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The balance of probabilities vs. the balance of harms in merger control☆

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ABSTRACT

I examine the difference between the balance of probabilities and the balance of harms standards in merger control. I show that both standards take into account the entire distribution of post-merger outcomes, but the former focuses on the median outcome whereas the latter focuses on the mean outcome. Consequently, a shift from a balance of probabilities to a balance of harms standard broadens the set of mergers that are blocked if the distribution of post-merger outcomes is skewed to the left and conversely if it is skewed to the right.

1. Introduction

In many jurisdictions, including the U.S., the EU, and the UK, the standard of proof in merger control is a "balance of probabilities" or "preponderance of evidence": a merger is blocked if the probability that it will give rise to a substantial lessening of competition (SLC) is above 50%; otherwise, the merger is allowed to go through (see e.g., OECD, 2024).[1] Recently, it has been argued that this standard is too cautious and should be replaced by a "balance of harms" standard, where the probability of each outcome is weighted by its consumer surplus effect. For example, Furman et al. (2019) argue that the balance of harms standard "would provide a strong, clear, rational, economically sound approach to appraising mergers" (Furman et al., 2019, Paragraph 3.100). They also argue that in merger cases involving potential competition and harm to innovation, a "balance of harms" standard "would only broaden the set of mergers which may be found problematic" (Furman et al., 2019, Paragraph 3.97). The balance of harms standard is also advocated by Katz and Shelanski (2007) and Motta and Peitz (2021). For instance, Motta and Peitz (2021) write: "the relevant criterion should be that the expected gains in consumer welfare from competition are larger than the gains that would come from the upgraded offer of the merging firm. Such a balance-of-harm approach has been proposed by Furman et al. (2019), and we fully agree with it." Cabral (2023) develops and calibrates a game of startup innovation, incumbent acquisition, and merger review, and estimates that moving from a balance of probabilities standard to a balance of harms standard increases welfare by 15%.

Which standard of proof is used in merger control is obviously an important question. In this paper, I contribute to the discussion by considering a formal model that compares the balance of probabilities and the balance of harms standards.[2] The model clarifies the difference between the two standards and shows that it is more subtle than one may think at first glance. In particular, the model shows that both standards take into account the entire distribution of the welfare effect of the merger, but under a balance of harms standard, a merger is blocked if the mean welfare effect is negative, while under a balance of probabilities standard, it is blocked if the median welfare effect is negative. Consequently, if the distribution of the welfare effect of the merger is skewed to the left (there is a long tail of negative potential effects) then the balance of harms will indeed broaden the set of mergers which may be blocked. But if the distribution of welfare effect of the merger is skewed to the right (there is a long tail of positive potential effects) then the balance of harms will narrow the set of mergers which may be blocked rather than broaden it.

2. Comparing the two standards

To compare the two standards, consider a merger which, if approved, leads to an outcome y (say consumer surplus). Absent a merger,

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[1] Salop (2024) argues that the standard of proof in the U.S. is in fact more "interventionist" because the agencies should only show by a preponderance of the evidence that the merger "may be" likely to substantially lessen competition rather than "will" substantially lessen competition.

[2] For a legal perspective on the shift from the balance of probabilities standard to a balance of harms standard, see e.g., Levy et al. (2020) and Thorson (2024).

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the counterfactual outcome is c. Let $x \equiv y - c$ be the "welfare effect of the merger" and assume that x is distributed over an interval $[x_0, x_1]$, where $x_0 < 0 < x_1$, according to a distribution function, $F(x)$. When $x < 0$, the merger gives rise to an SLC and should be blocked; otherwise the merger should be allowed to go through.

Under a balance of probabilities standard, the merger is blocked if it is more likely than not to cause an SLC. That is, if

$$\int_{x_0}^{0} f(x)\,dx \equiv F(0) < 1/2.$$

Since the median welfare effect of the merger, denoted $\hat{x}$, is defined by $F(x) = 1/2$, it follows that a balance of probabilities standard amounts to assessing whether $\hat{x}$ is negative or positive. If $\hat{x} < 0$, the merger is blocked and if $\hat{x} \geq 0$, the merger is allowed to go through.

Under a balance of harms standard, the merger is blocked if the expected welfare effect of the merger is negative:

$$\int_{x_0}^{x_1} x f(x)\,dx \equiv \overline{x} < 0.$$

Comparing the two standards reveals that in both cases, the entire distribution of welfare effects of the merger is taken into account, but each standard focuses on a different summary static of the distribution. The balance of probabilities standard examines whether the median of the distribution is negative or positive, whereas the balance of harms standard examines whether the mean of the distribution is negative or positive.

Proposition 1. *Under a balance of probabilities, a merger is blocked if and only if $\hat{x} < 0$. Under a balance of harms, a merger is blocked if and only if $\overline{x} < 0$. Hence, a shift from a balance of probabilities standard to a balance of harms standard will broaden the set of mergers which may be blocked if $\hat{x} > \overline{x}$ (the distribution of the welfare effect of the merger is skewed to the left) but will narrow it if $\hat{x} < \overline{x}$ (the distribution of the welfare effect of the merger is skewed to the right).*

Proponents of the balance of harms standard argue that it is superior to the balance of probabilities standard because it takes into account not only the "likelihood" of outcomes, but also their "magnitude." Proposition 1 shows however that the difference between the two standards is more subtle. In particular, the difference is not due to the fact that one standard takes into account more information than the other. Rather, the difference is that the two standards focus on two different summary statics of the distribution of welfare effect of the merger.[3]

In particular, Proposition 1 shows that whether a shift from a balance of probabilities to a balance of harms standard will broaden the set of mergers that would be blocked depends on the skewness of the distribution of welfare effect of the merger. If the distribution is skewed to the left (we expect a long tail of negative outcomes), then the median is above the mean, so indeed, shifting from a balance of probabilities to a balance of harms standard would "broaden the set of mergers which may be found problematic" as Furman et al. (2019) argue. But if the distribution of the welfare effect of the merger is skewed to the right (we expect a long tail of positive outcomes), then the opposite is true.

Proposition 1 has the following implication: suppose that the uncertainty in market outcomes is driven by some variable z, distributed over the interval $[z_0, z_1]$ and assume that the mean and median of z are equal and given by $\hat{z}$. Let $W^*(z)$ and $W^{**}(z)$ be the objective functions of the antitrust agency (say consumer surplus or total welfare) before and after the merger, as a function of z, and let $\Delta W(z) \equiv W^{**}(z) - W^*(z)$ be the welfare effect of the merger. Suppose that $\Delta W(z)$ is monotonic in z. Then the median value of $\Delta W(z)$ is $\Delta W(\hat{z})$. The mean value of $\Delta W(z)$ is $E(\Delta W(z))$. Under a balance of probabilities standard, the antitrust agency blocks the merger if $\Delta W(\hat{z}) < 0$, whereas under a balance of harms standard, it blocks the merger if $E(\Delta W(z)) < 0$. Now by Jensen's inequality, $\Delta W(\hat{z}) < E(\Delta W(z))$ if $\Delta W(z)$ is strictly convex in z and $\Delta W(\hat{z}) > E(\Delta W(z))$ if $\Delta W(z)$ is strictly concave in z:[4]

Proposition 2. *Let $\Delta W(z) \equiv W^{**}(z) - W^*(z)$ be the welfare effect of the merger and assume that $\Delta W(z)$ is monotonic in z. Then a shift from a balance of probabilities standard to a balance of harms standard will narrow the set of mergers which may be blocked if $\Delta W(z)$ is strictly convex in z, but will broaden it if $\Delta W(z)$ is strictly concave in z.*

3. Examples

The following two examples illustrate Proposition 2. In both examples, the objective of the antitrust agency is consumer surplus, i.e., $W = CS$. The difference is that in the first example, uncertainty is about the post-merger outcome and is driven by the size of a merger-specific synergy; in the second example, uncertainty is about the counterfactual and is driven by the cost efficiency of the target firm absent a merger.

Example 1 (*Merger-Specific Synergies*). There are $n \geq 3$ identical quantity-setting firms which produce a homogeneous good. The inverse demand function is linear and given by $p = A - Q$, where p is the price, $A > 0$ is the choke price, and Q is the aggregate quantity. The cost function of each firm i is kq_i, where $0 \leq k < A$ and q_i is the quantity of firm i. Straightforward computations show that in a Nash equilibrium, the quantity of each firm is $q_i^* = \frac{A-k}{n+1}$, its profit is $\pi_i^* = \left(\frac{A-k}{n+1}\right)^2$, and consumer surplus is $CS^* = \frac{1}{2}\left(\frac{n(A-k)}{n+1}\right)^2$.

Now suppose that two firms merge. Following the merger, the cost function of the merged entity becomes $(k-s)q_m$, where $0 \leq s \leq k$ is a merger-specific cost synergy. The cost of each of the remaining $n-2$ firms remains kq_i. Again, straightforward computations show that the post-merger Nash equilibrium is $q_m^{**} = \frac{A-k+(n-1)s}{n}$ and $q_i^{**} = \frac{A-k-s}{n}$, the equilibrium profits are $\pi_m^{**} = \left(\frac{A-k+(n-1)s}{n}\right)^2$ and $\pi_i^{**} = \left(\frac{A-k-s}{n}\right)^2$, and consumer surplus is $CS^{**}(s) = \frac{1}{2}\left(\frac{(n-1)(A-k)+s}{n}\right)^2$.

Absent a cost synergy ($s = 0$), the model coincides with that of Salant et al. (1983), where a two-firm merger is unprofitable whenever $n \geq 3$. The merger then can be profitable only if s is sufficiently large. Specifically, the merger is profitable if the profit of the merged entity exceeds the sum of the pre-merger profits of the merging firms, i.e., if $\pi_m^{**}(s) > 2\pi_i^*$. The inequality holds whenever

$$s > s_0 \equiv \frac{(A-k)\left(\left(\sqrt{2}-1\right)n-1\right)}{n^2-1}. \tag{1}$$

The merger enhances consumer surplus only if

$$\Delta CS(s) \equiv \underbrace{\frac{1}{2}\left(\frac{(n-1)(A-k)+s}{n}\right)^2}_{CS^{**}(s)} - \underbrace{\frac{1}{2}\left(\frac{n(A-k)}{n+1}\right)^2}_{CS^*} > 0, \tag{2}$$

which holds whenever $s \equiv s_1 > \frac{A-k}{n+1}$. Notice that $s_1 > s_0$: mergers such that $s_0 < s < s_1$ are profitable but harm consumers, whereas mergers such that $s > s_1$ are profitable and benefit consumers. I will assume in addition that $k > s_1$ (otherwise all mergers harm consumers) which requires that $k > \frac{A}{n+2}$.

[3] One may argue that small negative values of x such that $\varepsilon \leq x < 0$ do not represent substantial harm. In that case, under a balance of probabilities, a merger is blocked if and only if $\hat{x} < \varepsilon$, whereas under a balance of harms, it is blocked if and only if $\overline{x} < \varepsilon$.

[4] The result can be generalized to the case where the mean of z, $\overline{z}$, and the median of z, $\hat{z}$, are not equal. If $\hat{z} \leq \overline{z}$ and $\Delta W(z)$ is strictly convex in z, then $\Delta W(\hat{z}) \leq \Delta W(\overline{z}) < E(\Delta W(z))$. If $\overline{z} \leq \hat{z}$ and $\Delta W(z)$ is strictly concave in z, then $\Delta W(\hat{z}) \geq W(\overline{z}) > E(\Delta W(z))$.

Now, assume that initially, the antitrust agency does not know the size of the cost synergy, s, but believes that s is distributed uniformly over the interval $\left[s_0, k\right]$.[5] That is, s is the counterpart of the variable z in Proposition 2. The mean and median values of s are equal and given by $\hat{s} = \frac{s_0+k}{2}$. Noting that $\Delta CS(s)$ is quadratic, Proposition 2 implies that under a balance of harms standard, the antitrust authority may approve some mergers which it would block under a balance of probabilities standard.

To illustrate further, suppose that $A - k = 20$, $n = 6$, and s is distributed uniformly over the interval $[1, S]$, where $S > 1$. The mean and median of s is $\frac{1+S}{2}$. Given that $A - k = 20$ and $n = 6$, $s_0 = 0.849$, so Eq. (1) implies that the merger is profitable for all $s \in [1, S]$ and Eq. (2) implies that it enhances consumer surplus whenever $s > 2.857$. Straightforward computations show that $\Delta CS\left(\frac{1+S}{2}\right) < 0 < E(\Delta CS(s))$ for all $4.703 < S < 4.714$: the merger is blocked under a balance of probabilities standard but is allowed to go through under a balance of harms standard. However, if $S < 4.703$, then $\Delta CS\left(\frac{1+S}{2}\right) < E(\Delta CS(r)) < 0$, so the merger is rejected under both standards, and if $S > 5.44$, then $0 < \Delta CS(\hat{r}) < E(\Delta CS(r))$, so the merger is allowed to go through under both standards. ■

Example 1 shows that a shift from a balance of probabilities to a balance of harms standard would narrow the set of mergers which may be found problematic rather than broaden it as Furman et al. (2019) argue. The next example shows that the opposite can also be true.

Example 2 (*Acquiring an Efficient Rival*). The setting is the same as in Example 1, except for two differences. First, absent a merger, the cost function of one firm, call it t (for target), is $(k - r)q_t$, where r is distributed uniformly over the interval $[0, k]$; the cost function of all other firms remains kq_i. Second, the merger-specific cost synergy, s, is now deterministic and known in advance. The value of r however is not known to the antitrust agency when it examines the merger.

As in Example 1, the post-merger Nash equilibrium is such that $q_m^{**} = \frac{A-k+(n-1)s}{n}$ and $q_i^{**} = \frac{A-k-s}{n}$, the equilibrium profits are $\pi_m^{**} = \left(\frac{A-k+(n-1)s}{n}\right)^2$ and $\pi_i^{**} = \left(\frac{A-k-s}{n}\right)^2$, and consumer surplus is $CS^{**} = \frac{1}{2}\left(\frac{(n-1)(A-k)+s}{n}\right)^2$. Straightforward computations show that absent a merger, the Nash equilibrium is such that $q_t^* = \frac{A-k+nr}{n+1}$ and $q_i^* = \frac{A-k-r}{n+1}$, the equilibrium profits are $\pi_t^* = \left(\frac{A-k+nr}{n+1}\right)^2$ and $\pi_i^* = \left(\frac{A-k-r}{n+1}\right)^2$, and consumer surplus is $CS^*(r) = \frac{1}{2}\left(\frac{n(A-k)+r}{n+1}\right)^2$.

In this example, the merger is profitable if $\pi_m^{**} > \pi_t^* + \pi_i^*$, which holds whenever

$$\left(\frac{A-k+(n-1)s}{n}\right)^2 > \left(\frac{A-k+nr}{n+1}\right)^2 + \left(\frac{A-k-r}{n+1}\right)^2. \tag{3}$$

Assume that s is large enough to ensure that this condition holds. The merger enhances consumer surplus only if

$$\Delta CS(r) \equiv \underbrace{\frac{1}{2}\left(\frac{(n-1)(A-k)+s}{n}\right)^2}_{CS^{**}} - \underbrace{\frac{1}{2}\left(\frac{n(A-k)+r}{n+1}\right)^2}_{CS^*(r)} > 0. \tag{4}$$

Noting that $\Delta CS(r)$ is strictly concave in r (which is the counterpart of the variable z in Proposition 2), Proposition 2 implies that under a balance of harms, the antitrust authority may block some mergers which it would allow to go through under a balance of probabilities standard.

To illustrate, suppose that $A - k = 20$, $n = 6$, $s = 5.22$, and r is distributed uniformly over the interval $[0, 5.5]$. The mean and median of r is $\hat{r} = 2.25$. Eq. (3) holds for all $r \in [0, 5.5]$, so the merger is profitable. Eq. (4) implies that the merger enhances consumer surplus whenever $r < 2.757$. Using (4), it follows that $E(\Delta CS(r)) < 0 < \Delta CS(\hat{r})$ whenever $5.214 < s < 5.223$, implying that the merger is blocked under a balance of harms standard but is allowed to go through under a balance of probabilities standard. However whenever $s < 5.214$, the merger is blocked under both standards as $E(\Delta CS(r)) < \Delta CS(\hat{r}) < 0$, and if $s > 5.223$, the merger is allowed to go through under both standards as $0 < E(\Delta CS(r)) < \Delta CS(\hat{r})$. ■

Example 2 is consistent with Proposition 1 in Cabral (2023), where uncertainty is also driven by how competitive the target firm is going to be absent a merger.[6] Both results show that a balance of probabilities standard is more lenient than a balance of harms standard. This is the opposite of Example 1, where the uncertainty is driven by a post-merger cost synergy. Although it is tempting to conclude that whether one standard is more lenient than the other depends on whether uncertainty is about the post-merger outcome or the about the counterfactual (what happens absent a merger), one has to be cautious as both examples were derived under certain assumptions, e.g., the distribution of the random variable is symmetric. More research is needed to study how robust the conclusions from the two examples are and whether they continue to hold under alternative assumptions.

4. Conclusion

I study the standard of proof in merger control and compare the balance of probabilities standard which is currently used in many jurisdictions (a merger is blocked if it is more likely than not to result in an SLC) and the balance of harms standard which was advocated recently (the expected outcome is worse with a merger than without it). I show that a shift from the former to the latter need not necessarily broaden the set of mergers that are deemed problematic as some commentators have recently argued. Whether it does or does not depends on whether the welfare outcome of the merger is convex or concave in the random variable that drives the uncertainty regarding the effect of the merger. I also consider two examples that suggest that when uncertainty is driven by the competitiveness of the target firm absent a merger, a balance of probabilities standard is indeed more lenient than a balance of harms standard as commentators argue. However if uncertainty is driven by a synergy produced by the merger then the opposite is true. My results suggest that it is not obvious which standard of proof is superior and more research is needed to explore this issue.

Data availability

No data was used for the research described in the article.

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[5] The assumption that $s \geq s_0$ ensures that an observed merger is profitable.

[6] In Cabral (2023) the uncertainty is whether, absent a merger, the target firm will become a substitute or a complement with respect to the acquirer. Here, the uncertainty is about the cost of the target firm absent a merger.

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