < L$$

(2)

Volume discounting not only means that the net price $[1-r(q)]L$ is less than the list price, but that the marginal cost m is less than the net price. Volume discounting makes branded drugs particularly cheap at the margin, even less than the brand net price. This is exactly what supports levels of utilization that are near (or, as in the Lakdawalla and Sood (2013) model, equal) to the competitive level and greater market surplus than would occur without volume discounts.

Furthermore, reducing the list price and rebate without increasing the marginal rebate $r'(q)$ would *increase* the marginal price. As shown by the $r'(q)Lq$ term in equation (2), the marginal rebate is worth less at lower list prices.

The marginal price m is allocated between the plan and the patient according to the plan's cost sharing formulas. Often cost sharing is proportional to list price, which means that reduced list price may result in a lower patient cost sharing at least if there is no change in the drug's position in the plan's formulary. But given m, a lower marginal price for the patient means a greater

marginal price for the plan. While a reduced patient cost sharing may encourage patients to utilize, the increase marginal price to the plan financially discourages the plan to encourage adherence and other drivers of proper drug utilization. At best, these two effects of reallocating the marginal price along the supply change cancel. If not, the reallocation of payment from patient to plan likely discourages utilization (Mulligan 2023). More important, the overall marginal price m is not constant but rather will increase as a result of reduce list price and rebates. That is, the plan takes on more financial obligation at the margin than the patient gives up.

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