Economics extended essay

Effect of seasonality on the real estate market in Riga

Research question: To what extent does seasonality affect Riga's real estate market?

Word count: 3954

Table of Contents

Introduction

Buying or selling real estate is an essential part of today's market. Real estate market is a dynamic market, that will always be active - almost everyone switches their residence from time to time due to various life reasons, such as moving out of your parent's place, moving into a bigger apartment with your newly created family, simply upgrading one's existing living conditions and so on. Most of these buyers and sellers face a challenge of deciding when to make the purchase so as it is in their favor - they get a better price, the timing suits their specific needs etc. In many real estate markets, people make the same choices in the aspect of when to buy their real estate and thus seasonality occurs - a reoccurring motive that in specific times of the year there are more deals made than in other times of the year. However, this is not necessarily the case in all real estate markets. In this essay I will look at the question: **To what extend does seasonality affect Riga's real estate market?** Knowing whether seasonality exists and to what extent would be beneficial to everyone currently searching for an apartment, because it would allow them to better anticipate further price fluctuations and decide when to make the investment.

Theoretical hypothesis

Seasonality is one of the non-price determinants that affect both demand and supply in the goods market. Seasonality by definition *''is a characteristic of a time series in which the data experiences regular and predictable changes that recur every calendar year. ''*[1] This effect is especially noticeable in the real estate market as shown by the fact, that for the housing industry to correctly assess its growth, the quantity of real estate sold needs to be seasonally adjusted in order to bring out the real results[2]. Specifically in the real estate market, seasonality mainly changes the demand and it is possible to differentiate two seasons: Winter-Spring and Summer-Autumn[3]. Typically, this seasonality occurs in the way, that there is an increase in the demand in Summer-Autumn season, while in Winter-Spring season there is a decrease in demand. Although there are many reasons to this, there are a few that stand out and are responsible for most cases[4]- Firstly, for families with school-aged children, summer is a traditional time to change their location as that is the only time of the year when children don't have to go to school and it makes the moving in the new apartment a lot easier. Additionally, families sometimes have to change the neighbourhood they live in so their child can go to a new school, and that is also usually done in summer. Secondly, the weather conditions- for practical reasons it is much easier to move in and repair a new apartment in the warm summer, early autumn rather than in cold winter, early spring periods.

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[1] Will Kenton "Seasonality." Investopedia, Updated May 27, 2019, https://www.investopedia.com/terms/s/seasonality.asp, date accessed: March 03, 2020

[2] Nadia Evangelou, "Seasonality in the Housing Market." National Association of Realtors, January 2, 2019, https://www.nar.realtor/blogs/economists-outlook/seasonality-in-the-housing-market , date accessed: March 03, 2020

[3] LA.LV, "Mainījušās nekustamā īpašuma tirgus tendences. Skaidro iemeslus" [Real estate market trends have changed. Explaining why] ,LA.LV, 29 April, 2019, https://www.la.lv/mainijusas-nekustama-ipasuma-tirgus-tendences-skaidro-iemeslus, date accessed: March 03, 2020

[4] Home Junction, "Real Estate Seasonality: How seasons affect the market", Home Junction, February 12, 2020, https://www.homejunction.com/blog/2020/02/12/real-estate-seasonality/, date accessed: March 03, 2020

As aforementioned, Summer-Autumn season is better suited for buying real estate for various reasons, and therefore there is an increase in demand, which causes a market equilibrium shift as shown in Figure 1.

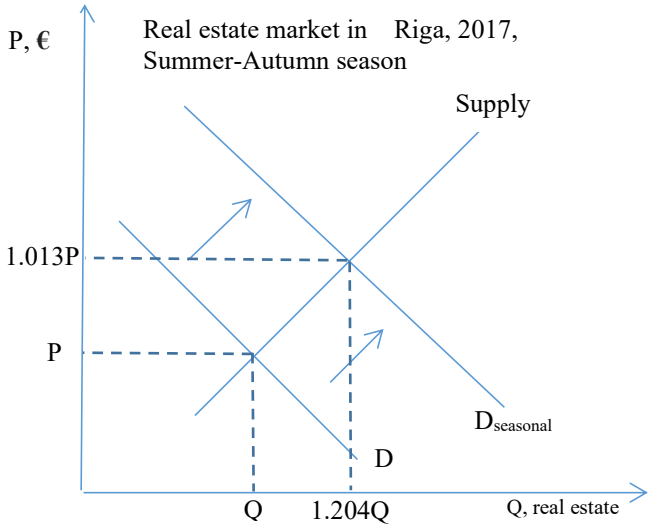

Figure 1

The figure represents the situation in the Summer-Autumn season of 2017 in Riga. There are more customers willing to buy apartments in this season, and therefore the demand curves shifts up and to the right from D to $D_{seasonal}$. There is an upward movement along the Supply curve, which causes a shift in the equilibrium point from (Q;P) to (1.204Q;1.013P), which means, that now, due to seasonality, there is more real estate sold at a higher price. The fact, that the quantity rises by 20.4% and prices rises by 1.3% is based on data shown later in the essay and the calculation itself can be found in the appendix 2 *(percentage calculations, 1&2).*

In the Winter-Spring season quite the opposite happens. Winter-Spring season is less suited for buying real estate, therefore demand falls and there is shift in the market equilibrium as illustrated by Figure 2

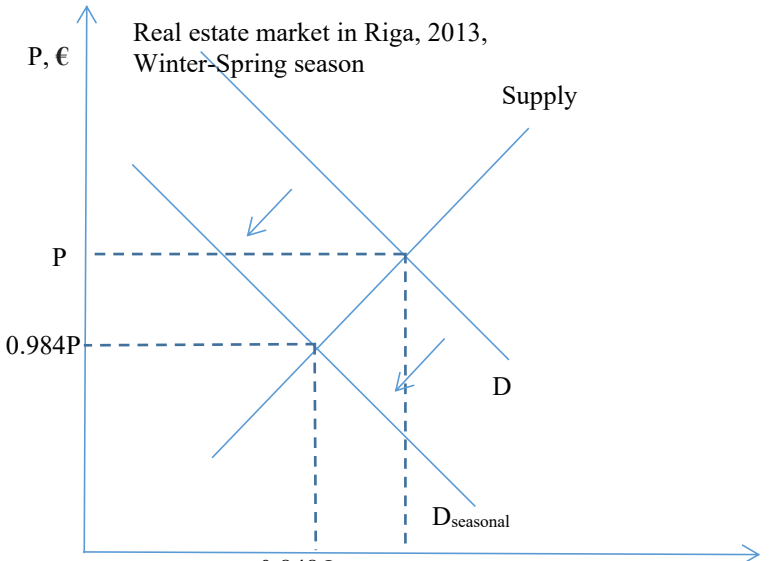

Figure 2

This figure depicts the situation in the Winter-Spring season of 2013 in Riga. There are less consumers willing to buy real estate, therefore demand shifts down and to the left from D to $D_{seasonal}$. There is downwards movement along the Supply curve, which causes a shift in the market clearing point from (Q;P) to (0.848Q;0.984P), which means, that now, due to seasonality, there is less real estate sold at a cheaper price. The fact, that quantity drops by 10% while price drops by 1.6% is based on data shown later in the essay and the calculation itself can be found in the appendix 2 *(percentage calculations, 3&4)*.

Differentiating markets within Riga's real estate market

Within Riga there is a vast variety of different apartments, each with its own specific area and quality. Some apartments are so distinguishably better than others (and hence cost higher), that it is impossible to get meaningful data by comparing them together, thus it is essential, that the market is grouped into sub-markets. Real estate apartments in Riga can be differentiated into two sub-markets, those being so called "series-style" apartments and new project apartments.

Series-style apartments are located in block houses built during the Soviet times from 1947 till 1985[5]. All block houses and their apartments built within a single building project looked pretty much the same, thus acquiring the name "series-style". These block houses were so popular, that there wasn't just a single project, there were a couple, for example, the 464th series (so called "Lithuanian project") and the Khrushchyovka (two most popular series-style apartments in Riga in 2017[6]), each of which differentiates from others at least slightly,however, for this essay ,they will all be combined into a single market, as the differences are too subtle to examine each of them individually.

New project apartments are located in apartment buildings, that are built from scratch in post-Soviet times, starting from year 2000. Typically these apartments are more modern and of better quality than series-style apartments, thus it is essential to differentiate both markets, because otherwise this factor will heavily influence the data.

Additionally, both of these markets need to be split further and divided regionally. Riga can be divided into a centre and 13 neighborhoods around it. Although some neighborhoods are arguably located in better places than others, these differences are marginal and thus all of these neighborhoods can be looked at as a single market. However, the centre of Riga is a different story, because the area is not only Riga's centre geographically, but also economically. Due to it being the central business district, the land use is heavily contested, which drives the prices of the apartments up significantly above the prices of neighborhood apartments, therefore forcing us to look at it as a different market.

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[5] RIA56, "КРАТКАЯ ИСТОРИЯ ПАНЕЛЬНОГО СТРОИТЕЛЬСТВА В РОССИИ"[A brief history of panel construction in Russia], RIA56, 11 July, 2013, https://ria56.ru/posts/kratkaya_istoriya_panelnogo_stroitelstva_v_rossii.htm, date accessed: March 03, 2020

[6] LA.LV, "Populārākie dzīvokļi Latvijā - lietuviešu un Hruščova laika projektos"[Most popular apartments in Latvia- in Lithuanian and Khrushchev time projects], 24 August, 2017, http://www.la.lv/popularakie-dzivokli-latvija-lietuviesu-un-hruscova-laika-projektos, date accessed: March 03, 2020

Thus we have divided Riga's apartment market into 4 sub-markets, those being series-style apartments in neighborhoods of Riga, series-style apartments in the centre of Riga, new project apartments in the neighborhoods of Riga and new project apartments in the centre of Riga.

Raw data

The raw data were acquired from the web-page[7] of State Land Service of Latvia, where the data are gathered based on the information present in the cadastre information system in which, by the law[8], there is information about every single apartment in the country, thus I can be sure, that my acquired data will be as accurate as possible. The data about the quantity sold and average price in the 4 different Riga's real estate markets are showcased in Figures 3.

Half-year	New project apartments in the centre of Riga		New project apartments in the neighborhoods of Riga		Series-style apartments in the centre of Riga		Series-style apartments in the neighborhoods of Riga	
	Average price, EUR/m^2	Number of deals	Average price, EUR/m^2	Number of deals	Average price, EUR/m^2	Number of deals	Average price, EUR/m^2	Number of deals
2011-1	1497	70	857	196	917	128	414	1179
2011-2	1445	201	981	286	839	182	412	1505
2012-1	1817	80	1006	303	865	153	446	1476
2012-2	1882	204	1025	432	1050	215	473	1737
2013-1	1937	132	1039	457	952	182	515	1791
2013-2	2178	167	1087	664	959	217	519	2039
2014-1	2331	177	1214	563	973	195	565	1918
2014-2	2115	141	1196	533	919	166	568	2123
2015-1	1991	101	1064	325	915	140	593	1802
2015-2	1856	127	1108	532	992	248	600	2208
2016-1	2216	120	1130	600	996	260	628	2089
2016-2	2039	168	1144	530	1039	231	650	2257
2017-1	2084	110	1260	538	1083	223	705	2329
2017-2	2087	147	1371	701	1119	256	738	2401

Figure 3

[7] Valsts zemes dienests, "Vidējās darījumu cenas dzīvokļiem" [Average transaction prices for apartments], http://kadastralavertiba.lv/videjas-darijumu-cenas-dzivokliem/, date accessed: March 03, 2020

[8] Likumi.lv, "Nekustamā īpašuma valsts kadastra likums."[State Cadastre Law for real estate] Latvijas Vēstnesis, Updated December 01, 2019, https://likumi.lv/doc.php?id=124247, date accessed: March 03, 2020

Adjusting the data

Firstly, before analyzing the data, it is essential, that the data are adjusted for consumer price index (CPI) regarding real estate. What this index essentially does is it adjusts prices with respect to inflation and consumer preferences on spending on real estate (how much of their income are they ready to spend on real estate)[9]. Since CPI is defined as $CPI = \frac{Cost\ of\ good\ in\ the\ given\ year}{Cost\ of\ good\ at\ base\ year}$, then to calculate prices to a single base year we need to use the formula $Cost\ of\ real\ estate\ at\ the\ base\ year = \frac{Cost\ of\ real\ estate\ in\ the\ given\ year}{CPI_{Real\ Estate}}$

Given CPI indexes, with the base 2015=100 can be seen in the Figure 4.

Year	CPI	Year	CPI	Year	CPI
2011/1.quarter	86.98	2013/2.quarter	97.37	2015/3.quarter	100.40
2011/2.quarter	88.51	2013/3.quarter	98.52	2015/4.quarter	102.91
2011/3.quarter	91.36	2013/4.quarter	101.08	2016/1.quarter	103.49
2011/4.quarter	88.05	2014/1.quarter	103.39	2016/2.quarter	109.52
2012/1.quarter	89.22	2014/2.quarter	104.90	2016/3.quarter	110.04
2012/2.quarter	90.28	2014/3.quarter	109.04	2016/4.quarter	110.09
2012/3.quarter	92.54	2014/4.quarter	96.57	2017/1.quarter	113.11
2012/4.quarter	93.41	2015/1.quarter	96.63	2017/2.quarter	119.53
2013/1.quarter	93.52	2015/2.quarter	100.06	2017/3.quarter	119.72
				2017/4.quarter	119.69

Figure 4[10]

It can be seen, that the CPI's are given for quarters, but our data for real estate is in half-years. Therefore, we need to find out the CPI by half-years. For the sake of simplicity let's assume, that $CPI_{half-year} = \frac{CPI_{1.quarter} + CPI_{2.quarter}}{2}$.

Using this formula we can get the $CPI_{half\text{-}year}$ as shown in Figure 5.

[9] U.S. Bureau of Labor Statistics, "How is CPI used?" in *"Consumer Price Index Frequently Asked Questions"*, U.S. Bureau of Labor Statistics, Updated April 25, 2019, https://www.bls.gov/cpi/questions-and-answers.htm, date accessed: March 03, 2020

[10] "PC070c. Mājokļu cenu indekss un pārmaiņas" [PC070c. Real estate CPI and its changes], Centrālās stastikas pārvaldes datubāzes, https://data1.csb.gov.lv:443/sq/34717 , date accessed: March 08, 2020

Half-Year	CPI	Half-Year	CPI	Half-Year	CPI
2011-1	87.75	2013-1	95.45	2015-2	101.66
2011-2	89.71	2013-2	99.80	2016-1	106.51
2012-1	89.75	2014-1	104.15	2016-2	110.47
2012-2	92.98	2014-2	102.81	2017-1	116.32
		2015-1	98.35	2017-2	119.71

Figure 5

In this case we have a CPI for the real estate market as a whole, however, we have split this market into 4 smaller ones. It can be argued, that the CPI will differ from market to market, and that using the same CPI will inevitably lead to inaccuracies, however, the specific CPI for each of the markets couldn't be determined due to the lack of data, and therefore for this essay it will be assumed, that the change in CPI between the markets in negligible.

Analyzing the sub-markets

Series-style apartments in the neighborhoods of Riga

We can adjust the prices using the formula $Price_{CPI\ adjusted} = \frac{Price}{CPI/100} = \frac{100 \cdot Price}{CPI}$ and then put the adjusted data for the market of series-style apartments in neighborhoods of Riga paired together with the number of deals *(Appendix 1, tables, 1)*

The data can be then put into a line chart to see how the prices and numbers of deals change seasonally.

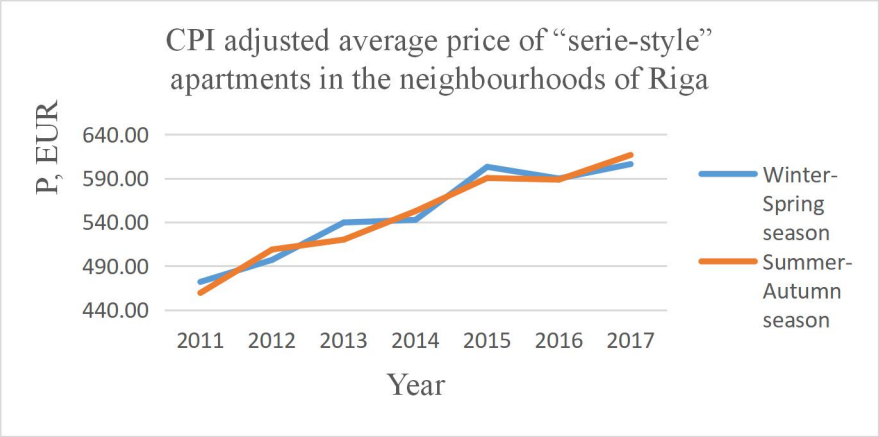

Figure 7

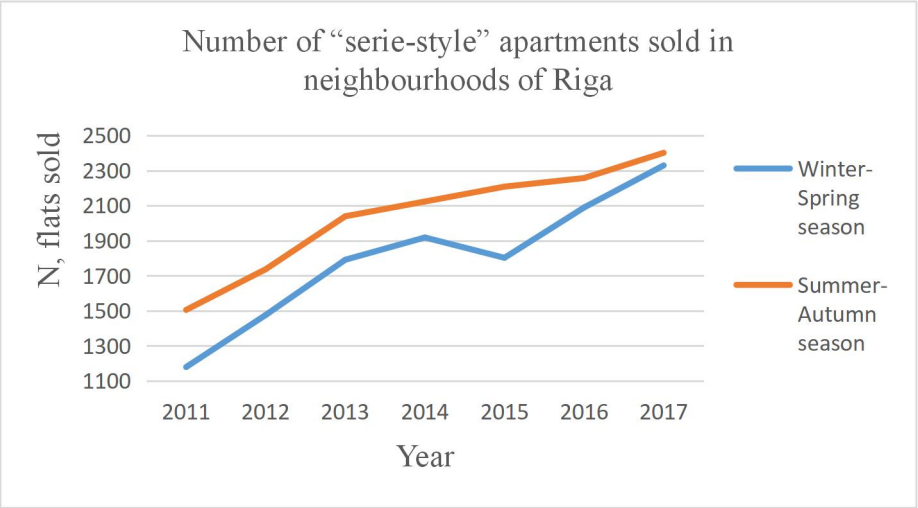

Figure 8

Figures 7 and 8 showcase the comparison between semesters of adjusted price and number of deals respectively.

In Figure 8 there is a clear pattern, that in the Summer-Autumn season there are significantly more apartments sold than in the Winter-Spring season of the respective year, hence the effect of seasonality is evident on the quantity. On average, in the Summer-Autumn season there were 15% more number of apartments sold *(appendix 2, percentage calculations, 5)*. However, in Figure 7 there is no such clear pattern to be seen, as there is no significant change in the price and in some years, the price is even higher in Winter-Spring season, contrary to what was proposed in the theory.

Series-style apartments in the centre of Riga

The prices of the apartments are adjusted for the CPI of real estate, and put in a line chart, next to the number of deals made (Figures 9&10). Data tables for these figures can be found in appendix 1 *(tables, 2)*.

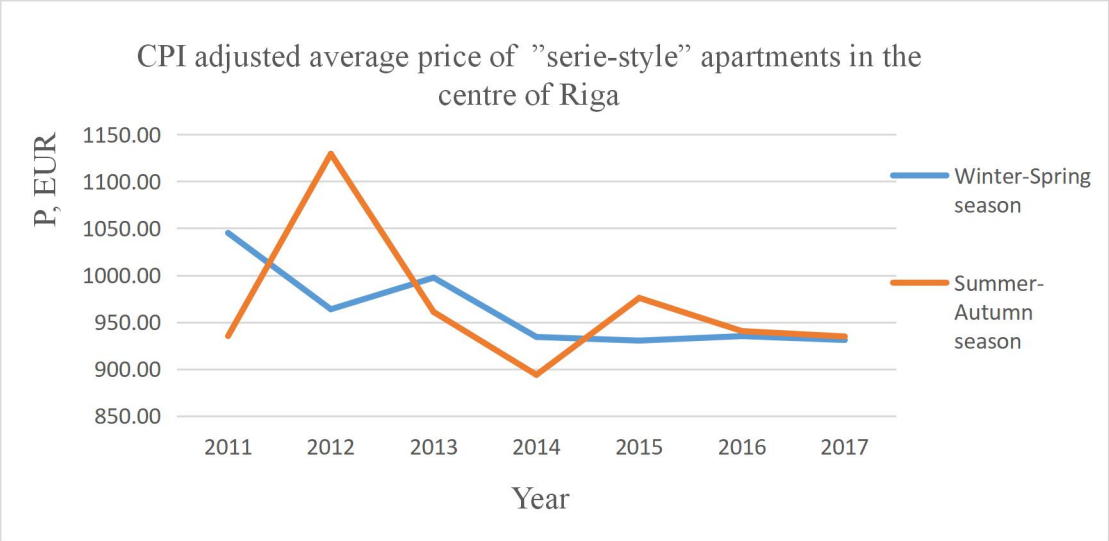

Figure 9

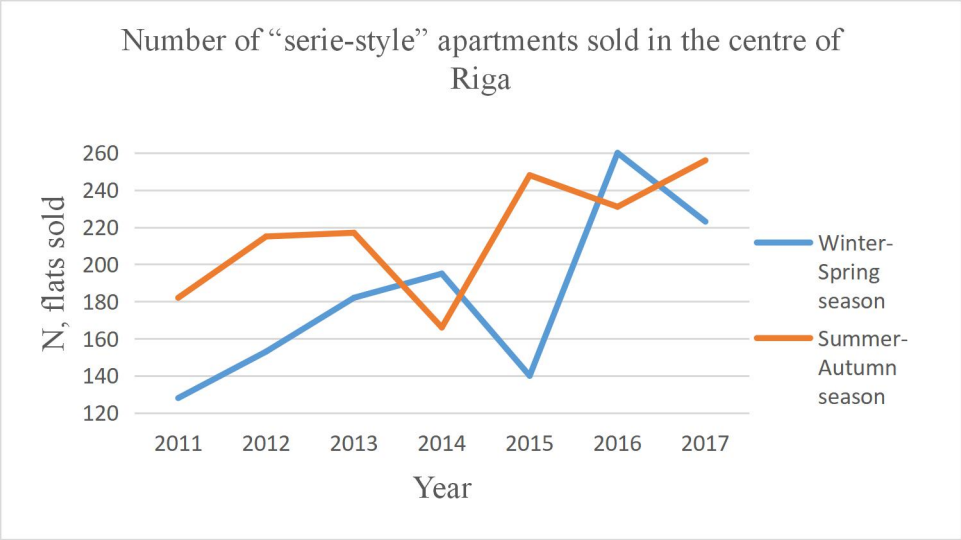

Figure 10

Although there are two exception years, those being 2014 and 2016, the seasonal pattern, that there are more apartments sold in the Summer-Autumn season, still is rather evident in this sub-market. On average, in the Summer-Autumn season there were 24% more apartments sold *(appendix 2, percentage calculations, 6)*. As for the average prices, there is no evident pattern throughout the examined period as prices are sometimes higher in one season and sometimes in the other season, in addition the intervals vary greatly and as such most likely seasonality isn't affecting this market's prices.

New project apartments in the neighborhoods of Riga

The prices of the apartments are adjusted for the CPI of real estate, and put in a line chart, next to the number of deals made (Figures 11&12). Data tables for these figures can be found in the appendix 1 *(tables, 3)*.

Figure 11

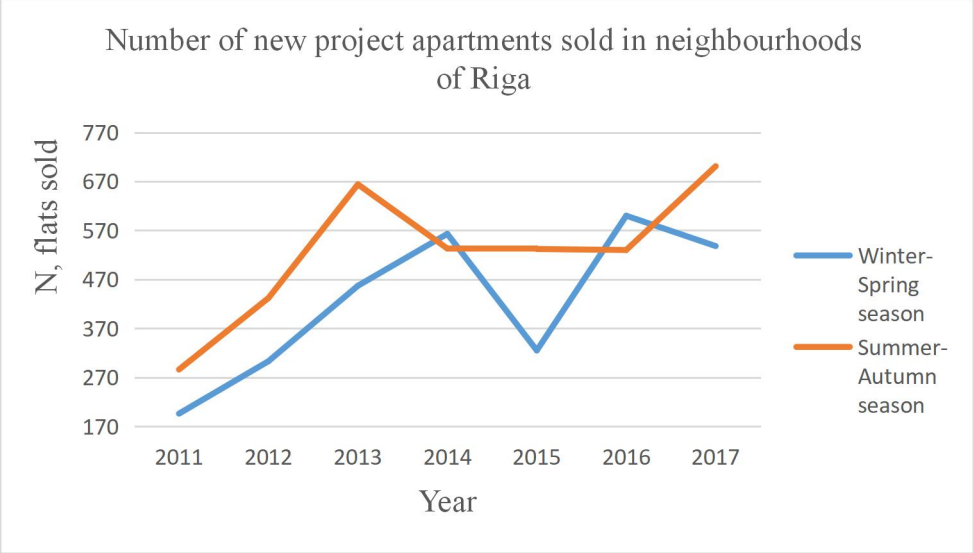

Figure 12

Since 2011 this sub-market has grown quite a lot, and apart from the anomaly years 2014 and 2016, this growth happens exactly in the Summer-Autumn season, because in the shifts from Summer-Autumn to Winter-Spring season the amount of apartments sold stays relatively constant, but in the shift from Winter-Spring to Summer-Autumn season the amount of apartments sold grows rapidly. On average, in the Summer-Autumn season there were 30% more apartments sold than in the Winter-Spring season *(appendix 2, percentage calculations, 7)*.

Despite that though, even in this sub-market, the seasonality effect doesn't have a significant impact on the prices as suggested by the fact, that for more than half (years 2013-2016) of the period examined the price in Winter-Spring season has been the same as Summer-Autumn season or even higher, contrary to the proposed theory.

New project apartments in the centre of Riga

In the last sub-market the prices of the apartments are also adjusted for the CPI of real estate, and put in a line chart, next to the number of deals made (Figures 13&14). Data tables for these figures can be found in the appendix 1 *(tables, 4)*.

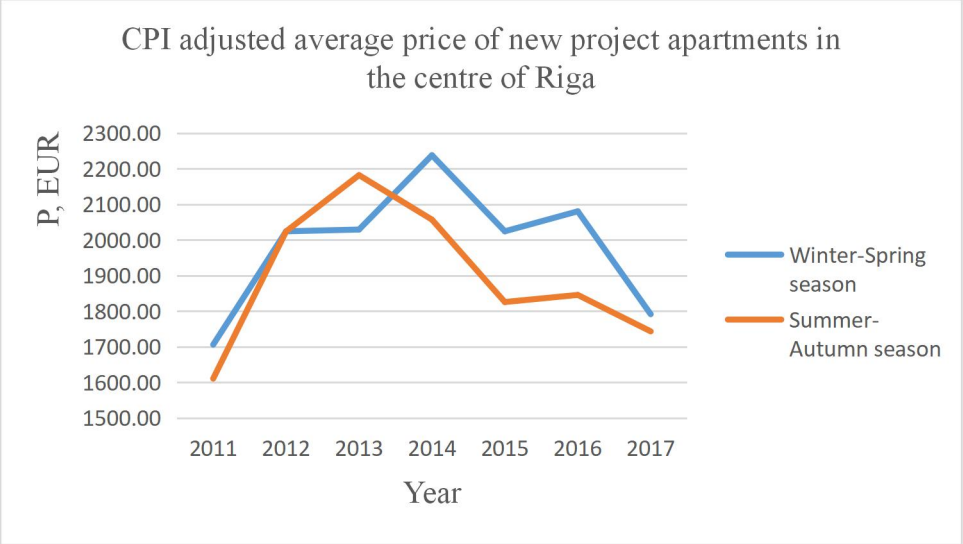

Figure 13

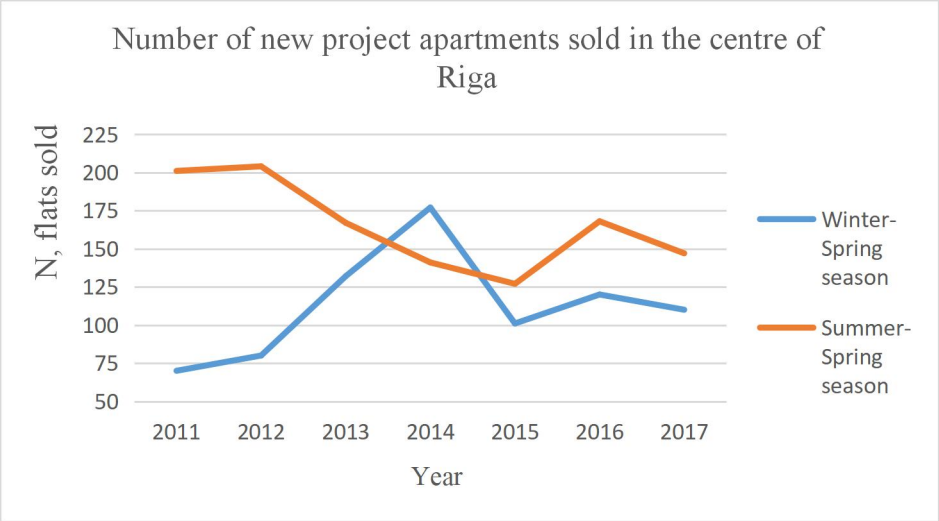

Figure 14

Similarly to the new project market in the neighborhoods of Riga, in the centre of Riga the market has grown quite a lot since 2011, and apart from the outliers year 2014 and year 2016, this growth has been happening in the Summer-Autumn season which points toward the seasonality effect being effective in influencing the amount of apartments sold in this market. On average, in Summer-Autumn there have been 64% more apartments sold than in the Winter-Spring season *(appendix 2, percentage calculations, 8)*, more than double than in the other sub-markets, which can largely be attributed to the abnormal increases in sales in Summer of 2011&2012, in the following years, the percentages return to levels similar to the other sub-markets.

As for the average prices, just like in the other new project sub-market, prices have actually been higher in the Winter-Spring season for most (years 2014-2017) of the examined year period, contrary to the proposed theory, thus showing that most likely seasonality doesn't affect the price level of this sub-market.

Supply-side of the real estate apartment market

So far, it seems, that seasonality only affects the quantity sold not the price, as shown by the data in all four sub-markets. However, thus far only data about the demand side has been gathered and analyzed. In a typical market though, not only the demand side, but the supply side as well contribute to the making of the market equilibrium point. By the economic theory, shifts in supply cause movement alongside demand curve, thus altering the effect of seasonality, that is, either making it seem bigger than it is or making it seemingly disappear. One such hypothetical situation, where a shift in supply evens out the shift in price is looked at in Figure 15.

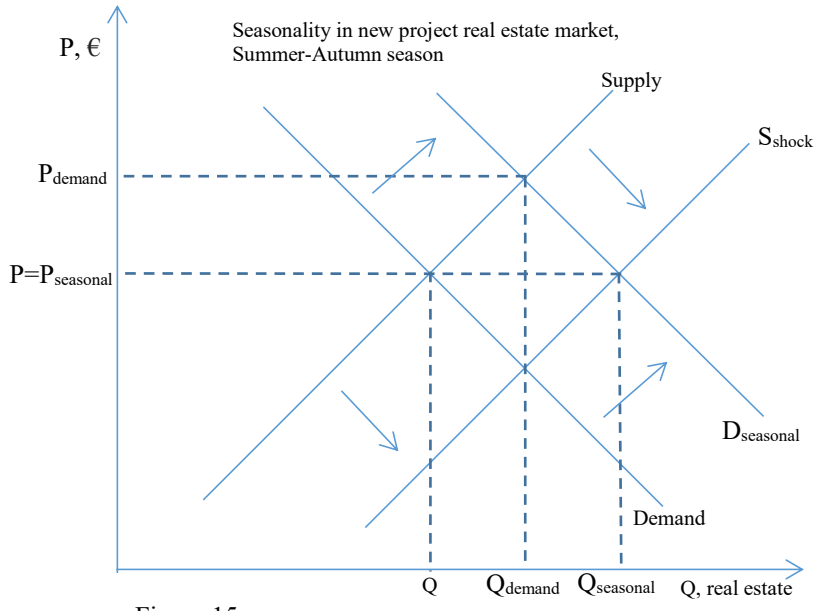

Figure 15

Due to seasonality, there is an increase in demand and it shifts up and to the right from Demand to $D_{seasonal}$ causing the equilibrium point shift to a point where more real estate is sold at a bigger price, just like explained in Figure 1. However, in this case, at the same time there is also a positive supply side shock, which shifts the supply curve down and to the right from Supply to S_{shock}, which causes the equilibrium point to shift from (Q_{demand};P_{demand}) to ($Q_{seasonal}$;$P=P_{seasonal}$). We can see that in this case, due

to changes in supply and demand, the quantity of real estate sold has increased from Q to $Q_{seasonal}$, however, the quantity has stayed exactly the same, because $P=P_{seasonal}$. This graph could be one of the possible ways how supply shift seemingly makes seasonality have no effect on price at all.

However, in real life, not all markets follow this theory, and one of such markets is the real estate market. Firstly, both producing and selling real estate involves very significant time-lags. Building new houses takes many years, it is not an item that can be quickly produced to adjust to changes in the market, and therefore the market equilibrium changes very slowly. Even in the secondary market, which is the selling of apartments that have already been purchased and used before, the movement of the equilibrium is slow[11], because for people to be able to sell their apartment, they first have to move out of it and find a new apartment in which to settle in, which is usually a slow, costly and annoying process. That's why there is not a lot of movement from apartment to apartment, because extra stress, discomfort and costs of moving out far outweigh any profits to be made due to the movement of the market equilibrium. Of course, there are people who are rich enough to have multiple apartments and just live in one, while try to sell others for a profit, however, they make up too small of a fraction of the market to make the market noticeably faster.

Secondly, for most people, real estate is the most valuable asset they have, and therefore they will take a very careful approach in selling it. It is not an item people are looking to just sell quickly, if it has been their most worthy investment, they will be willing to wait a long time in order to get the best price possible. For this reason, even if there is a big increase in supply of the apartments, the market equilibrium

[11] Conor MacEvilly, "Buying and selling a home and the joys of waiting. How to stay sane.", MySeattleHomeSearch, September 21, 2016, https://www.myseattlehomesearch.com/blog/buying-and-selling-a-home-and-the-joys-of-waiting-how-to-stay-sane/, date accessed: March 03, 2020

price won't decrease nearly enough as economic theory would suggest, because the price is very sticky downwards due to the ability to wait for future market shifts.

Thirdly, such demand and supply curves as in Figure 15 are very hard to draw, due to the countless factors that differentiate one product from another. Even dividing the market in sub-markets, as done in this essay, is likely to be in vain, because either the curves will be too inaccurate due to the undistinguished factors, that affect the price of each apartment or there will be the need to draw so many curves, that it will become practically unfeasible.

Therefore, for these reasons, in these essays, it will be assumed, that only the demand side affects the seasonality, because, as explained, the market doesn't operate like a classic market proposed by the economic theory, and thus there is no way to determine how the change in supply will alter the effect of seasonality.

Seasonality effect on the price in Riga's real estate market

As seen in Figures 7, 9, 11, 13 seasonality hasn't got any meaningful effect on the average price in any of the four Riga's real estate sub-markets, as opposed to what the economic theory predicts. This can be explained with a reasoning similar to why the real estate market doesn't operate like a classic free market. In fact, the fact that it doesn't operate in this way is the answer. Sellers are reluctant to decrease prices, because they are ready to wait for a better offer for such a worthy asset, and, similarly, buyers are reluctant to respond to increasing prices, as for such a huge investment they are ready to wait for some time to get a better deal. Of course, this doesn't mean, that the price will stay constant forever, the prices slowly fluctuate and over bigger periods of time (e.g. the time examined for this essay, years 2011-2017) do grow, however, this happens very slowly, and not on seasonal basis.

The trend of seasonality's effect on quantity sold

While the price isn't affected, quantity sold is affected by seasonality quite significantly, hence, it would be useful to look at the trend by how much is affected. This can be done by done by drawing a trend-line through the data points for both seasons and then examining the differences between them (Figures 16,17,18&19)

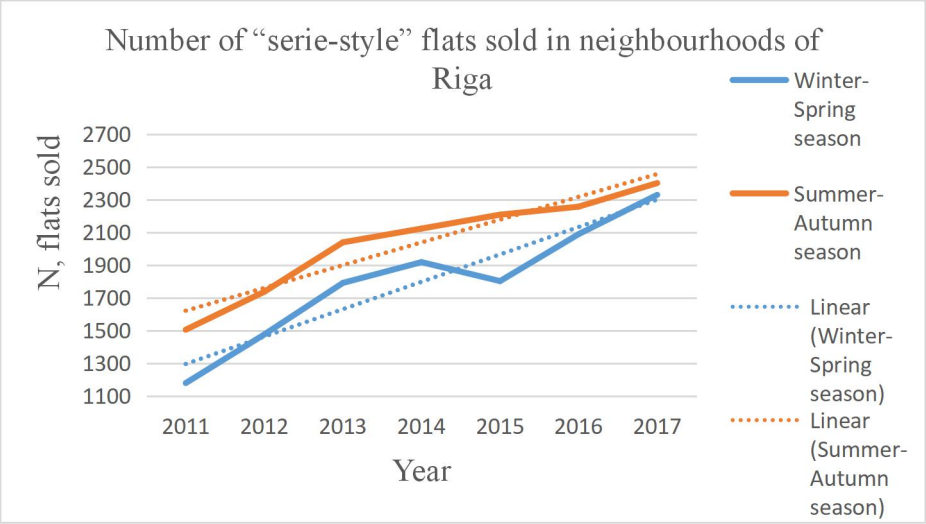

Figure 16

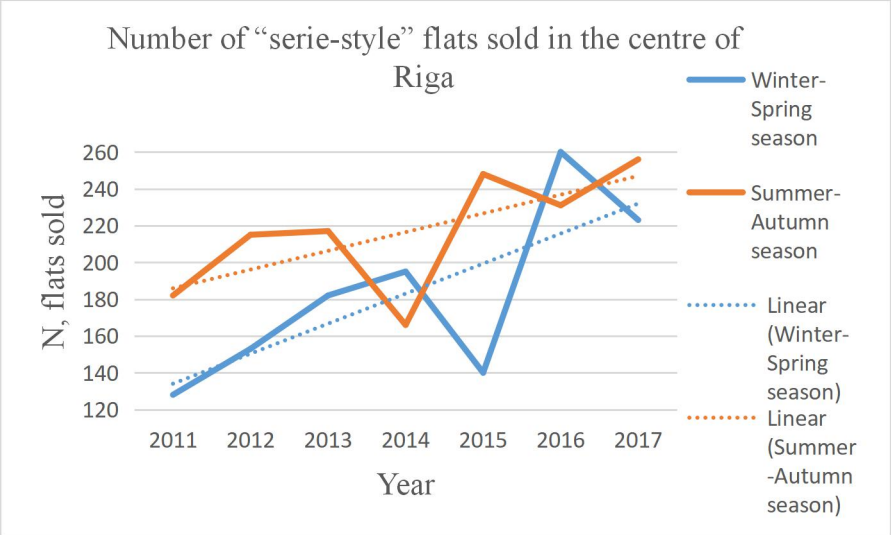

Figure 17

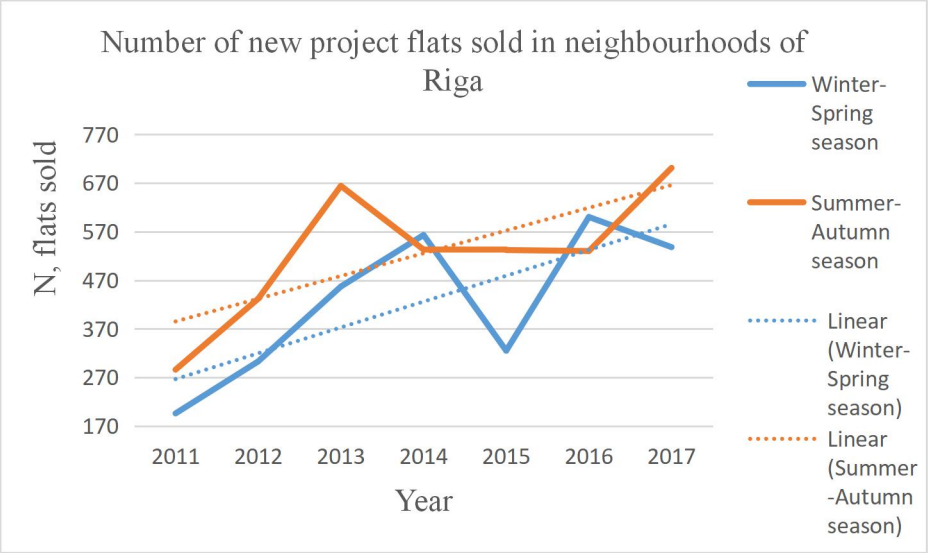

Figure 18

Figure 19

In the figures 16,17,18&19 it can be seen, that in all four sub-markets the difference between both season's trend-lines is decreasing and in some the two lines almost cross, which suggest, that overall, since 2011 the effect of seasonality on real estate market is constantly decreasing and thus the number of deals made today vary less seasonally than 5 years ago- in 2011 on average in 3 markets, excluding the new project apartment in the centre of Riga sub-market (this sub-market had to be excluded, because for an ,unfortunately, unknown reason, there was an abnormal 187% seasonal quantity increase *(appendix 2, percentage calculations, 9)*, which is

too large to possibly be caused by seasonality, and therefore is an anomaly that would interfere with the data if used) the numbers of deal made increased seasonally by 39% *(appendix 2, percentage calculations, 10)*and only by 20% *(appendix 2, percentage calculations, 1)* in 2017, which shows a decreasing trend and thus it is possible, that in the future seasonality will have no effect on Riga's real estate market not only in price, but in quantity sold as well.

Outside influence on the amount of real estate sold in Riga's real estate market

Although the overall trend of seasonality on quantity sold is evident, and matches the economic theory, there are some outliers, and interestingly enough, all of them ,in whichever sub-market are they, are either year 2014 or year 2016. In the next two paragraphs, potential outside influence will be examined and looked at whether there have been events, that seemingly hide the seasonality effect.

Change in the Immigration law and the "stored key principle"

On May 8, 2014 Saeima, the Latvian parliament, altered the Immigration law[12] regarding the acquisition of a temporary residence permit. The law being effective from 1st September, it stated, that now, to gain a temporary residence permit by buying real estate, the property must be worth not 150'000 EUR but at least 250'000 EUR (or its cadastral value must be not 50'000 EUR but at least 80'000 EUR). This

[12] Saeima press service, "Izmaiņas uzturēšanās atļauju izsniegšanā ārzemniekiem stāsies spēkā šī gada septembrī" [Changes in the issuance of residence permits to foreigners will take effect in September this year], Latvijas Republikas Saeima, May 08, 2014 , https://www.saeima.lv/lv/aktualitates/saeimas-zinas/22169-izmainas-uzturesanas-atlauju-izsniegsana-arzemniekiem-stasies-speka-si-gada-septembri, date accessed: March 03, 2020

change negatively affected the demand by foreign investors and thus the amount of deals made in the Summer-Autumn season were less than usual.

Selling off the Salna street 21 project

On October 6th, 2014 the apartments of the Salna street 21 project, the biggest new project house in Riga, were released publicly for sale[13]. Located in one of Riga's busiest neighborhoods Pļavnieki and having around 600 apartments, this project alone contributed a significant portion of all new project deals in the neighborhoods of Riga until, after 2 years, in 2016 most economy class apartments were sold out and by the start of 2017 all apartments were sold out[14]. This created a lack of economy class new project apartments available and decreased the demand for new project apartments as people rather opted for series-style apartments in other regions.

[13]CCDU Baltic, "Uzsākta dzīvokļu tirdzniecība Rīgas dzīvojamajā kompleksā Salnas ielā 21" [Sale of apartments in Riga residential complex Salnas Street 21 has been started], City24.lv, October 06, 2014, https://www.city24.lv/lv/nekustama-ipasuma-zinas/NEWS_3646/uzsakta-dzivoklu-tirdznieciba-rigas-dzivojamaja-kompleksa-salnas-iela-21, date accessed: March 03, 2020

[14]LATIO Market Analysis Division, "Residential market report Riga City and other regions H1 2017", LATIO, https://latio.lv/lv/pakalpojumi/tirgus-analize/majoklu-tirgus/147/latio-majoklu-tirgus-parskats-2017-1-pusgads.pdf, date accessed: March 03, 2020

Conclusion

In this essay I have examined the extent to which does seasonality affect the real estate market in Riga, Latvia. I differentiated the market in four sub-markets and found out, that seasonality plays no role in the average prices of the real estate market, due to prices being sticky and the patience of both involved parties. This finding shows that for buyers and sellers there is no need to wait for the slow and active season respectively, because the price won't be affected by it. However, the quantity sold does indeed get affected by seasonality, with the strongest effect of 64% average seasonal increase in the new project apartments in the centre of Riga market, and with the weakest effect being on the series-style apartments in the neighborhoods of Riga with 15% average seasonal increase. In addition, I found out that seasonality effect is diminishing every year as shown by the fact, that on average in the whole Riga's real estate market there was a 39% seasonal increase in 2011, but only 20% increase in 2017. Additionally, I investigated the outlier years 2014 and 2016, and found out, that seasonality effect persisted in those years too, but just was concealed by stronger outside forces, such as changes in Immigration laws and selling off of Salna street 21 project.

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Appendix 1

Note: All data tables are based on data from the 7th and 9th footnote (page 8 and page 9 respectively)

Tables

1.

Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals
2011-1	471.82	1179	2013-1	539.58	1791	2015-2	590.23	2208
2011-2	459.28	1505	2013-2	520.04	2039	2016-1	589.64	2089
2012-1	496.94	1476	2014-1	542.51	1918	2016-2	588.40	2257
2012-2	508.74	1737	2014-2	552.50	2123	2017-1	606.09	2329
			2015-1	602.98	1802	2017-2	616.52	2401

2.

Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals
2011-1	1045.07	128	2013-1	997.43	182	2015-2	975.85	248
2011-2	935.29	182	2013-2	960.92	217	2016-1	935.17	260
2012-1	963.79	153	2014-1	934.27	195	2016-2	940.53	231
2012-2	1129.34	215	2014-2	893.93	166	2017-1	931.05	223
			2015-1	930.40	140	2017-2	934.80	256

3.

Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals
2011-1	976.69	196	2013-1	1088.59	457	2015-2	1089.96	532
2011-2	1093.03	286	2013-2	1089.18	664	2016-1	1060.98	600
2012-1	1047.35	303	2014-1	1165.68	563	2016-2	1035.58	530
2012-2	1101.91	432	2014-2	1163.37	533	2017-1	1082.79	538
			2015-1	1081.91	325	2017-2	1145.32	701

4.

Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals	Half-year	Adjusted price	Number of deals
2011-1	1706.08	70	2013-1	2029.44	132	2015-2	1825.78	127
2011-2	1610.84	201	2013-2	2182.36	167	2016-1	2080.65	120
2012-1	2024.51	80	2014-1	2238.23	177	2016-2	1845.75	168
2012-2	2024.20	204	2014-2	2057.29	141	2017-1	1791.61	110
			2015-1	2024.51	101	2017-2	1743.45	147

Appendix 2

Percentage calculations

All of the percentage calculations were based on the data found on data tables in appendix 1. The percentage changes were calculated by the formula

$$\Delta = \frac{Value_{end} - Value_{beginning}}{Value_{beginning}} \qquad Average = \frac{a_1 + a_2 + a_3 + ... + a_n}{n}$$

1. $\Delta Q_{seasonal}$=((2401-2329)/2329+(256-223)/223+(701-538)/538+(147-110)/110)/3=0.204=20.4%
2. $\Delta P_{seasonal}$=((616.52-606.09)/606.09+(934.80-931.05)/931.05+(1145.31-1082.79)/1082.79+(1743.45-1791.61)/1791.61)/4=0.0130=1.3%
3. $\Delta Q_{seasonal}$=((1791-1737)/1737+(182-215)/215+(457-432)/432+(132-204)/132)/4=-0.1524=-15.2%
4. $\Delta P_{seasonal}$=((539.58-508.74)/508.74+(997.43-1129.34)/1129.34+(1088.59-1101.91)/1101.91+(2029.44-2024.20)/2024.20)/4=-0.0164=-1.6%
5. $\Delta Q_{seasonal}$=((1505-1179)/1179+(1737-1476)/1476+(2039-1791)/1791+(2123-1918)/1918+(2208-1802)/1802+(2257-2089)/2089+(2401-2329)/2401)/7=0,147=15%
6. $\Delta Q_{seasonal}$=((182-128)/128+(215-153)/153+(217-182)/182+(166-195)/195+(248-140)/140+(231-260)/260+(256-223)/223)/7=0,239=24%
7. $\Delta Q_{seasonal}$=((286-196)/196+(432-303)/303+9664-457)/457+(533-563)/563+(532-325)/325+(530-600)/600+(701-538)/538)/7=0.301=30%
8. $\Delta Q_{seasonal}$=((201-70)/70+(204-80)/80+(167-132)/132+(141-177)/177+(127-101)/101+(168-120)/120+(147-110)/110)/7=0.639=64%
9. $\Delta Q_{seasonal}$=(201-70)/70=1.871=187%
10. $\Delta Q_{seasonal}$=((1505-1179)/1179+(182-128)/128+(286-196)/196)/3=0.385=39%