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Testing the contestable market theory in eSports

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ABSTRACT
This article contributes to the development of contestable market theory by investigating how competitiveness in the eSports industry influences the size of this industry, as measured by the volume of monetary prizes. We use data on each gamer's prize earnings for each tournament from 1999 to 2015 to estimate panel vector autoregression (V.A.R.) model with fixed effects. The main finding is that competition does not increase industry size. This result confirms the hypothesis from the contestable market theory that perfect competition does not always facilitate better development, especially in industries where natural barriers result in a small number of leading firms or teams.

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1. Introduction

The cyclical evolution of markets and competition has always been a debatable issue in industrial organisation. In more traditional economic theories, it is assumed that competition is at the core of industry/market development. However, numerous studies address a reverse relation by asserting that industry growth, in turn, often affects the level of competition: bigger markets are more attractive for new companies. Early studies like those by Bailey and Baumol (1984); Baumol (1982); Malerba and Orsenigo (1996) mainly addressed regulation versus deregulation paradigms by looking for empirical evidence that a large number of competitive firms is not always the best solution for industry growth. The contestable market theory – tested on different oligopolistic and even monopolistic markets – demonstrates that natural entry barriers under low state regulation may create sufficient incentives for extensive and intensive growth. Hurdle et al. (1989) analyse one of the most apparent contestable markets – the airline industry – and affirm that no regulatory interference is required to induce industry development. An oligopolistic structure appears to be the most efficient way to enable long-term sustainability and growth. Graham (1998), Langridge and Sealey (2000), Morrison and Winston (1987) conducted similar

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research on other oligopolistic markets. More recent studies examine the banking, insurance, and telecommunication sectors by testing a naturally established equilibrium with a high concentration of professional actors on the market (see Chen & Tanaka, 2018; Huang & Liu, 2014; Pearcy & Savage, 2015).

Eventually, there is a new stream of literature which is discussing not just cases fitting contestable market theory but provides some insights on its ambiguity. These studies reconsider mostly positive and negative externalities associated with monopolistic pricing, decreasing social welfare, and deadweight loss from not competitive equilibrium. That is the case in papers by Cabon-Dhersin and Drouhin (2020), Dai et al. (2019) and Liu (2019). All the potential consequences from the inherent contestability of specific markets maybe, meanwhile, corrected if those failures would be predicted in due course.

Hence, this study contributes to the development of contestable market theory and its practical implications by challenging 'the competition and industry growth' problem through an analysis of one of the emerging industries of eSports, which may be considered a relevant case of potential contestability. Notably, that traditional sports present a similar structure, with a limited number of teams or players that compete in leagues or tournaments and may be considered a relevant case if not traditional regulatory context, which disables pure experimentation. However, much potential exists for exploring this newly born industry, which appears to be developing as professional sports did. Meanwhile, eSports is currently the most unregulated sport in the sector.

This article aims to study the effect of a tournament's level of competition on its attractiveness and popularity. We use eSports data to construct an empirical model to measure this effect. ESports provides a perfect setting to capture the impact of a league's concentration for the following reasons. First, there are no competition restrictions imposed by the league's administration. Second, the entry costs are significantly lower compared to other sports leagues. Third, an eSports team maximises its results like a firm tends to maximise its profit. Fourth, leagues are not affected by any country-specific laws.

Rewards and, therefore, the revenue-sharing scheme, in eSports are mostly performance-based, while in a majority of traditional sports, a significant share of an athlete's or a team's compensation is independent of their current match results. This makes our findings potentially transferable to other industries, since eSports organisations have similar incentives to firms. Finally, since in eSports tournaments, teams and individuals are organised similarly, it is possible to compare the competition between teams and individuals.

This study examines whether naturally developing competition in eSports has led this market to grow and the industry to become more attractive for viewers, sponsors, and businesses. We test the contestable market theory, hypothesising that any professional sport tends to higher concentration due to talent-driven performance and skills accumulation as critical factors of sporting success. The hypothesis of this study is operationalised on testing the bidirectional causality between industry growth and dynamically changing concentration of well-performing teams. If the hypothesis-driven of contestable market theory would be confirmed – meaning that higher

concentration of the teams leads to higher commercial attractiveness of the industry and drives its growth – the conclusion may have several important policy implications. Among those, the most important addresses lesser regulation imposed to keep a higher number of teams in the market artificially. By testing the reverse causality, the controversial relation of stimulus created for new entrants must be explored. Thereby, if causality in at least one direction is found, does it imply new requirements for the governance of this fast-growing market, and can the eSports experience can be transmitted to other professional sports, which are traditionally more regulated?

This study uses data on each gamer's prize earnings for each tournament (in nominal US dollars) from 1999 to 2015, collected from the eSports Earnings project (http://www.esportsearnings.com/). In particular, we focus on games with the longest history to have a longer time span: Counter-Strike, StarCraft, and WarCraft. Note that StarCraft and WarCraft are individual games, while Counter-Strike is a team game.

The remainder of this article brings both a theoretical discussion and empirical tests of the hypothesis of contestable market theory in the specific context of the eSports industry. We expect to contribute to the development of this theory by analysing a unique case of a barely regulated but fast-growing industry. This industry appears to have perfect conditions for demonstrating an unconstrained evolution of the market, which may converge to an oligopolistic structure due to its specific nature. If contestability in the eSports industry is evidenced, it might have several implications, including those that can classify this kind of sport within a particular case of governance and development mechanisms.

2. Contestable market theory: a different perspective of competition

The concept of perfect competition had been dominating the evolution of economic thought until the 1980s. This idea underpinned most of the practice of antitrust regulation by putting particular emphasis on firm size and market power as well as entry and exit barriers (Bailey & Baumol, 1984). The first conceptual paper that introduced a holistic view of contestable market theory by Baumol (1982) shows that some markets are subject to economies of scale in a broad sense, including required knowledge and competencies accumulation. This article opened a new line of research on contestable markets more than 35 years ago. It was a continuation of Adam Smith's '*laissez-faire*' and deregulation movements, which, in turn, brought substantial implications for governmental interference in specific sectors and markets. One of the phenomena discovered in the contestability hypothesis was referred to as 'hit and run'. It demonstrates the short-term opportunistic behavior of new entrants in markets where no regulatory barriers on entrance and exit exist (Agliardi, 1990; Paech, 1998). This strategy, having a stable Nash-equilibrium, asserts that if small firms penetrate a market with a priori insufficient scale to win a competition sustainably, they seek to gain short-term benefits and exit this market as soon as possible. This behavior brings distortion and can even have fatal consequences for the development of an industry. Therefore, it is no wonder that small firms are not pillars for the development of

such markets and should not be supported, according to the followers of the contestability theory.

Notably, a body of empirical studies, leaning on vast statistics and quasi-experimental data, demonstrated that oligopolistic markets work better in transportation (Graham, 1998; Hurdle et al., 1989; Langridge & Sealey, 2000; Lukyanov et al., 2018), finance (Carow, 2001; Chen & Tanaka, 2018; Cruz-García et al., 2018; Dickens & Philippatos, 1994; Mulyaningsih et al., 2016; Mulyaningsih et al., 2015), and telecommunication (Pearcy & Savage, 2015; Trubnikov, 2020). Summing up the key findings of the papers as mentioned above, the following claim can be advocated: self-regulation of markets with naturally growing entry barriers appears to bring better general equilibrium for the market than imposed antitrust regulation. This idea underpins the fundamental contestable market hypothesis and promises substantial changeovers for the markets where it may effectively work. In the transportation and telecommunication industries, effortless oligopolistic competition with a low risk of collusion leads to a higher quality of services. It pushes down prices, inducing demand and industry growth. In banking and insurance, higher capital consolidation allows for better diversification, with better warranties and client protection. Importantly, all cases redefine the role of professionalisation, which serves as a key driver of development by attracting more investments and sustainability. Anticipating this empirical evidence, the importance of knowledge accumulation was discussed more than 20 years ago by Rashid (1988), followed by Malerba and Orsenigo (1996).

Furthermore, Bailey and Baumol (1984), at the start of contestability theory, suggested that excessive regulation of such markets may bring consequences that are adverse rather than just ineffective, finding regulation itself to be 'among the primary causes of unsatisfactory industry performance'. A more recent empirical study by Chen and Tanaka (2018) supports this fact, explicitly pointing out why conventional methods should not regulate firms in contestable industries. For that, permit and product markets under imperfect competition and imperfect intertemporal arbitrage have been examined.

The empirical testing of the contestability hypothesis is eventually based on the statistical inference, which enables causality between the number of firms and industry performance expressed in the level of quality, pricing mechanisms, and competitive effectiveness (Cabon-Dhersin & Drouhin, 2020; Dai et al., 2019). The most recent empirical tests like those by Cruz-García et al. (2018); Suleman (2020) referrers to the level of concentration of firms, which brings specific focus on market structure. Thus, the comprehensive view on competition level demonstrates that under particular conditions of contestability, counterintuitive market outcomes must be naturally expected. That, in turn, implies a reconsideration of interference and regulatory policies.

On the whole, the mainstream of contestability theory followers seems to be consistent in providing new evidence of the 'invisible hand' as the best solution for oligopolistic and monopolistic competition. However, looking more carefully at the examples of contestable markets, one can notice that nearly all of them experience specific regulation, even though firm enlargement and high entry barriers are not a result of external pressure. This makes the results of experiments and hypothesis

testing somewhat distorted and probably biased since the isolation of all other interference is not plausible. Moving away from the conventional consideration of industrial-organisation settings but trying to mitigate possible criticism of noisy experimental data, we suggest testing the hypothesis on the emerging eSports industry. State of the art regarding the current stage of its development and regulation is given in the next section.

3. Contestability and deregulation in eSports

The history of eSports tournaments is quite long. The first event took place at Stanford University in 1972. It was called the 'Intergalactic Spacewar Olympics', and the prize was a subscription to *Rolling Stone* magazine (Hiltscher & Scholz, 2015). However, the industry of eSports events has evolved considerably during the last decade (Parshakov and Zavertiaeva 2018). Approximately 115 million hardcore enthusiasts watched eSports in 2015, and another 115 million were occasional viewers. Those numbers are expected to continue to increase, reaching 427 million by 2019. Despite this fact, there are a few studies that analyse the economics of eSports, and our goal is to fill this void.

In particular, we concentrate on the determinants of performance. The primary source of funding for this industry comes from game developers, which act as sponsors of tournaments on different levels. Unlike 'traditional' sports, eSports still does not have any league structure and is not regulated in terms of revenue-sharing and competitive-balance rules. Video games attract people from all over the world. Initially, they were just a form of entertainment, and no professionalisation of this industry was expected. However, in recent years, video games have become a recognised sport with professional players, very significant fundraising and viewership, and, as a result, new challenges for its governance. So-called eSports tournaments attract up to thousands of people who watch the competition among individuals or teams in a specific video game. With that, the eSports industry has experienced exponential growth in recent years. The number of tournaments, teams, and sportspersons, the volume of prizes, and the sales of producers are the primary evidence of that growth. This advancement, being rather unexpected and rapid, has created in this industry a unique phenomenon within sports – an unregulated, self-developing market with practically no entry barriers or imposed regulation.

Given that the eSports industry is considered a sport, it shares some features with the 'traditional' sports industry. However, it has some of its particular features, as well. Precisely, sports leagues have used their characteristics to justify avoiding some antitrust laws. The most developed professional sports are organised as leagues. They can be open – with promotion and relegation – as is the case of Europe, or closed, as in North America. But in both cases, the number of teams that take part in the sport competition does not change. In fact, they are like oligopolies. The eSports industry is still in an early stage of its development, and for that reason, is not much regulated. In that sense, the number of competitors can vary, and this can influence the level of competition and prize-money sharing.

The 'traditional' professional sports industry is characterised by dominant leagues that, together with the clubs, exercise economic power unconstrained by rivals or the threat of entry, often featuring market-division schemes (Ross, 2003). But also, when entry barriers are high, as in the case of sports, the teams might have to compete with other entertainment industries (Alexander, 2001). However, the panorama could be different when no high entry barriers exist, as Byford and Gans (2019) analyse. As for now, the eSports industry is not regulated in the way that traditional sports are. This provides an interesting ground to investigate the growth of that particular market and to analyse what could happen in the future with it. Meanwhile, there is a current discussion about whether regulation of eSports ought to be introduced and whether this interference should be similar to other sports or be specific to the nature of the new emerging professional video gaming tournaments (Chao, 2017).

The issues of market structure and regulation are the central points in most of the operations of professional sports leagues (Cyrenne 2009). In the case of eSports, there is not a clear line of operation, as there are not many professional leagues yet. As Coates and Parshakov (2016) mention, major eSports tournaments usually are live events, but there are also lower-level online events. A tournament may be a part of a more considerable competition that consists of several events (e.g., Dreamhack), or a competition may consist of just one major event (e.g., World Cyber Games). Note that in eSports, the difference between leagues and tournaments is not significant. Even the most popular 'league', Electronic Sports League (E.S.L.), organises series of tournaments in different games. Therefore, during one year, each team can decide in which tournament to participate and form its schedule. Round-robin tournaments, which are typical for traditional sports leagues, are not famous in eSports. The only exceptions are the first six seasons Starladder Starseries of Dota2 and regional-level tournaments in the League of Legends.

Despite their participation in different tournaments, teams can be compared at any time by the prize money won; unofficial ratings are available at https://esportsearnings.com. In our analysis, we use the term 'league' for the group of teams that participate in tournaments in a particular eSports discipline or game (e.g., Counter-Strike). The number of tournaments and leagues has been rising continuously in recent years, but the number of international events has grown more slowly. In 2018, there were 13 international tournaments/leagues. The number of tournaments per year might be treated as the number of matches a team participates in within the league.

Rottenberg (1956) and Neale (1964), in their seminal papers, show that excessive dominance of a particular team will reduce interest in the competition and develop the so-called Uncertainty of Outcome Hypothesis (U.O.H.). Borland (1987) tested the U.O.H. using data from Australian Rules football; Soebbing (2008) used M.L.B. data to test it. At the same time, however, evidence for the U.O.H. is not always convincing: for example, Parshakov and Baidina (2017) tended to reject it for Russian football.

It should be noted that in most leagues, revenue sharing has been introduced to reduce sports-dominance effects. A team is interested in increasing its sports performance to increase its prestige and revenues. However, if one team dominates the other teams, this might decrease the popularity of the competition and therefore

reduce team revenue. For this reason, leagues have introduced different schemes of revenue sharing. There is evidence that revenue sharing, in general, contributes to keep leagues competitive (El-Hodiri and Quirk 1971; Kesenne 2000), though there are different results for regulation and self-regulation schemes (Vrooman 1995; Szymanski 2003). That is not the case in eSports and makes it interesting to study it.

4. Five reasons to test the eSports industry for contestability

ESports, not being a traditional industry for either sports or business, should be precisely dissected to make it understandable for analysis. On the other hand, there are evident traits that relate to its commercial capacity and pursuit. On the one hand, eSports teams raise funds from winning tournaments. Therefore, the reward is mostly performance-based, and all teams compete for the same prize pool or revenue. In this sense, teams are similar to traditional firms. Besides, eSports teams do not act as traditional clubs in other professional sports and do not perform as a conventional firm on the market. They are seeking to regularly win prize money in tournaments and ensure their sustainable professional development; only a few teams have stated financial provisions and professional management. That conditions the specific nature of the entire industry.

However, five reasons to expose the eSports industry to a test of the contestability hypothesis can be claimed:

1. *ESports is a predominately knowledge-led industry.* Knowledge and skills consolidation drive the professionalisation of teams. It creates natural barriers where newcomers can barely win competitions and receive prizes, which makes them not sustainable in the long-term. However, '*hit and run*' behavior may take place since entry costs are fairly low, and no substantial risk of taking part in tournaments exists, even if the probability to defeat more experienced rivals is tiny.
2. *The main source of capital comes from game developers who are using these tournaments as sales drivers.* That implies that capital providers seek more spectacular professional competition and would prefer a 'fierce battle' among fewer relatively equal rivals rather than the predictable outcome of a significant number of beginners. Meanwhile, attractiveness for game developers alone may induce industry growth. It means that sponsors of eSports tournaments may prefer monopolistic or oligopolistic markets rather than perfect competition. Moreover, one of the pivotal issues of the eSports industry refers to the various spillover effect produced by tournaments (see Parshakov et al., 2020)
3. *The absence of regulation, which enables pure experimental data.* Unlike other professional sports, no league structure and revenue sharing is imposed on eSports tournaments. That allows for the examination of historical and current data, which has documented the natural evolution of this industry, mitigating all possible consequences of regulatory interference. The same applies to antitrust control, which substantially affects all other industries and sectors by restricting the consolidation of capital in a small number of firms.

Table 1. Descriptive statistics.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Gini	320	0.523	0.181	0.020	0.415	0.662	0.837
Prize	320	1,748,429.000	5,465,181.000	41	21,416.5	911,935.5	45,119,836
N_teams	320	16.650	22.546	2	3	21.2	116
N_tournaments	320	52.225	103.895	1	6	45.5	621

Source: Authors' own elaboration.

4. *Evident information asymmetry in the industry.* Asymmetry and implicit knowledge are considered two of the critical markers of contestability. If the natural leaders of the market are significantly better informed about the hidden mechanisms that underpin success in the industry, new entrants have fewer chances to outperform their more-experienced rivals. Such a situation appears to exist in the eSports industry, where no technologies have been published and become common knowledge so far.
5. *ESports is one of the most data-rich professional sports.* Due to its nature, eSports tournaments generate huge amounts of data that can be structured and processed for empirical analysis. That makes eSports not just fit within the scope of contestable markets but also able to be used for testing hypotheses relevant for contestable markets.

5. Data

We use data from the www.esportsearnings.com project. It is a community-driven eSports resource based on freely available public information for both major and minor tournaments. We have scraped the data with R script (R Core Team 2018), which is available upon request. The sample includes all tournaments which were held during the period from 2000 till 2019. Also, the sample includes the distribution of prizes among the teams during this period. So, we observe the number of tournaments, total prizes, and the individual reward of the teams, as well as the number of teams. The number of observations in the original data set is 46,140. For the analysis, the data has been aggregated to the team-game-year level as some teams participate in competition of different games. Descriptive statistics are presented in Table 1.

The points of inequality often measure the level of competition in sports. In traditional industries, revenue inequality is often used. Since the reward is performance-based, and there are no points in eSports, we use prize money inequality to measure the competitiveness level. The Gini coefficient is used as the metric, but the results are robust to other metrics (Theil index, coefficient of variation, and Herfindal-Hinchman index). As one can see, the degree of competitiveness varies considerably: the minimum for the Gini coefficient is slightly above zero, and the maximum is close to one. The prize varies even more: from US$41 million to US$45 million by year (note that this is the prize money of tournaments of different games by year). The number of teams varies from two to 116.

Interestingly, the mean value is 17, which is close to the number of teams in some traditional sports leagues (e.g., European football leagues). The number of tournaments ranges from one to 621. The average number of events each year is 52.

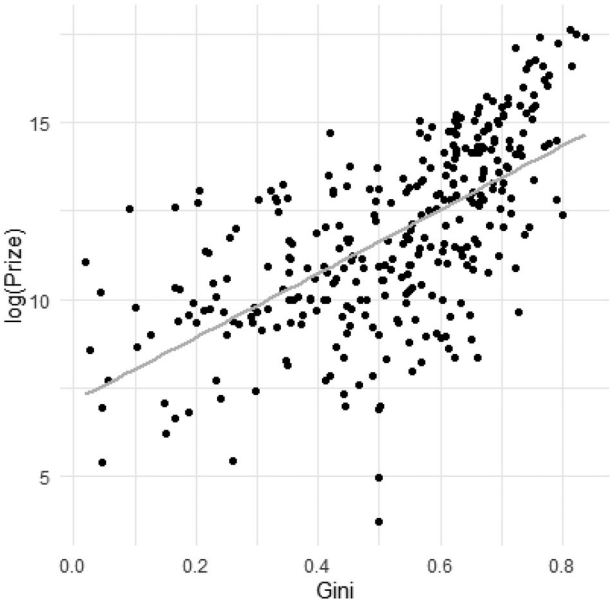

Figure 1. Scatterplot of the Gini ratio and Prize.

Such a considerable variation should be the result of the difference among games. This is important from an empirical point of view. First, we should address this issue with an appropriate methodology. Second, high variation potentially improves the validity of our analysis: we have the proper amount of variation, which allows us to capture the effect. In traditional sports leagues, the number of teams, games, and tournaments is almost the same during recent decades, whereas in eSports, the number of teams, prize size, and number of events is changing dramatically.

Figure 1 illustrates the correlation between the logarithm of the prize and the Gini coefficient. As one can see, these variables are interdependent. However, we need to understand the causal effects. This is what we will do next.

6. Methodology

To empirically test the contestable market theory, we estimate the relationship between competition and prize. It is challenging because these variables simultaneously affect each other. For this reason, we use vector autoregression (V.A.R.). This approach allows us to estimate the reaction of one variable (for example, the Gini coefficient) to a shock in another variable (for example, Prize) in case of mutual interdependence between these variables. All variables in the model are included in the same way. Each variable has an equation explaining its current value based on its own lagged values and the lagged values of the other variables. Such an approach does not require the same knowledge about the forces influencing a variable as structural models. The only thing which is required is a list of variables that can affect each other.

This method was proposed to be used in economics context by Sims (1980), who applied it to macro-level analysis. Sims argues that V.A.R. models provide a theory-

free method to estimate economic relationships, thus being an alternative to the 'incredible identification restrictions' in structural models (Sims 1980). This approach might be used as an exploratory tool that helps to reveal causal relations without a well-developed underlying theory. Of course, V.A.R. has some limitations. First, standard methods of statistical inference (such as computing standard errors for impulse responses) may give misleading results if some of the variables are highly persistent. Another limitation is that V.A.R. does not account for nonlinearities, conditional heteroskedasticity, and drifts or breaks in parameters.

Since the data present a panel structure, the estimation is done using panel V.A.R. This is an advantage, since we can control for the unobservable heterogeneity between games (Love and Zicchino 2006; Naidenova and Parshakov 2013). This technique helps to combine the advantages of V.A.R. with the advantages of panel data, allowing us to take into account the individual heterogeneity of games. In other words, we use mean-differencing to exclude the effect of games and make our results more robust.

This article estimates panel V.A.R. of the second order. The choice of order is based on the information criteria. We perform four tests, which indicate that the order should be 1 or 2 (AIC = 2, HQ = 1, SC = 1, FPE = 2). We have chosen 2 to make sure our model is able to capture the relationship of different lags.

$$z_{i,t} = \alpha + z_{i,t-1} \cdot \beta_1 + z_{i,t-2} \cdot \beta_2 + f_i + e_{it} \tag{1}$$

Where $z_{i,t}$ is a vector of four variables {Prize, Gini, Number of teams, Number of tournaments} andf_i is the company's individual fixed effect.

To analyse the impact of a shock to one variable on another variable, we estimate *impulse-response functions* (I.R.F.). These functions allow for an understanding of how a shocked variable (e.g., Gini) affects another variable (e.g., Prize), keeping other shocks to other variables (e.g., number of teams) constant. The x-axis of this function represents time, and the y-axis represents re response of variable to shock (one standard deviation increase) of another. We discuss the interpretation of I.R.F. in the results section. To estimate the confidence intervals for I.R.F., we use the bootstrap approach, since it is difficult to derive the distribution of I.R.F. analytically. The bootstrap approach allows for an approximation of this distribution empirically. We use the 'vars' package by Pfaff (2008) for the empirical analysis.

7. Empirical results

Before estimating the V.A.R., we have done the Granger test to confirm that there is a relation between our time series. As we have four variables, we run four Granger tests for each variable as a 'cause' variable. The null hypothesis is that there is no instantaneous causality between the cause variable and the rest three. Table 2 below summarises the results. Note that the degree of freedom is three for all tests.

As one can see, all tests show that we can reject the null hypothesis of no dependence in each case. Interestingly, the effect of industry growth on competition and number of tournaments is positive. Hence, the more this industry is developed, the higher number of events and the level of competition takes place. The fact that the

Table 2. Granger test results.

Cause		p-value
Prize	110.08	2.2e-16
Gini	73.861	6.661e-16
N teams	110.48	2.2e-16
N tournaments	70.762	2.887e-15

Table 3. Empirical results of VAR equations.

	Dependent variable:			
	Prize	Gini	N teams	N tournaments
Prize (one-year lag)	0.156*	0.005	−0.286	−5.373*
	(0.082)	(0.008)	(0.677)	(2.913)
Gini (one-year lag)	−0.033	−0.033	1.345	14.464
	(0.705)	(0.069)	(5.803)	(24.977)
N teams (one-year lag)	0.008	0.001	0.374***	−0.556
	(0.010)	(0.001)	(0.082)	(0.355)
N tournaments (one-year lag)	0.005***	0.00005	0.077***	1.087***
	(0.002)	(0.0002)	(0.015)	(0.065)
Prize (two-year lag)	−0.059	−0.002	−0.394	−0.489
	(0.082)	(0.008)	(0.676)	(2.911)
Gini (two-year lag)	1.004	0.028	2.094	6.883
	(0.706)	(0.069)	(5.816)	(25.037)
N teams (two-year lag)	−0.004	−0.0004	0.072	0.603*
	(0.010)	(0.001)	(0.081)	(0.348)
N tournaments (two-year lag)	−0.001	0.0001	−0.032**	−0.303***
	(0.002)	(0.0002)	(0.016)	(0.067)
Const	−0.002	−0.00002	−0.004	−0.005
	(0.072)	(0.007)	(0.596)	(2.567)
Observations	318	318	318	318
R^2	0.143	0.029	0.405	0.664
Adjusted R^2	0.121	0.004	0.389	0.655
Residual Std. Error (df = 309)	1.291	0.126	10.633	45.769
F Statistic (df = 8; 309)	6.431***	1.140	26.244***	76.325***

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

industry growth induces competition points out that we are considering one of the clear cases of the contestable market theory. This theory, in turn, claims that if a market structure has the traits of contestability, no imposed regulation is required to have a stable equilibrium at a competitive price. Thus, such industries on a particular stage of their development can be effectively self-regulated. However, the Granger test doesn't allow us to estimate the effect of a particular variable on another, so we continue our analysis by employing the V.A.R. estimator.

Table 3 contains the results of the estimations. Note that since we have four endogenous variables, it is challenging to understand the marginal effects from this table. For that reason, we report below the I.R.F.s. However, it should be noted that all models are statistically significant: the lowest value of F joint test statistics is 2.465. This allows us to interpret the I.R.F.s. We also report some diagnostic plots in the Appendix, which shows the absence of autocorrelation in the residuals.

The rest of the section contains I.R.F. plots. For each variable, we have four plots. Each plot contains the response of one variable to a shock to all of the other variables. The x-axis represents the period (in years) for all of the plots. Figure 2 presents

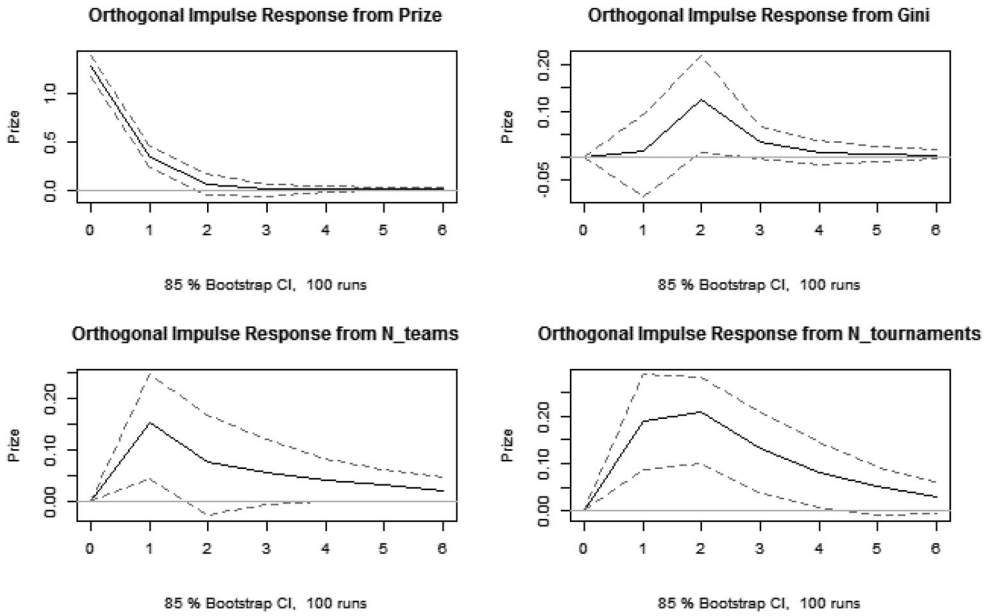

Figure 2. Impulse-response function for Prize.

I.R.F.s for the Prize variable. The first plot of the figure shows that if there is a shock (positive increase with a size of 1 standard deviation) to prize in the current period, this would cause an increase of prize also in the next two years. The confidence interval for the next plot of Figure 2 shows a significant effect of the Gini Prize in the second year. Therefore, there is evidence that the decrease in competition in two years affects industry size. The bottom plots of Figure 2 show that the number of teams and number of tournaments positively affect Prize with a one-year lag. Therefore, the number of competitors and events increases the industry's size. If we consider both factors together, we can say that with more participants, the industry will grow. However, to increase the size of the industry, the competition has to be more unbalanced (higher Gini coefficient). We can say that there is an organic growth due to the number of competitors and events, and at the same time, there is a growth with origin in a concentration of 'talented' players and events. This is in line with what the contestable market theory says – few firms that can bring advanced knowledge to the market will contribute to the development of the industry. This can bring higher spillover effect and enhance the industry development and growth (Parshakov et al., 2020).

Figure 3 shows the I.R.F.s for Gini. First, the shock of Prize increases Gini, but the effect lasts for only one year. Probably, the more money invested in this industry, the higher the interest and the number of gamers and teams. Importantly that this effect lasts for one year only, which may witness that the reaction of gamers is immediate and mitigates rather fast; this is probably due to low entry costs in the eSports industry: one can organise a team and start competing without substantial investments.

The same holds for the Gini coefficient itself. The bottom plots show that the number of teams does not affect competition, but the effect of the number of tournaments on Gini is positive after two years. It means that competition decrease – it is

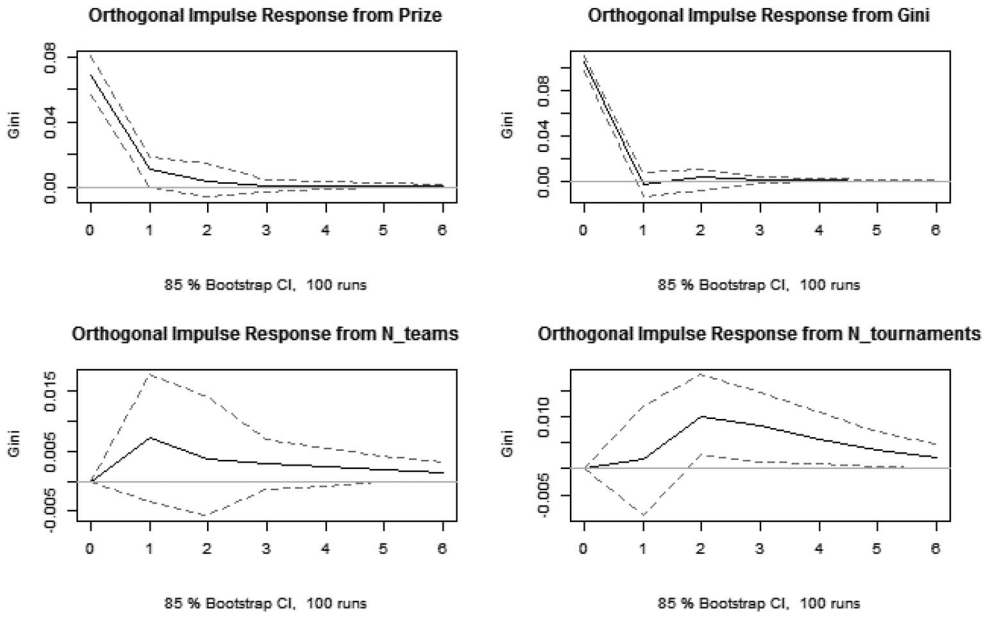

Figure 3. Impulse-response function for Gini.

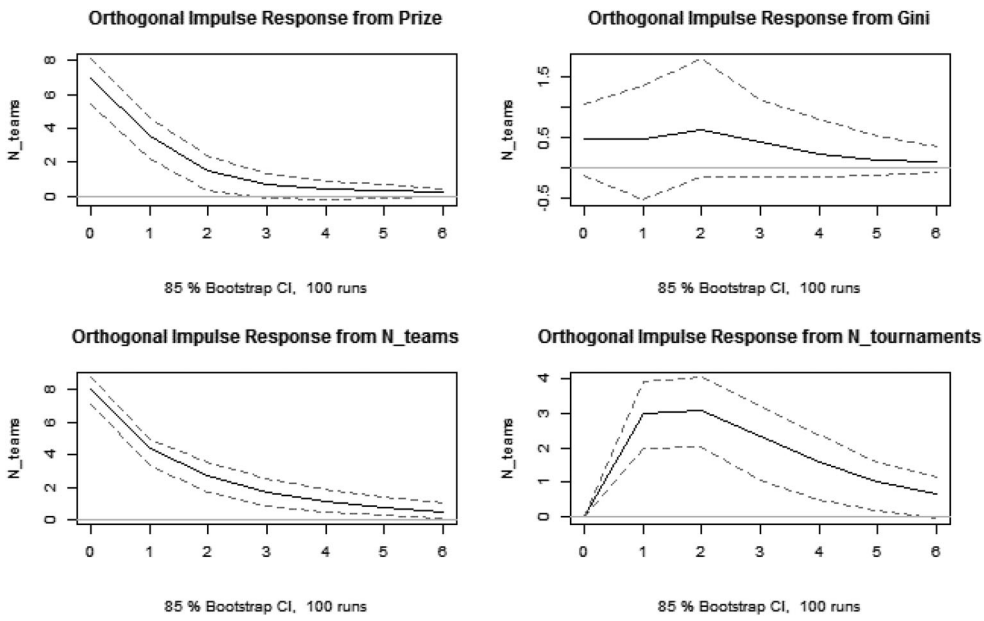

Figure 4. Impulse-response function for Number of teams.

more unbalance. Therefore, the number of tournaments decreases competition with a significant time delay.

Figures 4–5 contain the I.R.F.s for the number of teams and tournaments, respectively. The expected result is that they are not affected by competition. Still, an increase in prize money has a positive effect on them.

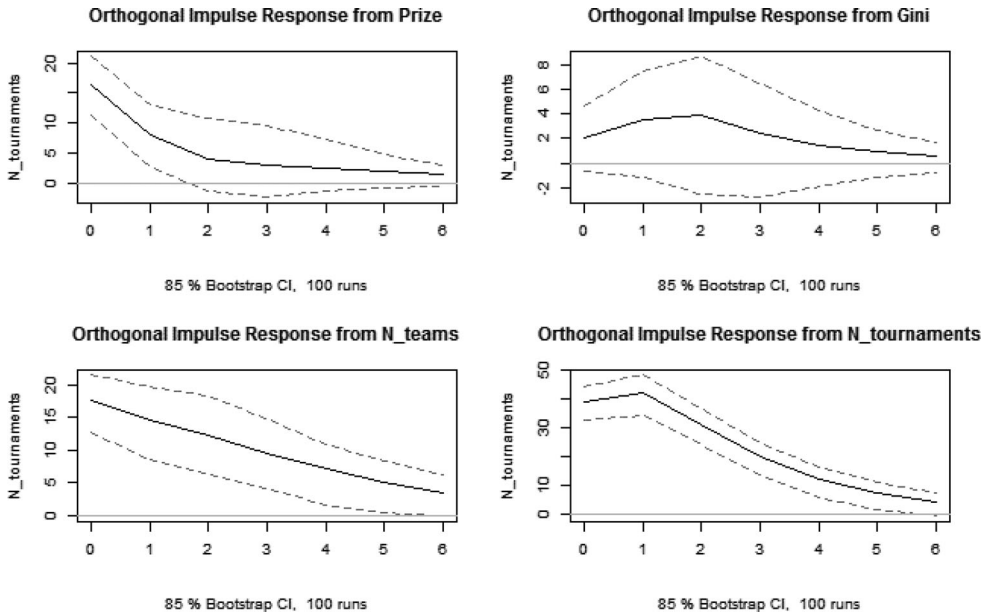

Figure 5. Impulse-response function for Number of tournaments.

8. Conclusion

In this article, we have tested the contestable theory using data from one of the non-conventional industries, which evidently has a tendency to converge to natural oligopolistic or monopolistic competition and has not been affected by any regulation, so far. ESports is considered an emerging, fast-growing market in professional sports, attracting significant financial resources and inducing new individuals and teams to enter tournaments. This issue appears to be relevant for the research exercise, contributing to empirical evidence of the well-known contestable hypothesis. We believe that eSports also represents a unique case of a pure self-developing market and can be considered as an excellent example of reshaping sports governance, which is not usually questioned in other professional sports. Furthermore, eSports provides us with a relevant setting to estimate this effect mainly because of the absence of country-specific law regulations. Eventually, several interesting findings that are highlighted hereafter provoke a discussion of governance regimes not only for eSports but also for other industries and markets.

The main result of this article is that unbalanced competition increases industry size. Interestingly, the reverse relation is significant: industry size decreases competition, but the effect disappears after one year. What has been observed is that the prizes tend to concentrate on a smaller number of competitors. This is in line with contestable market theory, which implies that eSports has enormous potential for self-regulation. There is also a broader implication: we have found that industry development reduces the level of competition, but the industry is still evolving. Hence there is any evidence of contestability, which implies no regulation for better equilibrium. According to our findings, on the current stage of the eSports development, no external regulation is required to make it better off, and inherent self-regulation of the contestable market

works better due to low levels of heterogeneity and high opportunities for self-selection and professional advancement of teams. Unlike traditional professional sports, where the inequality between top well-established teams and new teams is significant and challenges normal competition if no regulation is imposed, eSports does not experience these distortions and demonstrates all features of effective competition. Thus, we assert that self-regulation in the eSports industry works for now, but perhaps would require external regulation upon reaching its matured stage in some years. The studies of which features are able for self-regulation and which do not seem to be an interesting idea for future research. The effect on the number of teams is in line with the other results: it has been found that as there are no entry barriers, new competitors can enter, but their chances to get a share of the market are scarce. At the same time, strong competitors are getting stronger and dominating the industry.

The practical implication of this research with respect to the future management of eSports can be formulated as follows: eSports professionals may benefit from the historical records of regulation of the other sports by not introducing excessive regulation before these measures are crucial indeed. The better response to the current challenges of eSports development would be to observe and register all the factors of evolution predicting the nearest trends. However, no strong interference may induce faster and better development of the market, making it more attractive for viewership, sponsors, and investors. Nevertheless, at the time when the industry growth rate will decrease, team managers and game publishers might decide to introduce regulation, which is similar to traditional sports.

This study is subject to two main limitations in terms of the external validity of our results. First, eSports teams are somewhere between traditional sports teams and traditional firms. Second, the industry is rapidly evolving, so the findings might not be transferrable to the well-established industries. We, however, believe that eSports might be used as a source of data to test how firm behavior change in the digital industries.

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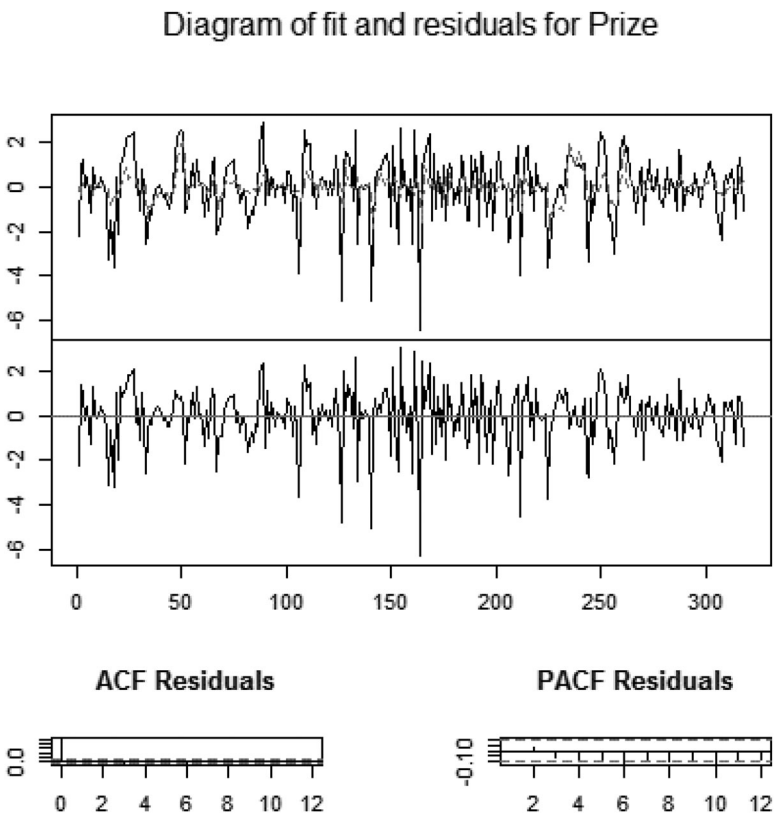
Appendix. Diagnostic plots of panel VAR



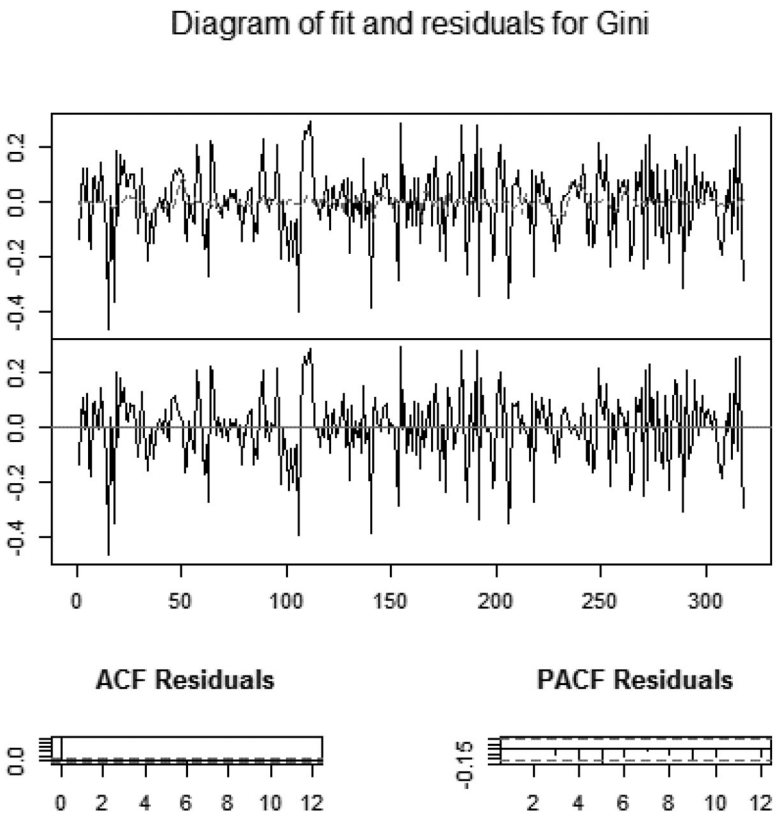


Diagram of fit and residuals for Gini
0.2
0.0
-0.2
-0.4
0
50
100
150
200
250
300
ACF Residuals
PACF Residuals
0.0
-0.15
0
2
4
6
8
10
12

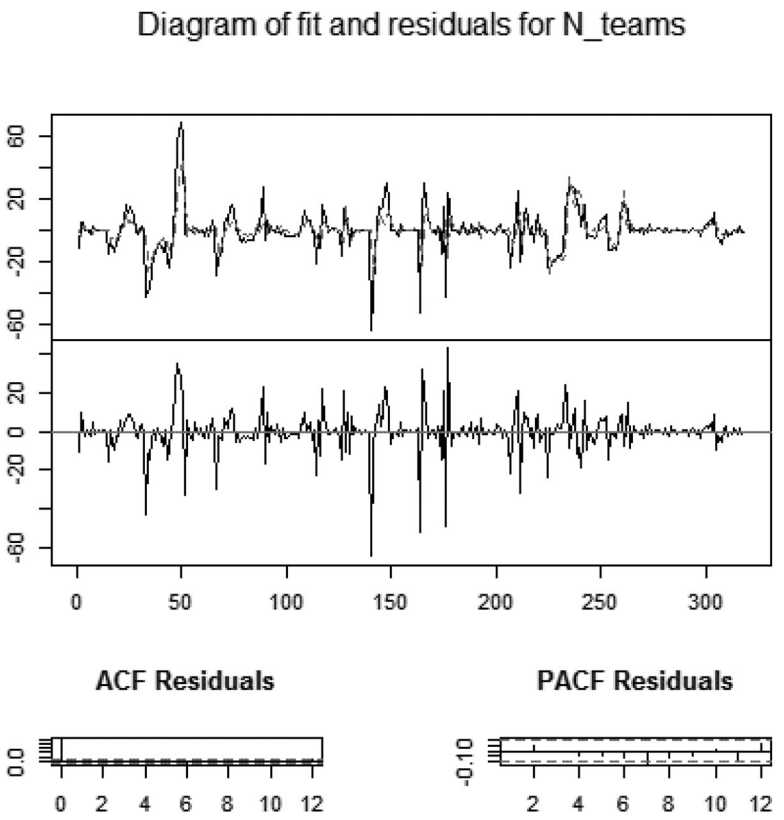


Diagram of fit and residuals for N_teams
60
20
-20
-60
20
0
-20
-60
0
50
100
150
200
250
300
ACF Residuals
PACF Residuals
0.0
-0.10
0
2
4
6
8
10
12
2
4
6
8
10
12

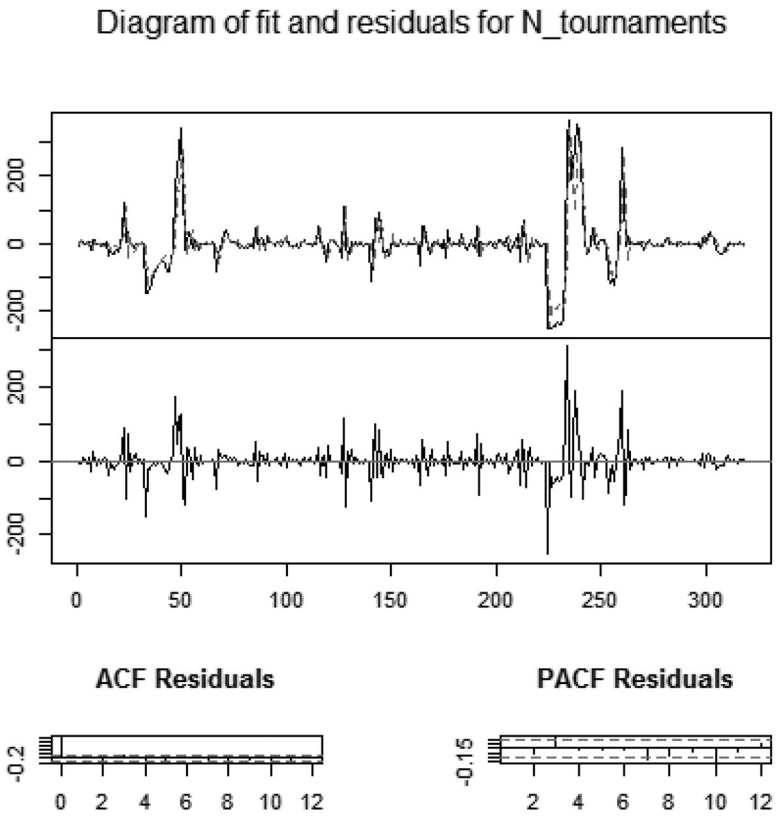


Diagram of fit and residuals for N_tournaments
200
0
-200
200
0
-200
0
50
100
150
200
250
300
ACF Residuals
PACF Residuals
-0.2
0
2
4
6
8
10
12
-0.15
2
4
6
8
10
12