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Unilateral effects of partial acquisitions: consistent calculation of *GUPPI* under horizontal merger guidelines within the EU

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Abstract We derive a consistent formula of the Gross Upward Pricing Pressure Index (*GUPPI*) with Council Regulation Horizontal Merger Guidelines (2004) by: (i) expressing the amount of acquired equity stake as a function of the market share of the victim firm and (ii) assuming a logit demand function. The results show that the anti-competitive effects of partial acquisitions are higher in this case than under partial acquisitions with constant equity stakes and that competition authorities should be skeptical when they use traditional screening indicators in order to estimate the unilateral effects of partial acquisitions in Bertrand markets with differentiated products.

Keywords Partial acquisitions · GUPPI · Logit demand · Merger control · Unilateral effects

JEL Classification L41 · L13 · D43

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1 Introduction

The adverse unilateral price effects in the U.S. Horizontal Merger Guidelines (2010) (see DoJ and FTC 2010) rely primarily on the value of sales diverted from one product to another after an increase in the price of one of the products of the merged entity. Section 6 of the Horizontal Merger Guidelines (2010) deals with several common types of unilateral effects of which none of them assumes Herfindahl–Hirschman Index (HHI) and market shares of the merging firms to be appropriate tools for evaluating merger specific unilateral effects.

Particularly, Section 6.1 of the Horizontal Merger Guidelines (2010) states, *inter alia*, that "...[T]he Agencies rely much more on the value of diverted sales than on the level of HHI for diagnosing unilateral price effects in markets with differentiated products. If the value of diverted sales is proportionately small, significant unilateral price effects are unlikely.[...]Where sufficient data are available, the Agencies may construct economics models designed to quantify unilateral price effects resulting from the merger...These merger simulation methods need not rely on market definition...".

Within the European Union (EU), the Council Regulation Horizontal Merger Guidelines (2004) (see OJ C 31/5, 2004) are based on a number of factors which may influence unilateral effects (or non-coordinated effects in the guidelines' jargon), if the latter are likely to arise from a merger. One of them is the market shares of the merging firms. According to Paragraph 27 of the Council Regulation Horizontal Merger Guidelines (2004) "....[T]he larger the market share, the more likely a firm to possess market power. And the larger the addition of the market share, the more likely it is that a merger will lead to a significant increase in market power." (OJ C 31/5, 2004, para 27, p. 8).

Moreover, with respect to mergers in markets with differentiated products, even though the Council Regulation Horizontal Merger Guidelines (2004) state that "[t]he higher the degree of substitutability between the merging firms' products, the more likely is that the merging firms will raise price significantly." (OJ C 31/5, 2004, para 28, p. 8), they do not explicitly state that *HHI* and market shares of the merging firms are not appropriate tools for evaluating unilateral effects of horizontal acquisitions. Therefore, in most merger cases the Agencies within EU use *HHI* and the market shares of the merging firms to evaluate merger specific unilateral effects, even in markets with differentiated products. This contradicts the economic theory and as a consequence lawyers and policy makers find difficulties in supporting merger cases in the courts.

The motivation of this paper is to derive a more consistent formula of the Gross Upward Pricing Pressure Index (*GUPPI*) with Council Regulation Horizontal Merger Guidelines (2004) for assessing the unilateral effects of partial acquisitions. For this purpose we (i) express the amount of acquired equity stake as a function of the market share of the victim firm and (ii) assume a logit demand function. Regarding the former, the amount of acquired equity stake in a rival is an increasing function of the acquired firm's market share. Following Willig (1991) firms decide to link the amount of acquired equity stake with respect to the market share of the

victim firm since the greater the market share of product 2 the more attractive the product is in the eyes of the consumers and the greater the probability to be acquired by the owner of product 1. In other words, the greater the attractiveness of product 2, the higher the number of marginal consumers who will divert to it after an increase in the price of product 1. Therefore, under this view, victim's market share plays a crucial role in determining the degree of consumer diversion from product 1 to product 2. Moreover, the partial acquisition increases the profitability of the acquiring firm depending on the market share of the victim firm.[1]

The rationale behind the use of a logit demand function to assess the unilateral effects of partial acquisitions stems directly from Paragraph 28 of the Council Regulation Horizontal Merger Guidelines (2004). According to it "...a merger between two producers offering products which a substantial number of customers regard as their first and second choices could generate a significant price increase.". Under a logit demand function, the greater the market share of product 2, the greater the number of consumers of product 1 who value product 2 as the second best choice (assuming that product 1 is the best choice for the consumer).

The results of this paper show that the anti-competitive effects of partial acquisitions are higher when equity stakes are expressed as a function of the market share of the acquired firm than under constant equity stakes. Particularly, we show that the *GUPPI* is downward biased when the percentage of equity stakes of the acquirer in the target firm is assumed to be constant. Expressing the acquired equity stake as an increasing function of the acquired firm's market share implies that given the market share of the acquiring firm, the higher the market share of the acquired firm, the higher the market share of the merged entity.

The paper is organized in the following way. Section 2 reviews the literature and Sect. 3 presents the basic model. In Sect. 4, we derive the formula of *GUPPI* and provide some basic comparisons between *GUPPI* with and without constant equity stakes. Lastly, in Sect. 5 we conclude the paper by providing some policy implications.

2 Literature review

Economists have estimated in detail the potential anti-competitive effects of partial acquisitions, in terms of static and dynamic perspective. Partial acquisitions may harm competition either unilaterally or via coordinated effects. More specifically, they decrease the level of competition in the market by enhancing cooperation among firms or by increasing the probability that a firm will abuse its dominant position. Regarding the static effects of partial acquisitions, the relevant literature shows that they decrease consumer welfare by increasing the product price and reducing its quantity. The magnitude of these effects depends on the share of the

[1] Deneckere and Davidson (1985) use a demand function first proposed by Shubik (1980) and state that acquisitions in Bertrand markets with differentiated products are always profitable since the products are assumed to be strategic complements. Huck et al. (2001) have also stated that in Stackelberg markets with quantity competition two leaders have only the incentive to merge if the number of leaders in the market is equal to 2.

target's profits to which the acquiring firm is actually entitled as a result of the acquisition, and the ability of the acquiring firm to materially influence the target's strategic behavior.[2]

Horizontal unilateral effects of partial acquisitions have been extensively examined in both Cournot and Bertrand markets. In their seminal paper, Reynolds and Snapp (1986), argue that if the level of partial acquisitions increases among firms in a homogeneous product Cournot market without entry, then the equilibrium market output will decline. The authors calculate the *HHI* appropriately adjusted [Adjusted Herfindahl–Hirschman Index (AHHI)] to reflect the effects of ownership interests due to the presence of partial acquisitions.

In another study, Bresnahan and Salop (1986), assume the case of a joint venture in a homogeneous product Cournot market with n production units, the profits of which are shared between two firms[3] and calculate the Modified Herfindahl–Hirschman Index (MHHI). The latter depends on the type of control the two firms have over the joint venture. O'Brien and Salop (2000) develop a general formula of *MHHI* which depends on the relative degree of ownership control among firms.

Farrell and Shapiro (1990) state that in a homogeneous product Cournot market if a firm slightly increases its minority interest in another firm in the market then total output will decrease even thought the other firms in the market without a minority shareholding increase their output. However, if a small firm acquires a minority shareholding in a competitor, in which it previously has no interest at all, then welfare may increase and *HHI* decreases. Flath (1991) states that in a Cournot market with homogeneous products it is not strategically efficient (profitable) for each firm to acquire minority shareholding in its rival. Moreover, Dietzenbacher et al. (2000) state that under Cournot competition, when firms increase the level of minority shareholdings in each other, their price-cost margins also increase.

In Bertrand differentiated product markets, O'Brien and Salop (2000), develop the formula for the percentage increase in firm i's product price (ΔPPI) after the acquisition of a minority shareholding in firm j's equity capital with and without cost reductions (efficiencies) resulting from the acquisition. In both cases ΔPPI depends on the so-called 'diversion ratio', namely the marginal ratio between the greater sales of good j over the reduced sales of good i, both induced by a higher price from firm i (Hausman et al. 2011; Shapiro 1996). Dietzenbacher et al. (2000) conclude that in the presence of partial acquisitions $L \geq \frac{1}{\eta}$, where L is the Lerner Index and η is the own-price elasticity of demand.

Foros et al. (2011) examine a 3-firm Bertrand model with differentiated products and compare the profitability of two firms engaged in a full merger with the profitability of a partial acquisition in which the acquiring firm although acquires less than 100 % of the target's equity capital is able to obtain corporate control over

[2] Pro-competitive effects of partial acquisitions have also been examined in the literature. See, for instance Amundsen and Bergman (2002), Brito et al. (2014a), Clayton and Jorgensen (2005), Ono et al. (2004).

[3] See also the European Commission (EC) cases COMP/39.595 Continental/United/Lufthansa/Air Canada, decision of 23 May 2013 and COM/39.596 BA/AA/IB, decision of 14 July 2010.

all its pricing decisions. The authors conclude that the anti-competitive effects and joint profits are enhanced more in the latter rather than in the former case.

Willig (2011) calculates the Upward Pricing Pressure (UPP) and the *GUPPI* in the presence of minority interests.[4] The mathematical condition for *UPP* of products 1 and 2 is, $m\frac{(p_2^0-c_2^0)D_1^2(p_1^0,p_2^0)}{-p_1^0D_1^1(p_1^0,p_2^0)} > \frac{c_1^0-c_1}{p_1^0}$, where $(p_2^0 - c_2^0)D_1^2(p_1^0, p_2^0)$ is the value of diverted sales from product 1 to product 2 evaluated at the pre-merger values, $(p_2^0 - c_2^0)$ is the margin between price and cost for the diverted sales, $D_1^2(p_1^0, p_2^0)$ is the volume of sales added to the demand for product 2 as a result of an increase in the price of product 1, $c_1^0 - c_1$ are the cost efficiencies due to the partial acquisition and m is the percent of firm 2 acquired by firm 1. The mathematical formula of *GUPPI* is $m\frac{\left(p_2^0-c_2^0\right)D_1^2\left(p_1^0,p_2^0\right)}{-p_1^0D_1^1\left(p_1^0,p_2^0\right)}$. Alternatively, *GUPPI* can be calculated with respect to price p_i as $GUPPI = m\frac{p_2^0-c_2^0}{p_1^0}DR_{1,2}$, where $DR_{1,2}$ is the diversion ratio.

Shelegia and Spiegel (2012) show that under cost asymmetries (different levels of constant marginal costs) among firms with partial acquisitions, the equilibrium price may be as high as the monopoly price of the most efficient firm in the market. Brito et al. (2014b) propose a structural method of identifying the unilateral effects of horizontal partial acquisitions based on the studies of Brito et al. (2014a) and O'Brien and Salop (2000).

Lastly Brito et al. (2015), propose generalizations to *HHI* and *GUPPI* indexes which can be used to assess any form of acquisition (i.e., the acquisition of a rival or a firm that is currently out of the market but is engaged in common-ownership schemes, direct or indirect with firms in the market).[5] By providing an empirical application to several partial acquisitions in the wet shaving industry, the authors conclude that (i) the unilateral effects of a full merger are higher than in partial acquisitions (ii) a partial controlling acquisition induces higher unilateral effects than a partial non-controlling acquisition and (iii) an acquisition by a firm in the market induces more anti-competitive effects than an acquisition by firms outside the market that participate in more than one competitor firms in the market.

However, all the above measures used in Bertrand markets with differentiated products in order to assess the unilateral effects of partial acquisitions do not coincide with the traditional European Union (EU) Horizontal Merger Guidelines where the assessment of market shares plays a fundamental role (see the discussion in Sect. 1).

[4] The versions of *UPP* and *GUPPI* accounting for full acquisitions were introduced by Farrell and Shapiro (2010) and Salop and Moresi (2009), respectively. Regarding *UPP* with non-symmetrical firms and static competition with differentiated products, see Mathiesen et al. (2012).

[5] A firm's minority shareholding is called direct (indirect) when it holds it directly (indirectly) in another firm without (through) the intervention of a third firm. See for instance Fotis and Zevgolis (2016), p. 25-26.

3 The model

Assume a Bertrand market with differentiated products and 2 firms. In the pre-acquisition stage, each firm i ($i = 1, 2$) chooses its price p_i to maximize its profits $(p_i - c_i^0)Q^i(p_i, p_{-i})$ where c_i^0 denotes the marginal cost of firm i, and Q^i and p_{-i} are the demand function and the price of the ith competitor, respectively. The equilibrium prices p_i^0 in the pre-acquisition stage are given by the solution to the following system of equations:

$$(p_1^0 - c_1^0)Q_1^1(p_1^0, p_2^0) + Q^1(p_1^0, p_2^0) = 0 \tag{1}$$

$$(p_2^0 - c_2^0)Q_2^2(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0) = 0 \tag{2}$$

where Q_j^i is the derivative of Q^i with respect to p_j (with $j = 1, 2$).

In the post-acquisition stage where m percent of firm 2 is acquired by firm 1, the profits of firm 1 are given by

$$\Pi_1^m = (p_1 - c_1^0)Q^1(p_1, p_2) + m(p_2 - c_2^0)Q^2(p_1, p_2) \tag{3}$$

In (3), we assume that the marginal costs do not change in the post-acquisition stage. In contrast to the existing literature about *GUPPI* calculation, m is determined 'endogenously' in our analysis.[6] More specifically m is assumed to be a function of target firm's market share, i.e. $m = m(Q^2/(Q^1 + Q^2)) = m(p_1, p_2)$. Hence, the post-acquisition change in the profits of firm 1 with respect to a change in p_1 is given by

$$\begin{aligned}\frac{\partial \Pi_1^m}{\partial p_1} &= (p_1 - c_1^0)Q_1^1(p_1, p_2) + Q^1(p_1, p_2) + m'(p_1, p_2)k(p_1, p_2)(p_2 - c_2^0)Q^2(p_1, p_2) \\ &\quad + m(p_1, p_2)(p_2 - c_2^0)Q_1^2(p_1, p_2)\end{aligned} \tag{4}$$

where $m' > 0$ is the derivative of m with respect to $Q^2/(Q^1 + Q^2)$ with $m'' < 0$[7] and $k(p_1, p_2) = \frac{Q_1^2(p_1,p_2)Q^1(p_1,p_2) - Q_1^1(p_1,p_2)Q^2(p_1,p_2)}{[Q^1(p_1,p_2)+Q^2(p_1,p_2)]^2}$.

4 Derivation of *GUPPI*

Evaluating (4) at the pre-acquisition price levels (Willig 2011), we get

$$\begin{aligned}\left.\frac{\partial \Pi_1^m}{\partial p_1}\right|_{p_i = p_i^0} &= (p_1^0 - c_1^0)Q_1^1(p_1^0, p_2^0) + Q^1(p_1^0, p_2^0) \\ &\quad + m^0(p_2^0 - c_2^0)\left[Q_1^2(p_1^0, p_2^0) + (m^{0\prime}k^0/m^0)Q^2(p_1^0, p_2^0)\right]\end{aligned} \tag{5}$$

[6] The term 'endogenously' refers to the decision of firm 1 to link the acquired equity stake with the market share of the victim firm. In this paper we are not interested in modelling the incentive of firm 1 to follow this strategy.

[7] Since we focus on partial rather than full acquisitions, we assume here that m increases as the market share of the victim firm increases but at a decreasing rate.

where superscript '0' denotes the pre-acquisition values of the variables (i.e., $m^0 = m(p_1^0, p_2^0)$ and $k^0 = k(p_1^0, p_2^0)$).

From (1) and by rearranging, we get that the condition for *UPP* is

$$m(p_1^0, p_2^0) \times \frac{(p_2^0 - c_2^0)DR_{12}}{p_1^0} \times \left[1 + \frac{\epsilon_m^0 Q^2(p_1^0, p_2^0)}{Q^1(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0)} \times \left(\frac{Q^1(p_1^0, p_2^0)}{Q^2(p_1^0, p_2^0)} + \frac{1}{DR_{12}}\right)\right] > 0 \quad (6)$$

where ϵ_m^0 is the elasticity of m with respect to the target firm's market share evaluated at the pre-acquisition prices, $DR_{12} = Q_1^2(p_1^0, p_2^0)/ - Q_1^1(p_1^0, p_2^0)$ is the "diversion ratio".

Proposition 1 *If the percentage of equity stakes of the acquirer in the target firm is determined by the market share of the target firm, then the GUPPI is given by*

$$GUPPI^{ncon} = m(p_1^0, p_2^0) \times \frac{(p_2^0 - c_2^0)DR_{12}}{p_1^0} \times \left[1 + \frac{\epsilon_m^0 Q^2(p_1^0, p_2^0)}{Q^1(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0)} \times \left(\frac{Q^1(p_1^0, p_2^0)}{Q^2(p_1^0, p_2^0)} + \frac{1}{DR_{12}}\right)\right] \quad (7)$$

Proposition 2 *The GUPPI is downward biased when the percentage of equity stakes of the acquirer in the target firm is assumed to be constant. The degree of biasness is captured by* $\frac{\epsilon_m^0 Q^2(p_1^0, p_2^0)}{Q^1(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0)} \times \left(\frac{Q^1(p_1^0, p_2^0)}{Q^2(p_1^0, p_2^0)} + \frac{1}{DR_{12}}\right) > 0$.

Proof Proposition 2 comes straightforwardly from Propositions 1 and the value for the *GUPPI* with constant percentage of partial equity stakes, $\tilde{m}$, as defined by Willig (2011). If we pick a value for $\tilde{m}$ which is equal to $m(p_1^0, p_2^0)$, then it can be easily shown that $GUPPI^{ncon} - GUPPI^{con} = GUPPI^{con} \times \frac{\epsilon_m^0 Q^2(p_1^0, p_2^0)}{Q^1(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0)} \times \left(\frac{Q^1(p_1^0, p_2^0)}{Q^2(p_1^0, p_2^0)} + \frac{1}{DR_{12}}\right) > 0$, where $GUPPI^{con}$ denotes Willig' s *GUPPI*.[8] □

According to Proposition 2, there is a degree of biasness between Willig's model of *GUPPI* and our specification. Specifically, we argue that when m is considered to be constant, then *GUPPI* exhibits a downward biasness. The level of this biasness depends on the elasticity of m with respect to target firm's pre-acquisition market share, the pre-acquisition market share of the target firm, the inverse of the diversion ratio and the relative market share of the acquirer to the target firm. The downward biasness of Willig's *GUPPI* increases with all these measures.

[8] Dividing both sides by $GUPPI^{con}$, we get that the percentage change in *GUPPI*s is equal to $\frac{\epsilon_m^0 Q^2(p_1^0, p_2^0)}{Q^1(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0)} \times \left(\frac{Q^1(p_1^0, p_2^0)}{Q^2(p_1^0, p_2^0)} + \frac{1}{DR_{12}}\right)$.

4.1 The case of the logit demand function

In this subsection, we reproduce our results under a logit demand function. The reason why we examine this special case is that the assumption that the amount of acquired equity stake can be expressed as a function of the market share is mainly underpinned by the existence of logit preferences (Anderson and Palma 1990).[9] Moreover, we aim at providing a tractable example for policy makers. By assuming a logit demand function, demand for good i will be:

$$Q^i(p_i, p_{-i}) = \frac{e^{-\gamma p_i}}{\sum_{j=1}^{2} e^{-\gamma p_j}} \tag{8}$$

where $\gamma \in (0, 1)$ is a positive constant denoting the rate of substitution between the products (the lower the γ, the greater the differentiation between products).

By performing the same analysis as above, we get the following Propositions:

Proposition 3 *If the percentage of equity stakes of the acquirer in the target firm is determined by the market share of the target firm and demand is approximated by the logit specification in* (8)*, then the GUPPI is given by:*

$$GUPPI^{ncon}_{\log it} = \hat{m}(\hat{p}_1^0, \hat{p}_2^0) \times \frac{\left(\hat{p}_2^0 - c_2^0\right)}{\hat{p}_1^0} \times \left[1 + \hat{\epsilon}_m^0\right] \tag{9}$$

where $\hat{p}_i^0$ *(for* $i = 1, 2$*) denotes the equilibrium pre-acquisition price of firm i under* (8) and $\hat{\epsilon}_m^0$ *and* $\hat{m}$ *are the analogous of* ϵ_m^0 *and m under* (8)*, respectively.*

Proof Straightforward direct calculations. □

Proposition 4 *If the demand is approximated by the logit specification in* (8)*, then the GUPPI is downward biased when the percentage of equity stakes of the acquirer in the target firm is assumed to be constant. The degree of biasness is captured by* $\hat{\epsilon}_m^0$.

Proof The value for the *GUPPI* with constant percentage of partial equity stakes, $\check{m}$, and the logit demand function in (8) will be $GUPPI^{con}_{\log it} = \check{m} \times \frac{(\hat{p}_2^0 - c_2^0)}{\hat{p}_1^0}$. From Proposition 3 and by setting $\check{m}$ equal to $\hat{m}(\hat{p}_1^0, \hat{p}_2^0)$, we get $(GUPPI^{ncon}_{\log it} - GUPPI^{con}_{\log it})/GUPPI^{con}_{\log it} = \hat{\epsilon}_m^0 > 0$. □

In order to illustrate the biasness of *GUPPI* when the percentage of partial equity stakes is not expressed as a function of the market share of the acquired firm, we simulate the results in Section 3.1 for different values of the elasticity of the percentage of the target firm acquired with respect to the target firm's market share. For simplicity, we assume that this elasticity is constant.

A notable result from Fig. 1 is that as the rate of substitution increases (i.e., the level of differentiation between the two products decreases), the unilateral effects of mergers decrease.

[9] However, this does not diminish the value of the general model.

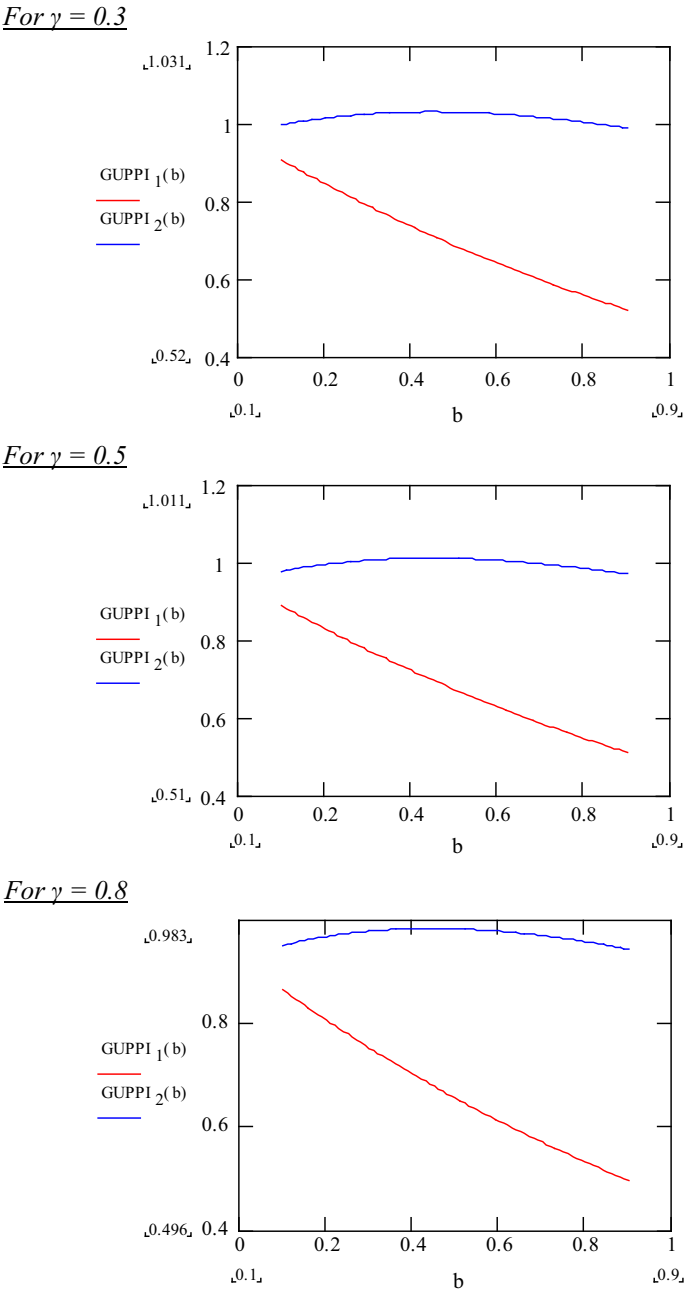

Fig. 1 Bias in *GUPPI* under a logit demand function. Note: We assume the following functional forms and parameter values: $c_1^0 = c_2^0 = 0.2$, $m^0 = \left[\frac{Q^2(p_1^0, p_2^0)}{Q^1(p_1^0, p_2^0) + Q^2(p_1^0, p_2^0)}\right]^b$, where $b \in (0, 1)$ is the elasticity of the percentage of the target firm acquired with respect to the target firm's market share, $\gamma = 0.3, 0.5, 0.8$. $GUPPI_1(b) = GUPPI_{\log it}^{con}$ and $GUPPI_2(b) = GUPPI_{\log it}^{mcon}$

5 Conclusions and policy implications

Market shares and *HHI*, unlike US, continue to play a crucial role in determining merger unilateral effects within the European Union. Policy makers and lawyers find difficulties in supporting traditional screening indicators of unilateral effects of mergers, such as *UPP* and *GUPPI*, in the courts.

In this paper, we derive the formula of *GUPPI* by arguing that the amount of acquired equity stake depends on the market share of the victim firm. Furthermore, we examine the special case of a logit demand function since the assumption that the amount of acquired equity stake can be expressed as a function of the market share is mainly underpinned by the existence of logit preferences. Thus, we calculate a more efficient screening indicator in alignment with the traditional merger guidelines within the EU.

The results show that the anti-competitive effects are higher when equity stakes are expressed as a function of the market share of the acquired firm than under constant equity stakes. These results are consistent with the EU merger guidelines, which focus on the market share of the merged entity with respect to the overall market; given the market share of the acquiring firm, the higher the market share of the acquired firm, the higher the market share of the merged entity.

Therefore, we argue that competition authorities should be skeptical when they use traditional screening indicators in order to estimate the unilateral effects of partial acquisitions in Bertrand markets with differentiated products. The skepticism is not stemmed only from the above mentioned results, but also from the fact that our *GUPPI* formulation can be easily supported by lawyers in the courts since it is based on the market shares' perspective.

Lastly, in this paper we examine the effects of the decision of the acquiring firm to link the acquired equity stake with the market share of the victim firm. Modelling the incentive of a firm to follow this strategy constitutes a topic for future research.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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