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"IS THE VIDEO GAMES INDUSTRY RECESSION-PROOF?"

Master's Thesis

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I have written this Research paper/Bachelor Thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

Abstract

This master's thesis investigates the relationship between GDP growth and video games revenues' growth by testing for the presence of Granger-causal relationships between GDP growth rates and video game revenue growth rates through the application of VAR models, IRF curves, and the Toda-Yamamoto (1995) Granger Causality method; using Video Games Revenues' annual Growth Rates (*Total* and by *segment*) and GDP Growth Rates of *North America*, *Europe & Central Asia*, *East Asia Pacific*, and *South Asia* from 1972 to 2019. Our analysis shows no general evidence of GDP growth rates Granger-causing Video Games Growth rates, except in the region of *North America* for the *console* segment and *video games industry*. We also find strong evidence that the mobile gaming revenue is granger-caused by GDP growth in *Europe & Central Asia* and *South Asia*. IRF curves further show a short-run inverse relationship between GDP-growth rates and video games growth rates across segments in *North America*, which points to the industry being recession-resistant in that area.

Keywords: *Video games, Recession-proof, Granger Causality, Vector Autoregressive Model, Toda-Yamamoto Causality Test.*

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1. Introduction: A case for video games

"We would like to convince you that there is indeed a market in which money can be made in the near future." – Ralph Baer (The Father of Video Games), 1968

Video games are big business. While they were originally seen as a fad that would quickly die out when they were first introduced to the consumer market in the early 1970s, the video game industry boasted a whopping $159.3 Billion estimated revenue in 2020, dwarfing the Movie and Music industries by around 4 and 3 times respectively (Newzoo, 2020). Even more impressively, the latest DFC intelligence report (March 2022) estimates that around 40% of the world population (around 3 billion people) play some form of video game. These numbers are expected to increase further as the global covid-19 pandemic persists.

The industry has also been growing rapidly for the past couple of decades, consistently and increasingly exceeding analyst expectations – 2016 estimates for 2020 revenue were 90 billion USD, while actual industry values in the said year were 76.8% higher. The industry is hence set to hit the 200 billion USD mark by 2023. (Statista, 2020).

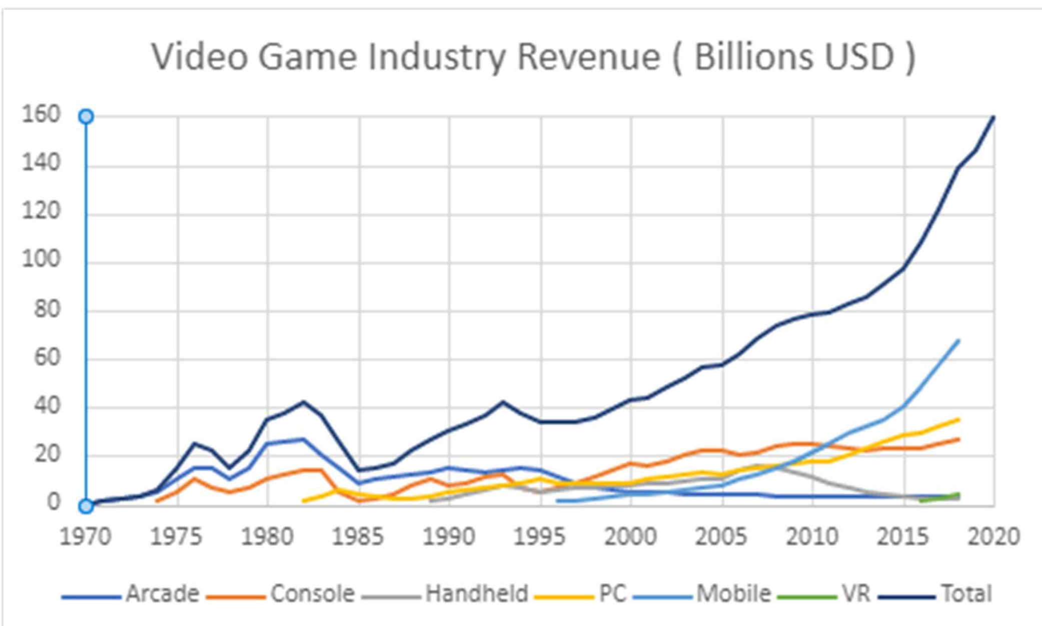

Figure 1: Video Games Revenue over the years

Source: Bloomberg Finance 2019, Statista 2020

The historical importance of video games and their contributions to society therefore shouldn't be overlooked. As video games become increasingly accepted as a form of art and entertainment in contemporary culture, it can be argued that their influence on society grows accordingly (Ivory, 2015). Since their inception, video games have generally been regarded as significant drivers of progress, often acting as catalysts for the development of numerous new technologies, from 3D graphics computing to game controllers routinely being repurposed for military and space exploration purposed by the US Army and NASA. Sherry (2015) explores the different ways in which video games can be used as an educational tool to promote learning at different ages. Likewise, Dale and Green (2015) investigate the claims that video games positively influence perceptual and cognitive measures and concluded that they did result in better spatial selective attention. Olson (2015) further writes about how educational video games geared towards health and medical purposes are useful in instructing users on nutrition, emergency health procedures, or managing illnesses, while persuasive games can help gamers be more productive and overcome addictions to substance.

Considering the impact and growth of the industry, there have been numerous claims of the latter being immune to recessionary turmoil (as discussed in the literature review). However, there also seems to be a significant gap in the literature when it comes to the empirical study of the economics of video games, and the recessionary-resistant features it allegedly has.

This paper aims to empirically determine whether the videogame industry is affected by recessions is empirically sound. Hence, we set out to find if video game revenue growth is affected by GDP growth (considering that recessions are characterized by periods of negative GDP growth), and if this is the case for the industry as a whole or specific segments only (ie. *Arcade*, *Handheld*, *Console*, *Mobile* and *PC* gaming). We only consider direct video game revenue streams from the sale of hardware and software, and disregard indirect revenue from esports and merchandising. Furthermore, this study does not factor in Virtual Reality gaming due to its novelty and subsequent lack of data.

The structure of this paper is as follows: the next section deals with the literature review on the video games industry's wider economic impact, followed by an analysis of prior research pertaining to the effects of video games on the labor market, as well as theories regarding recession-resistant industries and habit-forming good.

We then move on to a presentation of the data used in our study and document the application of lag-augmented VAR models to test if GDP growth rates Granger-cause Video Games Revenue Growth Rates. We find evidence of counter-cyclicity in *North America* for the *video games industry* and the console segment, implying that the industry thrives during recessions. Our results overall support the general claim that the video games industry is recession-proof for the rest of the segments and geographical areas, except for the *mobile* game industry in *Europe & Central Asia* and *South Asia*. We end our analysis by discussing our results and drawing parallels with prior papers and existing economic theory relating to recession-proof industries.

2. Literature review

2.1 A general overview:

From philosophers to science-fiction writers, the virtual experiences offered by video games have often been regarded as having the potential to drastically change the way humans interact inside and outside of the virtual space. Søraker (2010) explores the question of how activities in Massively Multiplayer Online games such as Second Life and World of Warcraft affect how people act, communicate, and overall exist in the real world, by analyzing how multiplayer games influence the gamer's philosophical concept of well-being, while also drawing on psychological research regarding arbitrary concepts of wellness.

In his 2011 novel *Ready Player One,* Cline imagines a world ravaged by climate change, pollution, and overpopulation where humanity retreats into an alternate reality in the form of an ultra-realistic Virtual Reality online game, complete with its own economy and societal system. While seemingly whimsical, such works of fiction remind us that as technology evolves and video games become more realistic, the potential effects of video games on humans as a species grow past what we presently may deem rational. With the advent of the metaverse and the move towards WEB 3.0, numerous business and tech analysts, JP Morgan (2022) predict that this vision of the future grows ever more into an eventuality.

More recently, politician Alexandria Ocasio-Cortez broadcasted herself playing the video game "Among Us" with popular internet personalities on the streaming platform "Twitch" during the 2020 US presidential elections campaign. While unconventional, this can be seen as a novel way for politicians to interact and cultivate relatability with their target demographics.

The event ended up being watched by around 439,000 users concurrently, leaving Cortez with the title of third most-watched twitch individual streamer as of October 2020. Analysts have qualified this event as significant in the outcome of the elections, encouraging many youths to cast their votes for the democratic party (The Guardian, 2020).

Indeed, it can be argued that Gaming Streamers and Youtubers are the new ‘rockstars’. Youtube gaming has roughly doubled in size from 2018 to 2020, with around 100 billion hours of gaming-related content being watched on the website in the last year, 10 billion of which were from live-streaming from gamers (Wyatt, 2020). Other platforms such as Twitch and Mixer offer highly skilled competitive gamers a platform to transform themselves into internet entertainers rather than only competing in e-sports tournaments. Forbes 2020 estimates for the top-earning pro-gamers showcase figures as high as $17 million with Tyler Blevins (a.k.a “Ninja”) at the top spot, followed by the likes of PewDiePie ($15 million) and Preston Arsement ($14 million). Therefore, it is evident how much influence these gaming entertainers have on ever-growing crowds of gaming fans; and the significant economic and political power that such popularity entails.

Speaking of pro-gamers and esports- while esports figures are not considered in the Pelham Smithers data presented earlier, the esports gaming industry is growing rapidly together with the video games industry, with a revenue of around $1.06 billion in 2020 (Statista, 2020). I chose not to include esports data for the sake of caution, but it is to be noted that the use of conservative figures undervalues the enormity of the video game industry by excluding brand deals, licensed movie spin-offs, merchandising, and so on.

Hence, considering that the video games industry has experienced consistently positive growth figures since as far back as 1995 regardless of recessionary years (Bloomberg, 2019), as well as the aforementioned discussion about its tremendous potential and impacts on the economy and society as a whole: is it unsurprising that news outlets and industry analysts have frequently put out sensationalist headlines about the video games industry being recession-proof.

"Is the video game industry recession-proof?" - NBC News, March 2008
"Analyze This: Is the Video Game Industry Recession-Proof?" - Gamasutra, 2008
"Play on -Video games have proved to be recession-proof—so far, at least" - The Economist, 2008
"Pandemic Video-Game Boom Sends Sales Forecasts Soaring" - Bloomberg, 2020
"Is Gaming Recession-Proof? Record Revenue For $160 Billion Industry With 2.7 billion Players" - Forbes, 2020
"Fully Charged - The Video Game Industry Is Consolidating" - Bloomberg, 2021
"Gaming Industry Sees Big Growth While People Stay Home" - Forbes, 2021

These are but a few of the hundreds of news headlines that have popped up over the years, especially during times of economic downturn. And understandably so- despite recessionary events, video game revenue seems to showcase an ever-positive trend. It is hence surprising that despite the question of whether video games are recession-proof is so often asked- there seems to be a significant gap in the literature on the topic in the field of academia.

Huntemann (2010) briefly depicts the discourse around the video game industry in the period 2000-2010 and argues that when it comes to the industry's resilience to a recession, it is mostly hits-driven (that is, the industry performance depends on the quality of the products it churns out, and recessionary years have potentially coincidentally also been hit-years). Furthermore, they conclude that while video game revenue has mostly resisted the economic downturn at the end of the decade, it still experienced a deep fragmentation of its demographic and market segments.

While a plethora of academic papers exists on in-game video game economies such as the works of Castronova (2002), Hamidi (2018) & Bilir (2020), a lack of research on real-life video game economics is very much observed, and the inner workings of the video game industry from an economics perspective are still relatively unexplored. For the sake of this paper, the use of economic research on recession-proof industries and recession-related concepts is hence necessary, as these may apply to the video games context.

2.2 Gaming hours vs Labor hours

Using Engel leisure curves, Aguiar et al. (2017) found that over the years, younger male workers significantly decreased their amount of labor hours supplied compared to older male workers or female workers due to an increase in leisure hours directly attributed to video gaming consumption. Furthermore, as innovations in video games increased the quality of the product, the fall in labor hours increased steeply compared to other demographics.

Likewise, Pasharov and Paklina (2019) found a positive relationship between video games' popularity and unemployment rates, despite the subsequent fall in the income of gamers.
This dynamic between labor and gaming hours can arguably happen the other way around: during recessions, layoffs and falls in wages result in a fall in labor hours supplied and a rise in unemployment. It is hence reasonable to infer that this increase in free time or leisure hours is likely to drive up the demand for leisure and entertainment in the form of video games, despite the expected fall in income.

2.3 The Lipstick Effect

Economic theory tells us that economic recessions are often associated with a relative increase in consumer spending on inferior goods (such as lower quality staples), and morale boosters (such as the consumption of uplifting media during a time of economic turmoil.) In this regard, the "Lipstick Effect" was coined by the honorary chairman of cosmetic company Esteé Lauder, who remarked that the sales of lipstick increased significantly during the 2001 recession, especially after the 9/11 attacks on the World Trade Centre. Lauder later brought up that a similar upward shift in lipstick consumption occurred following the 2008 recession. (Chan 2021)

As such, the lipstick effect stipulates that those *affordable luxuries* experience an increase in demand compared to less affordable luxuries, due to the "feel good" or "morale-boosting" factor that they provide.
Using real-world data and five different experiments studying the dynamics of unemployment and consumer spending priorities, the psychological impacts of recessions on mating preferences, and the comparison of the impact on beauty products versus inferior goods (low-cost indulgences), Hill et al (2012) argue that women's spending on beauty product can be seen

as an indicator of economic recessions. Similarly, Finuras (2017) argues that the increase in demand for lipstick is more significant than other types of cosmetics due to lipsticks being relatively more efficient in "beautifying and attracting" compared to other beauty products.

While the lipstick effect has mostly been used when considering beauty products, Tajtakova et al. (2020) show that hedonic consumption in the face of recessions as stipulated by the theory can also be applied to other goods and services; by demonstrating through empirical analysis the increased consumption of Outdoor Cultural events (theatre, cinema, and similar forms of entertainment) in Slovakia during recessionary times, potentially due to the escapism that such consumption items offer.

This is a particularly interesting argument in the case of video games (assuming these can be considered to be affordable luxuries compared to expensive holidays or theatre plays, and morale-boosting due to their entertainment nature), as it may account for the general claim that video games tend to be more recession-resistant.

2.4 The habit-forming nature of video games

"Gaming Disorders" is listed by the WHO (2018) as "*gaming behavior ... characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences.*"

Looking at the field of psychology, there is plenty of literature regarding the addictiveness of video games. Rooji (2010) explores how gamers can exhibit the behavior of addiction which disrupts other facets of their school, work, and social life. An interesting comparison is made between the gambling industry and gambling addiction despite the latter being much more regulated than the video games industry.

Adding to the research on gaming addictions, Sigerson et al. (2017) empirically test the validity of the Chinese Internet Gaming Disorder Scale (C-IGDS) and provide the reader with an in-depth picture of how extensive the degree of addiction is online video gaming can be. Saquib et al. (2017) demonstrated through survey data that a high proportion of students (16%) suffered from psychological distress associated with video game addiction.

This is further reflected by Gros et al. (2020), who provide an in-depth dive into the literature surrounding video game addiction and the confusion between gratification and happiness that comes from addictive video gaming behavior. The paper also investigates the relationship between different psychological indicators across study groups and provides many insights into how video game addiction can substantially affect video gamers that become too enthralled by the virtual world.

After considering the habit-forming and sometimes addictive nature of video games, it is sensible to consider the literature on how industries with addictive products fare during recessions.

2.5 Vice Industries & recession resilience

Vice industries can be defined as those industries that are generally regarded as of questionable morality, addictive, and/or harmful to society, such as alcohol, gambling, weaponry, pornography, and other such industries. In their financial textbook, Latane & Tuttle (1970) argue that investing in "sin" stocks during recessions is a viable way of diversifying portfolios, since, in their own words `*smokers, eaters and drinkers continue to smoke, drink and eat, no matter what . . . which is why the stocks of companies supplying these demands are usually described as ``defensive''*. Ahrens (2004) wrote about the financial ingenuity of investing in firms involved in these activities, which bear a certain social stigma due to ethical grey areas and often harmful societal spillover effects. Despite being generally frowned upon, Ahren argues that these industries tend to feature robust anti-recessionary behavior.

From a more empirical viewpoint, Freeman (2001) uses an error-corrected VAR model to test for Granger causality between beer consumption and macroeconomic indicators relating to economic activity and finds significant support for the claim that beer sales are relatively unaffected by economic cycles, and hence arguable "recession-proof". Furthermore, cointegration among the variables suggests the existence of long-term stability in this equilibrium.

In the same vein, Richey (2020) uses an EGARCH model to model the volatility of select Sin portfolios (funds consisting of stocks of companies in the Alcohol, Tobacco, Gambling & Defense industries.) against barometers such as the S&P500, BAB, and T-bill. Hence, it is shown that Vice-related stocks have less systematic risk than the market index (beta <1) while outperforming the S&P500 in terms of mean returns. Through variance modeling, Sin stocks are also shown to not be subject to high volatility for long periods, following negative shocks. Richey concludes that positive shocks have a greater impact on the volatility of sin-stocks than negative shocks do. Hence these studies paint a general picture of how "vice" industries, through their habit-forming nature, often display relatively more resilience and stability during recessions than non-vice industries.

Considering how video games industries have shown addictive tendencies similar to those of "vice" industries, it thus makes sense to contrast the behavior of said industries using the same methodologies. Hence Freeman's (2001) methodology was used as a baseline for our study.

3. Data and empirics

Due to *Real GDP* figures being in trillions, and *Real Video Game Revenue* values being in billions, our two main sets of variables were converted into their continuous growth rates to facilitate comparison. This was achieved by taking the difference in the log of each series, which leaves us with *Real GDP Growth* (by geographical area) and *Real Revenue growth* (for the total industry, and by segment),

The Real Gross Domestic Product was procured from the World Bank database and consists of annual real GDP segmented by geographical area. Considering that the bulk of video game revenue comes from North America (25.1%), Europe (18.6%), and Asia (49.2%), the real GDP for *North America*, *Europe, and Central Asia*, *East Asia & Pacific*, and *South Asia* were included. A full list of all individual countries included in these segments can be found on the World Bank database website. Latin America and Africa were omitted due to contributing only around 7% of total video game revenue, for the sake of simplicity (Newzoo 2021).

Furthermore, lipstick effect after testing for high multicollinearity with the other GDP variables. Multicollinearity Tests were carried out with the remaining GDP variables by running linear regressions with their respective Industry segments and generating Variance Influence Factor values. (Appendix 1), leaving us with our chosen GDP Growth Rates variables by geographical area.

Table 1

GDP Growth Rates Descriptive Statistics (1972 – 2019)

GDP Growth Rates	*North America*	*East Asia Pacific*	*Europe & Central Asia*	*South Asia*
Mean	0.0276	0.0485	0.0215	0.0517
Standard Error	0.0028	0.0020	0.0024	0.0031
Median	0.0290	0.0488	0.0229	0.0570
Standard Deviation	0.0192	0.0140	0.0167	0.0216
Sample Variance	0.0004	0.0002	0.0003	0.0005
Kurtosis	0.7675	2.2419	4.3536	4.1878
Skewness	-0.6764	-0.7519	-1.2309	-1.7503
Range	0.0959	0.0697	0.1032	0.1073
Minimum	-0.0260	0.0043	-0.0448	-0.0268
Maximum	0.0698	0.0740	0.0585	0.0806
Sum	1.3229	2.3265	1.0308	2.4833
Count	48	48	48	48

Annual Nominal Video Games Industry Revenue, originally compiled by Pelham Smithers, was web scraped from Bloomberg (2019). The original data consists of the annual total *video games industry* revenue as well as global revenues by segment (*Arcade*, *Personal Computer (PC)*, *Handheld*, *Consoles*). Being in nominal terms, these series were deflated using CPI data from the World Bank database to convert them to real values and enable comparison with the Real GDP data (at 2015 base values). It is to be noted that the dataset also included *Virtual Reality* revenue values. These were dropped as *VR,* being fairly new, offered only 5 data observations. This set of data was converted into growth rates as shown in Table 2.

The values for video game revenue for 2020 were dropped due to being unconfirmed estimates. Furthermore, while news outlets report unprecedented growth in the industry, it is to be noted that, unlike prior recessions, the covid-19 pandemic forced people indoors and thus, pushed consumers towards indoor entertainment. Considering the unique set of circumstances involved, including these estimates is likely to push for biased results, hence the omission.

Table 2*:*

Video Games Revenue Growth Rates Descriptive Statistics

Revenue Growth Rates	*Video Games Industry*	*Arcade*	*Console*	*PC*	*handheld*	*mobile*
Mean	0.0714	-0.0168	0.0457	0.0745	-0.0372	0.1680
Standard Error	0.0357	0.0358	0.0683	0.0422	0.0622	0.0293
Median	0.0575	-0.0220	0.0648	0.0560	0.0214	0.1532
Standard Deviation	0.2472	0.2482	0.4584	0.2567	0.3405	0.1407
Sample Variance	0.0611	0.0616	0.2101	0.0659	0.1159	0.0198
Kurtosis	3.0395	1.0892	5.7422	6.1754	4.6140	8.0006
Skewness	0.3522	0.5777	-0.6121	1.5755	-0.9122	2.3547
Range	1.4779	1.1928	3.1614	1.4968	1.8816	0.7037
Minimum	-0.6502	-0.5420	-1.6406	-0.4366	-1.2217	-0.0217
Maximum	0.8277	0.6508	1.5209	1.0602	0.6599	0.6820
Sum	3.4288	-0.8073	2.0549	2.7565	-1.1153	3.8647
Count	48	48	45	37	30	23
Time-period	1972 - 2019	1972 - 2019	1975 - 2019	1983 - 2019	1990 - 2019	1997 - 2019

It is to be noted that one significant limitation of this paper is the restrictive dataset. Unfortunately, there appears to be a lack of data on the video games industry. Other than the Pelham-Smithers dataset, firm-level data was deemed too difficult to obtain since 1) Historical data for firms was often locked behind corporate secrecy, and 2) it is difficult to identify specific video game revenue in diversified companies like Sony (PlayStation) and Microsoft (X-box).

Ideally, access to higher frequency data would make the models more robust. However, considering that only annual data is available and that certain segments of the video game industry were introduced as recently as the mid-90s (notably Mobile-phone gaming), certain compromises had to be made when it came to specifying the models (especially when choosing lags) to keep them stable.

4. Methodology

Building on the methodology used by Freeman (2001) in his analysis of Beer and the Business Cycle, this paper uses a VAR framework to test for Granger causality between the growth rates of the video game industry revenues (total and by segment) and the growth rates of the GDP of select geographical blocks.

The first step was to test for stationarity in the series. An augmented dickey fuller test was run, and the following results were obtained when using 2 lags. (Experiments with more and fewer lags were run, resulting in the same conclusions)

Table 3:

Augmented Dickey-Fuller Test for Stationarity and maximum order of Integration

growth rates p-values	growth	Max I(x)	growth rates p-values	level	1st diff	Max I(x)
VGI Revenue	0.0009	0	**Handheld Revenue**	0.7312	0.0275	1
North America GDP	0.0008	0	North America GDP	0.2486	0.0066	1
East Asia Pacific GDP	0.0052	0	East Asia Pacific GDP	0.1678	0.0012	1
Europe & Central Asia	0.0043	0	Europe & Central Asia	0.082	0.0104	1
South Asia	0.0009	0	South Asia	0.0226	0.0182	1
Arcade Revenue	0.006	0	**Mobile Revenue**	0.0000	-	0
North America GDP	0.0008	0	North America GDP	0.0601	0.0142	1
East Asia Pacific GDP	0.0052	0	East Asia Pacific GDP	0.0997	0.0052	1
Europe & Central Asia	0.0043	0	Europe & Central Asia	0.1519	0.0007	1
South Asia	0.0009	0	South Asia	0.1132	0.0119	1
Console Revenue	0.0000	0	**PC Revenue**	0.0000	-	0
North America GDP	0.0016	0	North America GDP	0.0601	0.0142	1
East Asia Pacific GDP	0.0266	0	East Asia Pacific GDP	0.0997	0.0052	1
Europe & Central Asia	0.0083	0	Europe & Central Asia	0.1519	0.0007	1
South Asia	0.0244	0	South Asia	0.1132	0.0119	1

Since H_0 in the Dickey-Fuller test is that the variable exhibits a unit root; we reject the null hypothesis when the p-value is less than 0.05 (at 5% significance levels)

Hence, we find out that all variables are stationary for the Revenue Growth of the Total *Video Game Industry*, *Arcade*, and *Console*. However, For *Handheld*, *Mobile* and *PC*, the variables are not stationary at level but have a maximum integration of order 1. The optimum number of lags overall is determined to be one ($t^*=1$) as per FPE, AIC, HQIC, and SBIC criteria. This is consistent with the literature since we are using annual data, hence no seasonality comes into play, and congruent with our limited dataset. Extra lags are later added to the appropriate models, as discussed further down.

Table 4:

lag selection as per FPE, AIC, HQIC, and SBIC

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
	Arcade							
0	518.526				8.40E-17	-22.8234	-22.4582	**-22.6226***
1	545.411	53.771	25	0.001	**7.8e-17***	**-22.9072***	**-22.7485***	-21.7027
2	565.266	39.709	25	0.031	1.00E-16	-22.6785	-21.8553	-20.4703
	Console							
0	456.989				2.50E-21	-30.4162	-30.3252	**-30.1679***
1	485.443	56.908	36	0	**1.3e-21***	**-31.111**	**-30.4741***	-29.3733
2	511.483	52.08	36	0	1.30E-21	-31.2027*	-30.0199	-27.9756
	Handheld							
0	325.896				7.60E-17	-22.9211	-22.8484	**-22.6832***
1	366.106	80.42	25	0	**2.7e-17***	**-24.0076***	**-23.5712***	-22.5802
2	387.034	41.856*	25	0.019	4.30E-17	-23.7167	-22.9167	-21.0999
	Mobile							
0	400.855				1.90E-24	-37.6052	-37.5405	-37.3068
1	459.539	117.37	36	0	2.50E-25	-39.7656	-39.3123	-37.6766
2	520.848	122.62*	36	0	**6.8e-26***	**-42.176***	**-41.334***	**-38.2963***
	PC							
0	418.13				1.90E-17	-24.3018	-24.2252	-24.0773*
1	460.006	83.752	25	0	**7.3e-18***	**-25.2945***	**-24.8352***	-23.9477
2	476.681	33.349	25	0.123	1.30E-17	-24.8047	-23.9627	-22.3356

Video Games Industry								
0	519.173				8.20E-17	-22.8522	-22.6727	**-22.6514***
1	550.238	62.13	25	0	**6.3e-17***	**-23.1217***	**-22.7773***	-21.9173
2	574.326	48.176	25	0.004	6.80E-17	-23.0812	-22.258	-20.873

It is to be noted that the Mobile segment required 2 lags: however, I chose to use only one because the dataset for mobile is small (n=21), resulting in an unstable model if too many lags are taken. This is later remedied by using the augmented-lag model.

Next, the Johansen Cointegration test was run to determine the number of cointegrating equations, which would point to whether a Vector Error Correction Model would be needed. The following results were obtained:

Table 5:

Johansen Cointegration test results.

Johansen Cointegration Test		Cointegration rank
Video Games Industry Revenue		0
Arcade Revenue		0
Console Revenue		0
handheld Revenue		2
Mobile Revenue		2
PC Revenue		3

Cointegration equations were found in all *handheld*, *Mobile,* and *PC* Revenue growth models. This implies the potential existence of long-term stable relationships between the variables of the models and warrants further testing of Granger Causality.

Generally, this would entail the need for a VEC Model to be specified to incorporate Cointegration Equations. However, attempting to do so with our small sample results in unstable models with autocorrelations in the residuals, eigenvalues exceeding 1, and residuals being not normally distributed when going through the post-diagnostics (Especially in smaller datasets like *Mobile*)

As an alternative to the use of VECs, the Toda-Yamamoto (1995) Granger-causality method is used instead, whereby a lag-augmented VAR (in levels) is instead specified to account for the cointegration. As proven by Toda-Yamamoto, adding an extra number of lags equal to the maximum order of integration (d_{max}) to a VAR's optimum lag (t*) allows for the added lags to capture the cointegration elements. This causes a notable loss of prediction power of the coefficients of the VAR model: however, if one's aim is not to interpret the model but to test for Granger Causality between the variables (as in the case of this paper), then running Granger-causality tests post-estimation factoring in only the optimum lags, allows for a reliable method to test for Granger causality. Furthermore, empirical tests of the Toda Yamamoto method have shown that the loss in power of the VAR is often negligible, hence allowing for prediction despite the truncated model (Clarke & Mirza 2006).

As such, the following set of equations is specified.

$$gV_t = \alpha + \sum_{i=1}^{k} \beta_i gV_{t-i} + \sum_{j=1}^{k} \gamma_i gWorld_{t-j} + \sum_{m=1}^{k} \psi_i gNA_{t-m} + \sum_{n=1}^{k} \eta_i gEAP_{t-n} + \sum_{p=1}^{k} \theta_i gEUCA_{t-p} + \sum_{q=1}^{k} \varphi_i gSOA_{t-q} + U_c \qquad (1)$$

Where gV_t is the growth rate of the video games industry revenue by segment

And $V_t = \begin{pmatrix} Video\ Games\ Industry_t \\ Arcade_t \\ Handheld_t \\ Console_t \\ Mobile_t \\ PC_t \end{pmatrix} \qquad (2)$

gNA is the growth rate of North America GDP

gEAP is the growth rate of East Asia Pacific GDP

gEUCA is the growth rate of Europe & Central Asia GDP

gSOA is the growth rate of the South Asia GDP

U_c is an error term that captures the residuals in the model

t = augmented lag,

whereby $t = t^* + d_{max}$ (3)

; t^*= optimal lag length ; d_{max} = maximum order of integration

It is to be noted that 'g' is not a parameter in this case but is used as a notation to denote the use of the growth rate. Hence, six distinct equations are obtained for each component of V_t, resulting in six lag-augmented var models in levels (still computed using the growth rates of the variables).

Since the maximum order of integration was found to be 0 for *Video Games Industry*, *Arcade*, and *Consoles*, and 1 for *Handheld*, *Mobile,* and *PC*, this extra lag is added to the previous optimum lag chosen (t^*+d_{max}), resulting in a lag augmented models consisting of t=1 and t=2 for each set of equations respectively. The results are discussed in the next section (Table 7)

Table 6:

Heteroskedasticity Tests

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity Ho: Constant variance ; Variables: fitted values of squares of residuals						
	Video Games Industry	Arcade	Handheld	Console	Mobile	PC
Chi2	8.54	18.45	23.79	7.15	4.09	30.06
Prob > chi2	0.0035	0	0	0.0075	0.043	0

P<0.05; presence of heteroskedasticity warrants the use of robust errors

Due to the presence of heteroskedasticity as per the Breusch-Pagan / Cook-Weisberg test in Table 7 (whereby $p<0.05$), the use of robust errors instead of standard errors was implemented to solve the issue and avoid overestimating the significance of the variables.

Post-estimation diagnostics for the lag-augmented VAR models can be found in the Appendix (Appendix 2.1– 2.6), to support the validity of the model. All the equations fulfill the VAR stability criteria, since all eigenvalues lie within the unit circle. All the models also pass the Lagrange Multiplier Test, except for mobile due to the latter's small sample size, which made taking more lags impractical. This leaves us with some autocorrelation in the *mobile* model, which could make the estimators less efficient. The main issue in our model is seen in the Jarque Bera Test, which shows that our errors are not normally distributed. This was partly fixed by using robust errors and small-sample degrees-of-freedom adjustments when running the var. However, the problem persists and may affect the efficiency of our models.

5. Results and Discussions

Considering that the focus of this paper is analyzing the unilateral relationships between GDP growth rates and Revenue Growth rates, only results about these are extracted from the 6 VAR results.

Table 7: *Selected Results from Augmented VAR*

Coefficients	G Video Games	G Arcade	G Handheld	G Console	G Mobile	G PC
G Industry Segment [β] L1	0.410** (0.193)	0.392** (0.185)	*1.077** (0.550)	0.205 (0.261)	0.279* (0.131)	0.455** (0.173)
G Industry Segment [β] L2			-0.409 (0.448)		0.0158 (0.140)	-0.341 (0.203)
G North America [ψ] L1	*-3.715** (2.878)	-1.096 (2.800)	-6.784 (6.610)	*-10.41** (5.787)	-3.204 (2.311)	-3.308 (2.888)
G North America [ψ] L2			8.921 (8.459)		-2.805 (3.276)	-0.289 (2.626)
G East Asia Pacific [η] L1	-0.703 (2.489)	0.0667 (2.454)	3.641 (4.324)	-0.909 (4.369)	-3.262 (2.265)	1.034 (2.276)
G East Asia Pacific [η] L2			1.033 (2.874)		0.648 (1.566)	1.122 (2.613)
G Europe& Central Asia [θ] L1	*4.714** (2.561)	2.228 (1.230)	5.806 (5.174)	*8.855** (5.250)	**5.072**** (2.215)	1.290 (2.784)
G Europe & Central Asia [θ] L2			-5.407 (7.389)		1.766 (1.887)	0.635 (2.248)
G South Asia [φ] L1	-0.604 (0.997)	-1.885 -1.432	1.209 (2.965)	1.661 (2.611)	*3.337** (1.730)	0.657 (1.984)
G South Asia [φ] L2			-9.122 (7.414)		-1.757 (2.087)	-1.057 (1.780)
Constant [α]	0.0969 (0.145)	0.0487 (0.138)	0.116 (0.364)	0.0624 (0.193)	0.130 (0.100)	0.0119 (0.158)
Observations	47	47	28	44	21	35

Robust standard errors in parentheses
***** p<0.01, ** p<0.05**, * *p<0.1*

It is to be noted that the term "G Industry Segment [β] L*x*" refers to the respective model's industry's own x^{th} lagged variable, L being the lag operator.

While the focus of the paper is the Granger Causality results, it is still useful to interpret the significance of the results of the lag-augmented VAR models. Looking at relationships between industry segments and geographical areas, the coefficients for *North America* and *Europe & Central Asia* in both the *Video Games Industry* and *Console* equations are found to be statistically significant at the 10% level. We also find significant coefficients for *Europe & Central Asia* and *South Asia* in the mobile equation at the 5% and 10% levels respectively. This points to the existence of relationships between GDP growth rates in these specific geographical areas and the Revenue Growth of the *Video Games Industry*, *Console,* and *Mobile* segments. The rest of the coefficients, as well as all coefficients for *Arcade*, *Handheld*, and *PC,* are not statistically significant, pointing towards Revenue Growth Rates for these segments not being affected by GDP growth rates.

Most interestingly, we find negative coefficients across North America for all segments. These are mirrored when looking at the Impulse Response Functions (Figures 2 and 3) which show the Responses of the Revenue Growths rates in response to a one standard deviation Impulse (or shock) in GDP growth rates. Overall, we see that Revenue growth rates across segments tend to stabilize in the long run (4 periods) after a brief initial increase in the short run when faced with an increase in GDP growth rates of one standard deviation for all geographical areas except for *North America* (gna). The latter features a negative impulse response in the short run, which points toward the existence of an inverse relationship between GDP growth rates and Revenue Growth rates in *North America.*

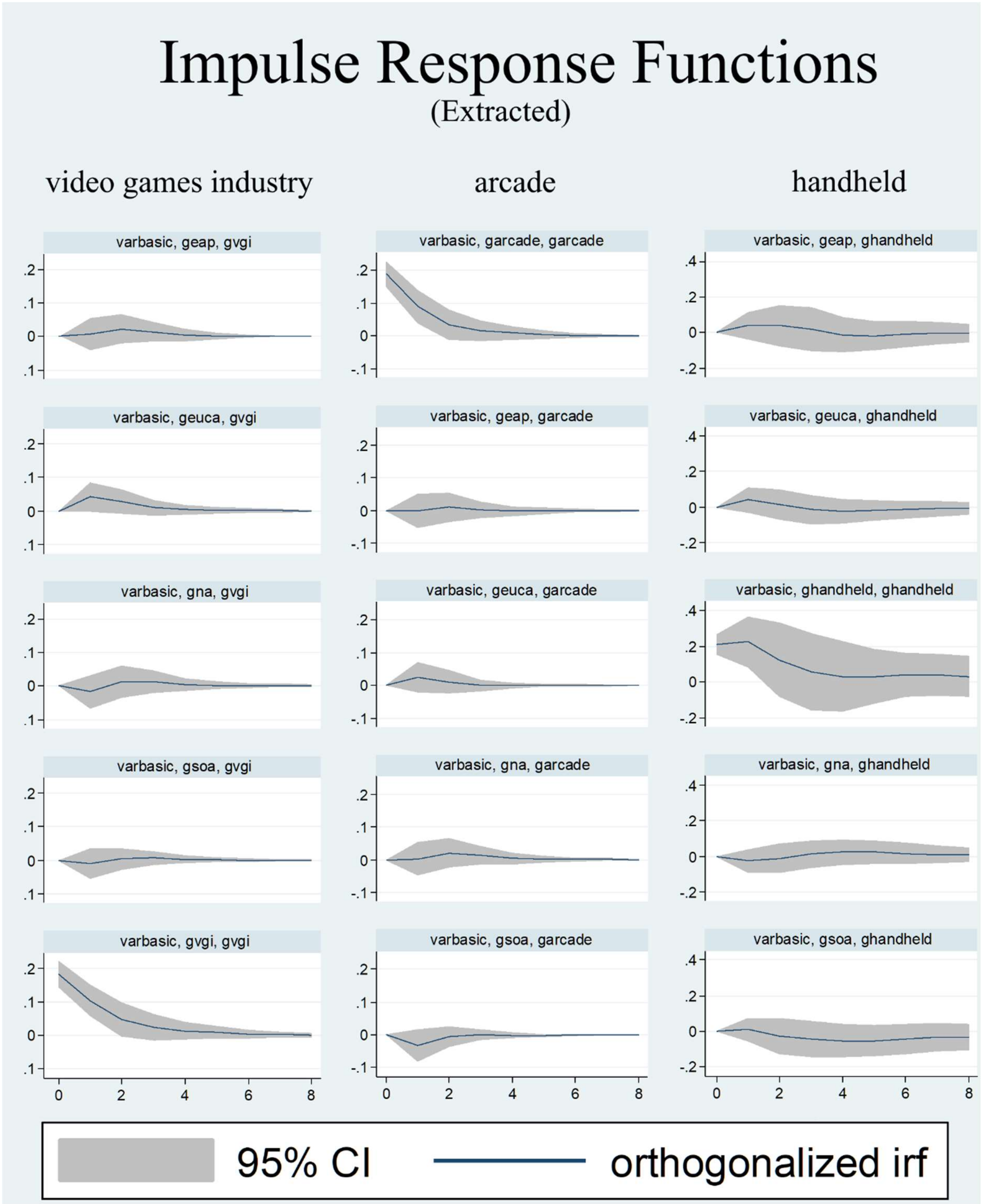

Figure 2: Impulse Response Functions for the Video Games Industry, Arcade, and Handheld.

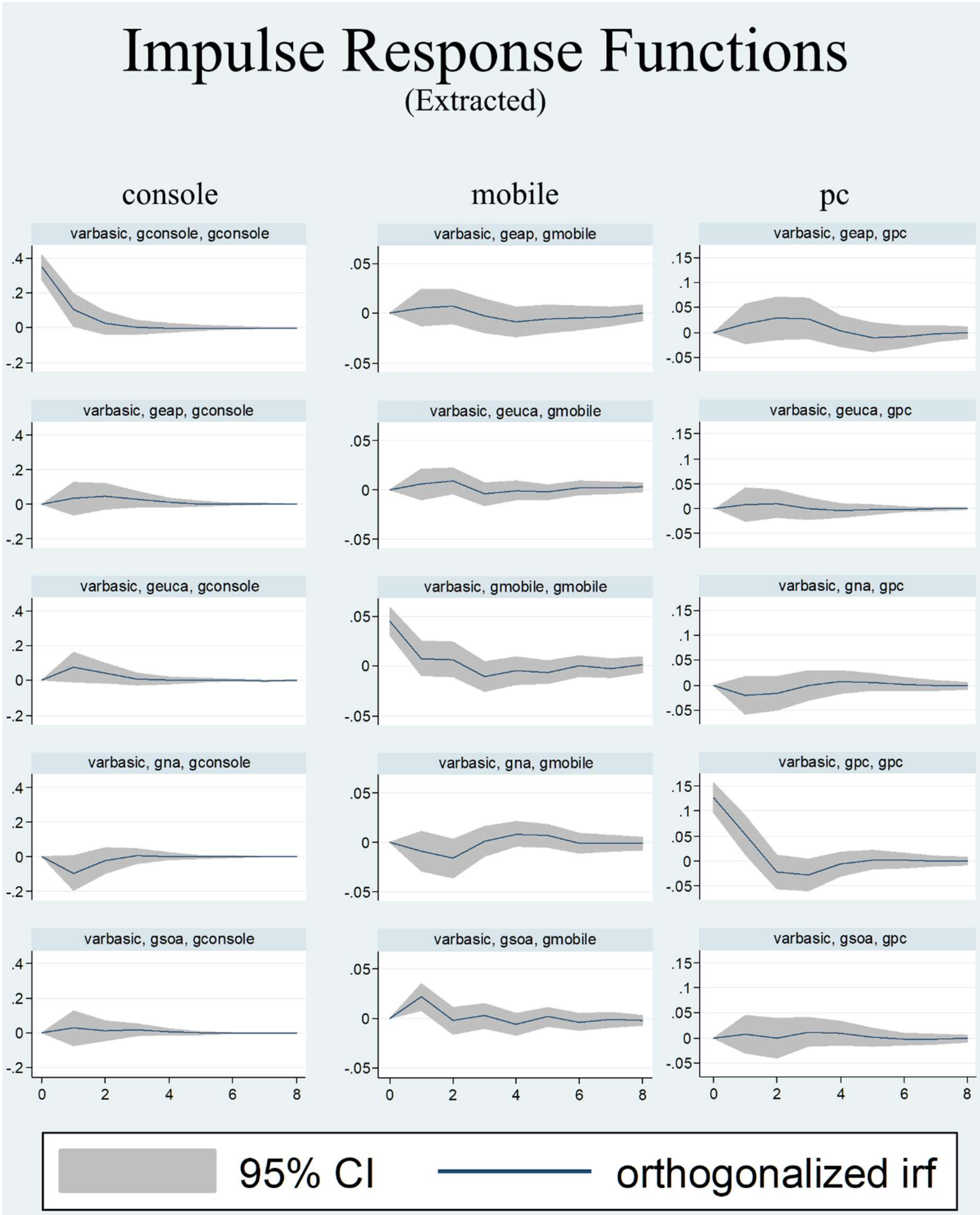

Figure 3: Impulse Response Functions for Console, Mobile, and PC segments.

The Granger Causality test can be run normally for the *Video Games Industry*, *Arcade,* and *Console* models since d_{max} for these was 0, hence no lags were added. For the *Handheld*, *Mobile,* and *PC* models, however, individual Wald tests were computed taking only into consideration t*=1 and disregarding the added augmented lag; as per the Toda-Yamamoto method.

Hence, we conduct the following hypothesis tests, whereby H_0 implies non-causality,
If the p-value is less than 0.05, it means that we can reject the null hypothesis at the 5% level.
If the p-value is less than 0.10, it means that we can reject the null hypothesis at the 10% level.

Only unilateral Granger causality is taken into consideration since whether the video games industry Granger-causes economic growth is not the interest of this paper. The results of the tests can be found in Tables 8.1-8.6.

We find evidence of *North America* GDP growth Granger-causing Revenue Growth for the *Video Games Industry* and *Console* segment, at the 10% and 5% levels respectively. There is no evidence of GDP growth Granger-causing *Video Games Industry* and *Console* Revenue Growth for *East Asia Pacific*, *Europe & Central Asia*, and *South Asia.* There is also no evidence of the collective GDP growth rates of all the geographical areas jointly Granger-causing Revenue Growth for these two segments.

We also find evidence of *Europe & Central Asia* and *South Asia* GDP growth rates granger-causing *Mobile* Revenue Growth at the 5% level. There is no evidence of such Granger Causality for *mobile* for *North America*, *East Asia Pacific,* and all geographical regions jointly taken together. Overall, we find no evidence of any GDP growth rates (jointly or area-specific) Granger-causing Revenue Growth for the *Arcade*, *Handheld,* and *PC* segments at any level of significance.

Table 8.1 *Granger Causality Tests for Video Games Industry*

Video Games Industry: Granger Causality test	F	Prob > chi2
H_0: North America GDP growth does not Granger-Cause Video Games Industry Revenue Growth	2.8872	0.0969 *
H_0: East Asia Pacific GDP growth does not Granger-Cause Video Games Industry Revenue Growth	0.08463	0.7726
H_0: Europe & Central Asia GDP growth does not Granger-Cause Video Games Industry Revenue Growth	3.3155	0.0759
H_0: South Asia GDP growth does not Granger-Cause Video Games Industry Revenue Growth	0.17814	0.6752
H_0: ALL GDP growth does not jointly Granger-Cause Video Games Industry Revenue Growth	1.0674	0.3849

Table 8.2 *Granger Causality Tests for Arcade*

Arcade: Granger Causality test	F	Prob > chi2
H_0: North America GDP growth does not Granger-Cause Arcade Revenue Growth	0.23198	0.6326
H_0: East Asia Pacific GDP growth does not Granger-Cause Arcade Revenue Growth	0.00072	0.9788
H_0: Europe & Central Asia GDP growth does not Granger-Cause Arcade Revenue Growth	0.71157	0.4038
H_0: South Asia GDP growth does not Granger-Cause Arcade Revenue Growth	1.5113	0.226
H_0: ALL GDP growth does not jointly Granger-Cause Arcade Revenue Growth	0.71261	0.5881

Table 8.3 *Granger Causality Tests for Handheld*

Handheld: Granger Causality test	F	Prob > chi2
H_0: North America GDP growth does not Granger-Cause Handheld Revenue Growth	1.1997	0.3255
H_0: East Asia Pacific GDP growth does not Granger-Cause Handheld Revenue Growth	0.21959	0.8051
H_0: Europe & Central Asia GDP growth does not Granger-Cause Handheld Revenue Growth	0.59059	0.565
H_0: South Asia GDP growth does not Granger-Cause Handheld Revenue Growth	1.1405	0.3429
H_0: ALL GDP growth does not jointly Granger-Cause Handheld Revenue Growth	0.4348	0.8839

Table 8.4 *Granger Causality Tests for Console*

Console: Granger Causality test	F	Prob > chi2
H_0: North America GDP growth does not Granger-Cause Console Revenue Growth	5.9488	**0.0195** **
H_0: East Asia Pacific GDP growth does not Granger-Cause Console Revenue Growth	0.02753	0.8691
H_0: Europe & Central Asia GDP growth does not Granger-Cause Console Revenue Growth	2.8257	0.101
H_0: South Asia GDP growth does not Granger-Cause Console Revenue Growth	0.28953	0.5937
H_0: ALL GDP growth does not jointly Granger-Cause Console Revenue Growth	1.5121	0.2181

Table 8.5 *Granger Causality Tests for Mobile*

Mobile: Granger Causality test	F	Prob > chi2
H_0: North America GDP growth does not Granger-Cause Mobile Revenue Growth	1.64	*0.2288*
H_0: East Asia Pacific GDP growth does not Granger-Cause Mobile Revenue Growth	1.73	0.2175
H_0: Europe & Central Asia GDP growth does not Granger-Cause Mobile Revenue Growth	5.20	**0.0458** **
H_0: South Asia GDP growth does not Granger-Cause Mobile Revenue Growth	5.96	**0.0348** **
H_0: ALL GDP growth does not jointly Granger-Cause Mobile Revenue Growth	2.00	0.1701

Table 8.6 *Granger Causality Tests for PC*

PC: Granger Causality test	F	Prob > chi2
H_0: North America GDP growth does not Granger-Cause PC Revenue Growth	1.39	0.2494
H_0: East Asia Pacific GDP growth does not Granger-Cause PC Revenue Growth	0.12	*0.7316*
H_0: Europe & Central Asia GDP growth does not Granger-Cause PC Revenue Growth	0.15	0.7017
H_0: South Asia GDP growth does not Granger-Cause PC Revenue Growth	0.11	0.7465
H_0: ALL GDP growth does not jointly Granger-Cause PC Revenue Growth	0.41	0.7999

*** p<0.01, ** p<0.05, * p<0.1

Factoring in the results from the VAR models, IRF graphs, and Granger-causality Tests, we can put forward some interesting claims about the video game industry's resilience in the face of recessionary pressures. First of all, insignificant coefficients in the equations for VAR models of *Arcade*, *Handheld*, and *PC*, and no evidence of Granger Causality being found in these segments of the video games industry point to these segments' revenues not being granger-caused by GDP growth: implying that they are recession-resistant. Furthermore, *East Asia Pacific* GDP Growth Rate does not Granger-cause any Industry Revenue Growth, implying that the video games industry and its different segments are unaffected by recessions in *East Asia Pacific* countries.

Negative and significant coefficients for *North America* GDP Growth for the *video games industry* and *console* equations; and evidence of the GDP growth Granger-causing *video games* and *console* Revenue growth in the North American Market has the interesting implication that while *video games industry* and *console* revenue growth are affected by *North America* GDP growth rates: it is an inverse relationship, whereby a negative *North America* GDP growth would result in a subsequent increase in the *video games industry* and *console* revenue growth (Which stabilizes after 2 periods, according to the IRF). This adds weight to the claim that the *video games industry*, particularly the *console* segment, thrives during recessions by being counter-cyclical in the *North America* area.

An attempt can be made to explain this phenomenon using the lipstick effect as discussed in the literature review. The World Bank's International Comparison Program (2017) shows that the median Purchasing Power Parity of consumers in the *North America* area is higher than those in the other geographical areas in this model. Considering that video game pricing is fairly consistent over the world (Wirtz, 2022) and that the lipstick effect is a theory of affordable luxuries, we can argue that video games are relatively more affordable in *North America* compared to other geographical areas, hence making it more likely to be treated as an affordable luxury during recessions. The same effect is hence less pronounced in the other geographical areas for all the other segments except *mobile* and reflected in the non-significant VAR coefficients and no evidence of Granger causality in these segments. This implies that video games in these areas are still seen as affordable luxuries; but not as affordable as in *North America*. The positive and significant coefficients in the *mobile* equation, and evidence of *South Asia* and *Europe and Central Asia* GDP growth Granger-causing *mobile* revenue growth further supports this theory, as South Asia and Central Asia have relatively low PPPs, hence consumers might not consider mobile gaming to be as affordable as consumers from other areas do: which leads to a lessened lipstick effect and mobile revenue growth contracting when GDP growth falls.

Our findings also follow mirror of those of Freeman's (2001) beer study, whose methodology was partly the basis of the one used in our paper. Considering the literature on video game addiction, and our overall findings that the industry and its different segments' revenue growths are generally not Granger-caused by GDP growth rates (and in the case of *North America*, even show counter-cyclical behavior), this draws an economic picture of a habit-forming industry and can be used to argue that there is a pattern of addiction to video games in general- most prominently in *North America* to *Console* games; and that there is less addiction in *South Asia* and *Europe & Central Asia* to *mobile* games. However, this is beyond the scope of this paper and would require further studies from a more qualitative and perhaps psychological approach.

The observed counter-cyclical behavior of the industry in *North America* can also bear a lot of interest to investors when it comes to recession-proofing their portfolios Supplementary to our findings, using Richey's (2020) EGARCH methodology and modeling the volatility of Video Game Stocks relative to industry benchmarks such as the S&P500 or the CBOE Volatility Index (VIX) topic would potentially be a good addition to the literature as it would give us a more financial perspective on the analysis of whether the video games industry is recession-proof.

Considering the relative lack of data on the video games industry while the existing historical data points to the video games industry being relatively recession-resistant, and the immense potential of the said industry in the upcoming future factoring in market predictions and the advent of the multiverse: our preliminary findings aspire to act as a call to data analysts to collect higher frequency data for future research. With more data, the expansion of our model could include variables such as game scores and consumer behavior patterns to better paint a portrait of the economics of video games, and further expand on the literature.

6. Conclusions

This paper uses the Toda-Yamamoto lag-augmented VAR model to ascertain the presence of unilateral Granger-causality between GDP growth (by geographical area) and the video-games industry revenue growth (industry-wide and by segment). In doing so, we find that the *video games industry* and *console* segment are countercyclical and actually thrive during recessions in *North America.* No evidence of GDP Growth rates Granger-causing *Arcade*, *Handheld,* and *PC* Revenue Growth Rates was found. Only *mobile* revenue growths were granger caused by *Europe & Central Asia* and *South Asia* GDP Growth Rates; however, the *mobile* segment was unaffected by any other area's GDP growth.

The main limitations of our study come from the lack of data on the topic due to the study of video game economics being arguable minimal so far. As such, some of our models (notably *mobile*) suffer from small sample sizes and the presence of some heteroskedasticity in the result disturbances. Our paper also does not factor in the very promising VR industry and ignores significant streams of revenues from esports and merchandising to prioritize a conservative approach and avoid overestimations.

To summarize our results: We find **no evidence** of the video games industry being negatively affected by recessions, except for *mobile* gaming when faced with recessionary pressures from *East Asia Pacific* and *South Asia*.

Our findings point to the video games industry being relatively recession-proof, and open the door for more research to be conducted on this topic in microeconomics (i.e., from a consumption-behavior approach) and finance (using stock volatility)

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8. Appendix

Appendix 1: Multicollinearity tests in Variables:

VGI	**VIF**	1/VIF	*Arcade*	**VIF**	1/VIF	*Handheld*	**VIF**	1/VIF
geuca	2.12	0.47189	geuca	2.12	0.47189	geuca	2.11	0.474078
gna	1.85	0.54038	gna	1.85	0.54038	gna	1.92	0.519904
geap	1.38	0.72204	geap	1.38	0.72204	geap	1.37	0.731395
gsoa	1.09	0.915032	gsoa	1.09	0.915032	gsoa	1.21	0.828474
Mean VIF	1.61		Mean VIF	1.61		Mean VIF	1.65	

Console	**VIF**	1/VIF	*PC*	**VIF**	1/VIF	*mobile*	**VIF**	1/VIF
geuca	2.09	0.479355	geuca	1.96	0.509083	geuca	4.57	0.218611
gna	1.75	0.570021	gna	1.66	0.602284	gna	3.93	0.254766
geap	1.32	0.756703	geap	1.36	0.737297	geap	1.71	0.584872
gsoa	1.06	0.939109	gsoa	1.1	0.91014	gsoa	1.32	0.758418
Mean VIF	1.56		Mean VIF	1.52		Mean VIF	2.88	

After dropping world GDP data, all VIF values are <10, indicating no/low multicollinearity.

Appendix 2.1: ‘Video Games Industry Model Post-estimation diagnostics:

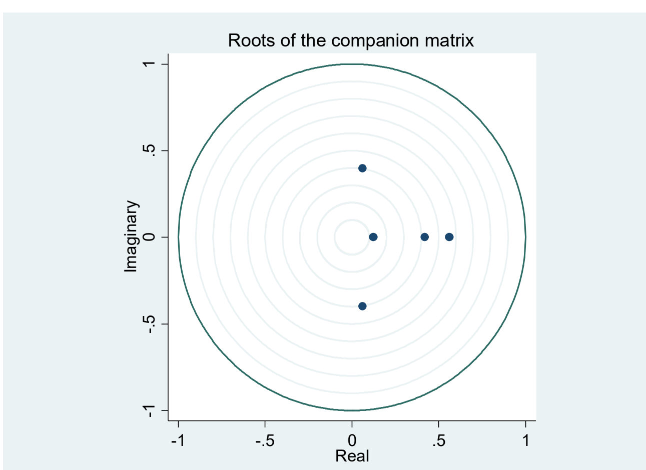
varlmar: Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	37.5934	25	0.05066
2	30.4490	25	0.20792

H0: no autocorrelation at lag order

Jarque Bera test

Equation	chi2	df	Prob > chi2
gvgi	0.297	2	0.8618
gna	2.079	2	0.35358
geap	9.265	2	0.00973
geuca	1.34	2	0.51173
gsoa	5.656	2	0.05914
ALL	18.637	10	0.04512

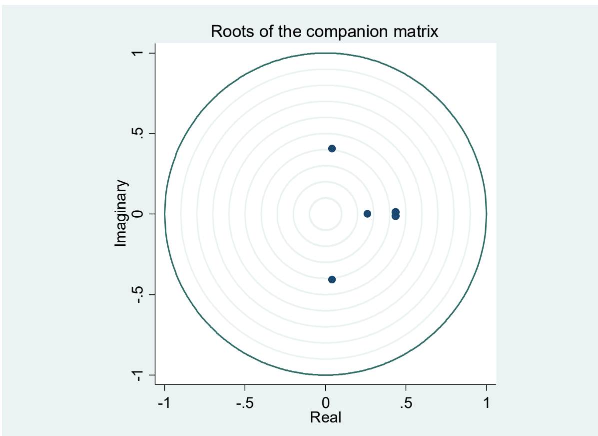


All the eigenvalues lie inside the unit circle. VAR satisfies stability conditions.

Appendix 2.2: Arcade Post-estimation diagnostics

Lagrange-multiplier test			
lag	chi2	df	Prob > chi2
1	28.5497	25	0.28318
H0: no autocorrelation at lag order			

Jarque Bera test			
Equation	chi2	df	Prob > chi2
garcade	0.077	2	0.96227
gna	1.587	2	0.45235
geap	11.336	2	0.00345
geuca	1.288	2	0.5253
gsoa	7.422	2	0.02446
ALL	21.709	10	0.01666

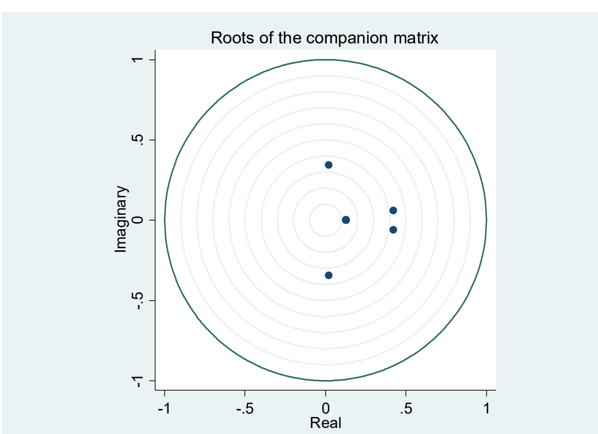


All the eigenvalues lie inside the unit circle. VAR satisfies stability conditions.

Appendix 2.3: Console Post-estimation diagnostics

Lagrange-multiplier test			
lag	chi2	df	Prob > chi2
1	31.7215	25	0.16623
2	31.3952	25	0.17626
H0: no autocorrelation at lag order			

Jarque Bera test			
Equation	chi2	df	Prob > chi2
gconsole	1.785	2	0.40958
gna	3.034	2	0.21941
geap	9.203	2	0.01003
geuca	2.081	2	0.35331
gsoa	24.367	2	0.00001
ALL	40.471	10	0.00001



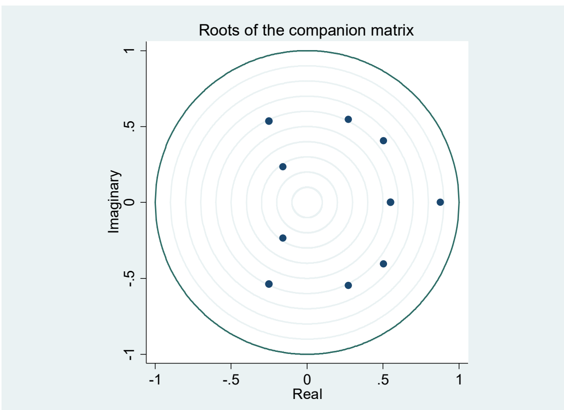
All the eigenvalues lie inside the unit circle.

VAR satisfies stability conditions.

Appendix 2.4: Handheld : Post-estimation diagnostics

Lagrange-multiplier test			
lag	chi2	df	Prob > chi2
1	28.5145	25	0.28472
2	23.9769	25	0.52071
H0: no autocorrelation at lag order			

Jarque Bera test			
Equation	chi2	df	Prob > chi2
ghandheld	2.406	2	0.30036
gna	3.916	2	0.14113
geap	4.351	2	0.11355
geuca	4.729	2	0.094
gsoa	4.214	2	0.12159
ALL	19.616	10	0.0331



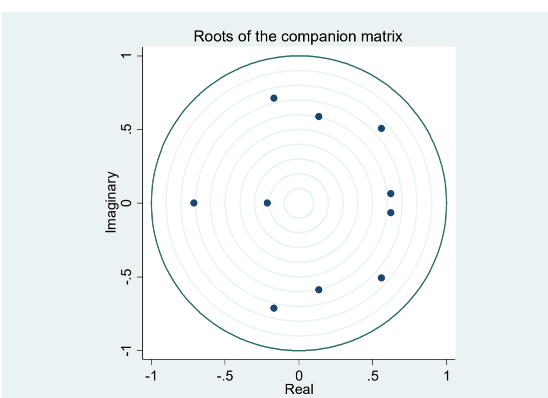
All the eigenvalues lie inside the unit circle.

VAR satisfies stability conditions.

Appendix 2.5: Mobile Post-estimation diagnostics

Lagrange-multiplier test			
lag	chi2	df	Prob > chi2
1	88.7023	25	0
2	30.4096	25	0.20932
H0: no autocorrelation at lag order			

Jarques Bera test			
Equation	chi2	df	Prob > chi2
gmobile	5.008	2	0.08174
gna	4.058	2	0.13148
geap	3.206	2	0.20129
geuca	5.23	2	0.07316
gsoa	4.589	2	0.10081
ALL	22.091	10	0.01465



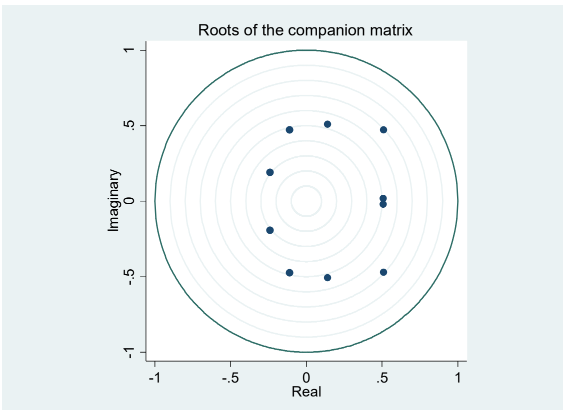
All the eigenvalues lie inside the unit circle.

VAR satisfies stability conditions.

Appendix 2.6 : PC Post-estimation diagnostics

Lagrange-multiplier test			
lag	chi2	df	Prob > chi2
1	37.1624	36	0.41527
2	26.2877	36	0.88238
H0: no autocorrelation at lag order			

Jarque Bera test			
Equation	chi2	df	Prob > chi2
gpc	28.944	2	0
gna	4.986	2	0.08266
geap	4.105	2	0.12838
geuca	0.741	2	0.69027
gsoa	2.41	2	0.29966
ALL	41.188	10	0.00001



All the eigenvalues lie inside the unit circle. VAR satisfies stability conditions.

Kas videomängude haru on majanduslangusekindel?

Käesolev magistritöö uurib sisemajanduse kogutoodangu (SKT) kasvu ja videomängude harus teenitavate tulude kasvu vahelist seost, testides sellel eesmärgil Grangeri põhjusliku seose olemasolu SKT kasvumäärade ja videomängude tulude kasvumäärade vahel vektori autoregresiooni mudelite, impulsi reaktsioonifunktsioonide ja Toda-Yamamoto (1995) Granger- põhjuslikkuse meetodi abil. Uurimistöös kasutatakse andmeid videomängude tulude aastaste kasvumäärade kohta (nii sektoris tervikuna kui ka selle segmentide kaupa) ning erinevate Maailma piirkondade (Põhja-Ameerika, Euroopa ja Kesk-Aasia, Aasia ja Vaikse ookeani piirkond, Lõuna-Aasia) SKT kasvumäärasid aastatel 1972–2019. Meie analüüsist ei ilmne, et SKP kasvumäärad Granger - põhjustavad videomängude tulude kasvumäärasid, välja arvatud Põhja-Ameerika piirkonnas konsoolide segmendis kui ka videomängude harus tervikuna. Samuti leiame kindlaid tõendeid selle kohta, et SKP kasv Granger-põhjustab mobiilseadmete mängude tulude kasvumäära Euroopa ja Kesk-Aasia regioonis ning Lõuna-Aasias. Impulsi reaktsioonifunktsioonide kõverad näitavad samuti lühiajalist vastupidist seost SKP kasvumäärade ja videomängude kasvumäärade vahel erinevates videomängude segmentides Põhja-Ameerika regioonis, mis viitab sellele, et videomängude haru on selles regioonis majanduslanguste suhtes vastupidav.

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