Communication Papers of the of the 17th Conference on Computer Science and Intelligence Systems pp. 209–216
DOI: 10.15439/2022F110
ISSN 2300-5963 ACSIS, Vol. 32

High-tech offers on ecommerce platform during war in Ukraine

Dariusz Grabara
University of Economics in Katowice
1 Maja 50 st., 40-287 Katowice, Poland
Email: dariusz.grabara@ue.katowice.pl

***Abstract*—Ecommerce plays a key role in market development. High-tech supports ecommerce, as well as being the subject of sales. However, the regional military conflict such as the war in Ukraine may change sellers' behavior. This article investigates changes on the Polish Allegro ecommerce trading platform before and during the four-week war periods in the high-tech smartphone category. During war maintaining communication in a foreign country is crucial. From this point of view, Xiaomi offers were discussed using Spearman rho coefficient. The study revealed that some high tier smartphone models like '11T Pro' are positively corelated (0.390), while most of the lower positioned devices in Redmi group are strongly and negatively correlated. This includes models like the 'Redmi Note 10' (-0.881), 'Redmi 10' (-0.829), or 'Redmi 9A' (-0.825). A possible explanation as migration shows the moderating effect of the correlation of Mi smartphones (0.422) and Redmi sub-brand (0.518) offers with the number of people crossing the border.**

I. Introduction

ECOMMERCE is perceived as a key player in the growth of the global market. Its continued growth is forcing companies to change their behavior in building new distribution channels or customer support channels. However, ecommerce does not develop independently of market disruptions. Disruptions are often related to problems of transfer, production and sale of goods and supplies. In the final stage of sales, it affects the retail customer in the form of a change in the number of goods offered on e-commerce platforms.

Disruption can be perceived from different points of view. The basic division is the scale of the event. In this sense, events can be of global or regional type. An example of one such event is the recent COVID-19 pandemic affected every aspect of ecommerce [1], [2]. The traffic bans were the fastest felt effect of COVID-19 on the retail market. However, in this context, it was ecommerce that thrived and gained momentum. Further analysis of ecommerce sales provided insight into customer behavior.

The second type of event is the regional type. From this perspective, a regional military conflict appears to be game changer for market growth. An example of regional event is Russia's invasion of Ukraine launched on February 24, 2022. It triggered a new assessment of the security situation in Europe. Concerns about the conflict spill-over to European Union countries are changing the economies. Ecommerce is also not fully immune to these changes.

Against this background, Poland was the most affected country by migration from Ukraine. In the period of more than 2 months, from February 2nd, 2022 to April 30th, 2022, the number of people crossing the border reported by Polish Border Guard (*Straż Graniczna*) was more than 3 million (3.076 million) [3]. The population of Poland is estimated at 38,057 thousand people, according to the central statistical office, Statistics Poland [4]. From this perspective, migration from Ukraine accounts for more than 8% of the native population.

People arriving from an invaded country can feel lost and abandoned. However, mobile devices and electronic services provided by the governments of Ukraine and Poland for evacuees can be quickly accessed through smartphones. In this context not having access to a smartphone for evacuee in foreign country is like losing major communication channel. It can therefore be assumed that ensuring the availability of smartphones is an equivalent of providing a basic need for those fleeing the war. Therefore, it is important to study the ecommerce market for much-needed devices, such as smartphones, in times of disrupted communications.

During a regional conflict, the transfer of goods from neighboring countries is disrupted. Embargoes are imposed and supply lines are severed. In the case of Poland, embargoes were imposed on the exchange of goods with Russia and Belarus, while disruptions affected transfers to and from Ukraine. Ecommerce platforms have also been affected by the disruptions. One form of ecommerce is selling on electronic trading platforms. The speed at which auctions/offers are issued makes them an appropriate observation point for changes in the number of issued offers. On this basis, the Allegro auction platform was chosen. Platform, originally developed in Poland, plays a key role in ecommerce in Europe and is one of ten most recognized ecommerce sites in the world [5].

Smartphones are also the most well-known high-tech devices available on the retail market. However, the trading platform offers all types of mobile devices. It is crucial then to obtain proper categories for time series analysis of offers. Product diversity is considered as a key to product and services platform competitiveness [6]. Wide availability of goods for each customer registered on the platform with conjunction of appropriately chosen categories, should provide adequate set of information.

In this perspective the article focuses on changes in the market for smartphone offerings that may be related to the large number of people migrating from a neighboring invaded country and fills a research gap on market decay caused by unexpected high-profile events.

Therefore, the aim of this study was to assess how regional military conflict affected the ecommerce auction platform in the field of high-tech.

Hypothesis H1 was issued stated that regional military conflict influenced the volume of offers through:

1. H1.1 offers change before and during war periods,
2. H1.2 existing correlation between volume of offers and number of people crossing border from country affected by military conflict.

Research methods used for hypotheses verification comprise of calculation of the Spearman rho correlations and iterative algorithm for smartphone segmentation. R-CRAN and Microsoft Excel software were used to provide results.

The remainder of this paper is organized as follows: section II reviews related literature, section III described used methods for smartphones' segmentation process, study timeframe, procedure and data analysis, section IV presents results divided by before and during war periods, and migration analysis results, section V presents discussion, section VI analyzes limitation of the study, and finally last section provides conclusions.

II. Literature Review

High-tech goods market is influenced by wide range of features. Perceived value of brand could be one of them. Smartphone studies such as Yeh et. al [7] point to brand identification as having a positive effect on brand loyalty, thus highly valued brands would attract more buyers. However, brands, especially in the high-tech field, are subjects to subsidies from the state and are aided by technology theft. China's emerging technology leaders are benefiting from this kind of extra help [8]. Thus, analyzing offers from Chinese companies, should be a better indicator in times of great uncertainty, when there is no time for potential customers to research products in the market. Relying on brand awareness and perception seems a reasonable assumption for choosing a brand. Unfortunately, capturing brand value is subject of brand perception through the prestigious perceived quality of a brand like Apple. Wang [9] observed the second-hand smartphone market and found that it was dominated by Apple, as this brand provided more recovery value. As the study stated, the market analysis is limited, thus analyzing a wider range of products should give a better representation of market models. However, Wang study is one of the few to include time series analysis in the smartphone market. The Apple brand is popular due to its quality. Chatrattikorn and Buavaraporn [10] or Hwang and Su [11] focused their findings on iPhone models, while a broader perspective would be beneficial.

Analyzing the state of the market from the perspective of unexpected events can yield new information about the behavior of buyers and sellers. The other approach is the well-known fact that military conflicts affect the development of high-tech industries. Zilberfarb [12] noticed that electronics sector grew rapidly after the war. Unfortunately, such growth could be viewed from perspective of years, while regional conflicts could quickly dissipate. Another issue of perceiving war in the long term is the shock state at its onset.

Market analysis is often provided by the perception of technology through the goods offered. This kind of study shows the state of an ecommerce platform through the number of offers. Grabara [2] indicated the state of the COVID-19 pandemic through a count of premium device offers. However, the author tried to determine changes in the long term, and samples were given in two-week periods. In the war in Ukraine humanitarian crisis each day brings catastrophic information about fatalities and huge material losses. Therefore, a higher frequency of captured changes will add value to the research. Unfortunately, this work also lacked a comparative period before the unexpected event occurred. The presented article offers a much deeper insights, also due to the higher frequency of samples taken (daily). Another novelty is the different nature of the event.

Another type of research relates to sustainable smartphone practices. Svenson [13] focused on growing potential for proper usage of high-tech, enabling customer to be more aware to environmental needs than to consumerism. Unfortunately, the qualitative type of research makes impossible comparison between different timepoints and type of phones.

Brief literature summary has been presented in table 1.

III. Methods

A. Smartphones' segmentation

In the scope of high-tech field, smartphone offers have been recognized as the best available high-tech in the retail market. However, smartphones differ in terms of their most valuable features. According to Chmielarz [14], this set includes high quality, and design. This suggests that a wide variety of smartphones from a particular brand should be available at the same time during survey. In other words, selected brand should include high-end smartphones and entry-

Table 1. Selected studies related to the high-tech field and/or market disruption events

Study	Study subject / information
Yeh C. H. at al. (2016)	Smartphone market brand loyalty prediction
International Economy (2019)	Discussed subsidies to high-tech sector in China
Wang G.-Y. (2021)	Study discussion of high-tech iPhone customers behavior
Chatrattikorn S. and Buavaraporn N. (2015)	Study discussed factors affecting purchase decision of smartphones
Su Y. and Hwang J. S. (2020)	Study focused on sustained usage time for different brands
Zilberfarb B. Z. (2018)	Discussed effect of war on high-tech industry
Grabara D. (2021)	Study discussed smartphones' market during COVID-19 pandemic
Svenson F. (2018)	Study focused on addressing sustainability issues on the market as smartphone crises

level devices. The Xiaomi smartphone brand was chosen to achieve this goal. After launching its first smartphone in 2011, Xiaomi has reached the status of the world's fourth largest manufacturer in 2019 [15]. Xiaomi was a recognized brand in Poland due to its high functionality. It was confirmed in Dąbrowski's survey on finding accuracy of geopotential models in Poland [16]. One of the key elements of Xiaomi's strategy is pricing. Established price levels could be considered as aggressive pricing strategy [17]. Xiaomi offers wide diversity of smartphones designated for different group of customers, allowing customers to choose between products with different levels of added features. In the presented study, 99 categories were found for various models listed on the Allegro platform. Second in terms of models was Samsung with 90 models. Models' selection was based on:

- availability of models through all days in survey timeframe,
- device positioning.

Positioning was determined by main brand and sub-brand. Xiaomi's main brand was Mi-based smartphones, while the Redmi brand was chosen as the sub-brand. The division exhausted the assumption of smartphone segmentation. However, additional differentiation was applied within the main brand. Xiaomi produces different varieties of products. For the actual model, there are versions with added features, which are represented by the naming convention 'Pro' or 'Ultra'. Other versions include the addition of the letter 'T' or word 'Lite'. In this scope, models with naming convention 'Pro' or 'Ultra' were considered high tier smartphones, while other smartphones were considered base tier smartphones. Within the group of high and base tier smartphones, the most frequently offered models were selected as representatives.

The Redmi sub-brand was chosen in similar fashion. However, the process was adjusted to divide devices into high tier smartphones group when they were marked with the keyword 'Note' and base tier smartphones without this designation. The 'Note' designation refers to Redmi sub-brand devices with improved hardware compared to base models. The next concern addressed in the selection of smartphones was the generation of smartphones. The highest generation of Xiaomi brand available on the platform on January 27th, 2022, was generation 11. For the study, previous generations were also of interests, as they could provide an insightful point of view on vendor behavior. Therefore, two generations preceding generation 11 were chosen for the study. A similar procedure was applied to the Redmi sub-brand. However, in the case of the Redmi sub-brand the highest generation comprised base and high tier product versions was generation 10. The selection process is shown in fig. 1.

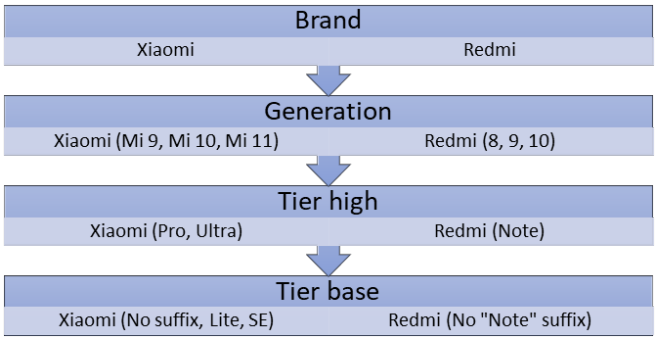

Fig. 1. Smartphones' segmentation process (Author's own work)

To find brand and sub-brand positions, Xiaomi Mi and Redmi representatives were summed and grouping variables were calculated (named 'Xiaomi group' and 'Redmi group' variables).

Additional Xiaomi smartphone launches were recorded during analyzed period. However, the impact was small, as the maximum offers were 49 for Redmi Note 11s. The dates of smartphone launches are shown in fig. 2.

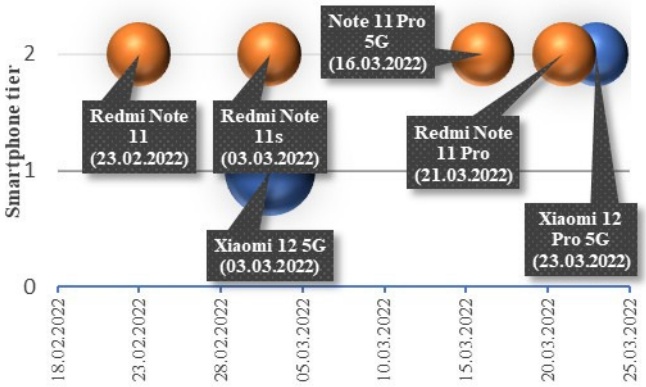

Fig. 2. Additional Xiaomi smartphone launches during study period

Table 3. Smartphones volume descriptive statistics before war (BWP)

Smartphone	Mean	±SD	Q1	Q3	IQR	Min	Max
Mi 9T	131.57	2.95	129.50	134.00	4.50	125	136
Mi 9T Pro	94.68	1.85	93.75	95.00	1.25	91	99
Mi 10T	138.54	4.23	135.00	142.00	7.00	133	146
Mi 10T Pro	85.86	4.13	83.50	89.00	5.50	79	94
Mi 11 Lite	699.82	32.99	668.50	714.25	45.75	661	762
11T Pro	136.57	21.50	118.00	154.00	36.00	102	178
Redmi 8	83.00	4.06	81.75	85.00	3.25	74	91
Redmi Note 8 Pro	262.43	9.45	255.75	266.00	10.25	251	283
Redmi 9A	623.54	27.67	601.50	647.00	45.50	573	663
Redmi Note 9 Pro	515.21	24.93	507.50	530.25	22.75	468	555
Redmi 10	330.00	43.35	301.50	373.25	71.75	253	396
Redmi Note 10	535.21	39.28	500.25	562.00	61.75	481	613
Mi (Group)	**1,287.04**	**30.66**	**1,277.75**	**1,303.25**	**25.50**	**1,219**	**1,335**
Redmi (Group)	**2,349.39**	**138.25**	**2,252.25**	**2,453.75**	**201.50**	**2,131**	**2,588**
Total	**3,636.43**	**152.67**	**3,569.25**	**3,726.25**	**157.00**	**3,364**	**3,892**

While diversity of models was a priority, Xiaomi is also recognized as the second largest smartphone vendor in Poland (25%) with preceding Samsung (31%). Globally, Xiaomi ranks third (12.7%) [18, 19].

In terms of the target group, due to the lack of Ukrainian language support on the ecommerce platform, the target group remained Polish language users.

B. Timeframe

The study was divided into two periods aligned to the same day of the week. Week alignment was applied to avoid biases from seasonal weekday changes. Each period consisted of four weeks.

The first period (also referred to as before war period - BWP) was set as four weeks before the war in Ukraine. The starting point was set for January 27th, 2022, and the ending point for February 23rd, 2022, the day before the start of the war.

The second period (also referred to as during war period - DWP) was chosen as four weeks from the start of the war. The starting point was set at February 24th, 2022, and the ending point was set at March 23rd, 2022. The fourth week of the second period represented timeframe in which the shock of the regional conflict should turn into a more stabilized state. In this perspective, the fourth week of the second period was the first in which the number of people crossing the border from Ukraine to Poland fell to the level of the first day of the war (30,081 people on March 21st, 2022, versus 31,178 on February 24th, 2022).

C. Procedure and data analysis

The data for the migration assessment were extracted from Polish Border Guard databases [20]. Offer volume data on the Allegro trading platform were recorded each. No personal information was recorded.

Analysis for each tier of smartphones was provided by comparing the time series before the war (BWP) and during the war periods (DWP). Spearman's rho correlation coefficient was calculated, and its statistical significance assessed. The coefficient is considered as one of the good assessment tools for evaluating monotonic relations [21]. In the presented study there is an expected trend in offers volume, thus Spearman coefficient is sufficient to detect vendor behavior. An additional argument in favor of using the Spearman correlation coefficient is that the coefficient is based on a ranking system thus correlation does not depend on the data distribution. The significance level was set at 5%. In addition, basic descriptive statistics was also provided.

R-CRAN version 4.0.3 and Microsoft Excel 2021 were used to analyze the data. R-CRAN software provides the necessary packages for statistical analysis and interaction with databases as well as allows design of research procedures in form of scripts.

IV. RESULTS

A. Before and during war periods analysis

Descriptive statistics are presented in tables 2 and 3.

A total number of offers with an average volume of 3,636 offers before the war period and more than 3,734 offers during the war period was observed. The number of offers from the Redmi group increased on average from more than 2,349 to 2,480 offers, while Mi group declined from 1.287 to 1.254.

The 'Mi 11 lite' smartphone model had the most offers before the war period with 762 offers, while during the war period the most offers were found for the 'Redmi Note 10' (698 offers). On average, the 'Mi 11 lite' model was also the most frequently offered before the war period with almost 700 offers per day (699.82). The situation changed during the war period, when the 'Redmi Note 10' was the most frequently offered smartphone (644.36 offers on average).

The Redmi group was represented by a higher volume of offers. Before the war period, offers from the Redmi group averaged 1.82 times more (182.54%) than Mi group of offers. This state was also observed during the war period,

Table 2. Smartphones volume descriptive statistics during war period (DWP)

Smartphone	Mean	±SD	Q1	Q3	IQR	Min	Max
Mi 9T	128.04	2.99	126.00	129.25	3.25	123	134
Mi 9T Pro	104.50	5.21	102.00	108.25	6.25	94	117
Mi 10T	138.00	5.37	134.00	141.25	7.25	131	150
Mi 10T Pro	97.75	4.19	95.00	101.25	6.25	91	107
Mi 11 Lite	611.50	37.47	568.75	642.25	73.50	560	664
11T Pro	174.68	14.02	167.25	184.25	17.00	148	201
Redmi 8	95.79	9.20	91.75	100.50	8.75	76	113
Redmi Note 8 Pro	290.46	10.04	284.00	294.75	10.75	278	312
Redmi 9A	598.00	46.48	568.00	616.50	48.50	527	683
Redmi Note 9 Pro	583.93	11.18	576.75	591.50	14.75	551	605
Redmi 10	363.54	41.20	323.50	407.25	83.75	294	434
Redmi Note 10	644.36	20.05	630.00	654.00	24.00	619	698
Mi (Group)	**1,254.46**	**46.26**	**1,213.75**	**1,288.25**	**74.50**	**1,171**	**1,324**
Redmi (Group)	**2,480.29**	**60.96**	**2,446.00**	**2,519.25**	**73.25**	**2,368**	**2,585**
Total	**3,734.75**	**103.42**	**3,649.00**	**3,795.75**	**146.75**	**3,539**	**3,905**

when the Redmi group outnumbered the Mi group even more (197.72%).

The average volume of offers before and during the war is shown in fig. 3 and 4.

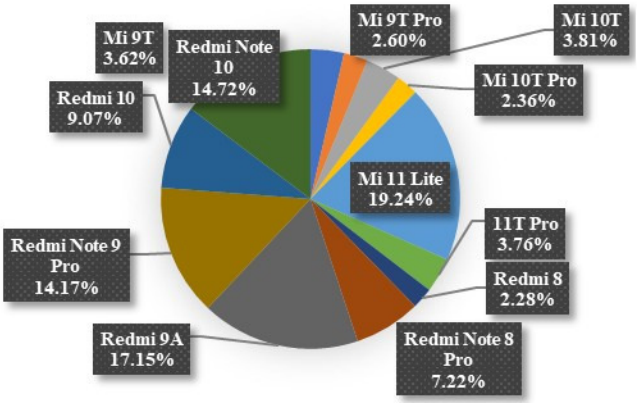

Fig. 3 Average offer numbers before the war period (Author's own work)

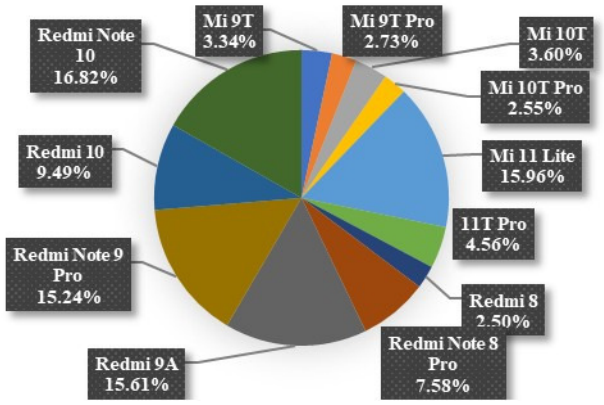

Fig. 4. Average offer numbers during the war period (Author's own work)

The group of most-offered smartphones is dominated by the Redmi sub-brand. The share above 10% of offers on average before the war period were achieved by 'Mi 11 lite' (19.24%), 'Redmi 9A' (17.15%), 'Redmi Note 10' (14.72%), and 'Redmi Note 9 Pro' (14.17%). During the war period shares above 10% were achieved by 'Redmi Note 10' (16.82%), 'Mi 11 lite' (15.96%), 'Redmi 9A' (15.61%), and 'Redmi Note 9 Pro' (15.24%).

The average percentage change in the volume of smartphones available before and during the war periods is shown in fig. 5.

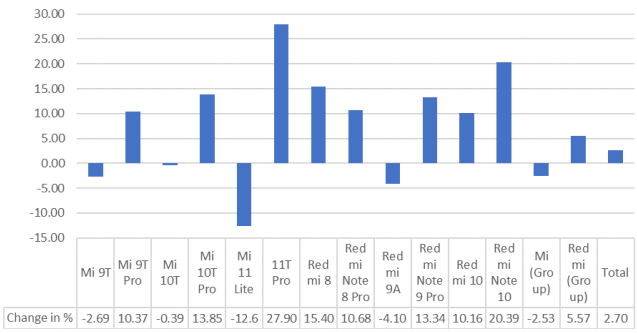

Fig. 5. Average change in percentage of smartphone offers before the war and during the war periods (Author's own work)

The total number of smartphones offers changed in favor of during the war period (2.70%). However, the changes were not the same for the Mi brand and Redmi sub-brand. The Redmi sub-brand gained 5.57%, while the Mi brand declined 2.53%. Higher positioned devices were offered in smaller volume of offers, while lower positioned devices were offered in higher volume.

Military conflicts may indicate that sellers are applying changes to their offers. To find these changes, correlations were calculated before and during the war periods. The calculated correlations are presented in table 4.

The analysis revealed that among Mi smartphones the 'Mi 9T Pro' and '11T Pro' had a statistically significant correlation. However, 'Mi 9T Pro' had a negative and moderate coefficient value (-0.468). Interestingly, there is a positive and moderate coefficient value (0.390) for the latest generation of the Mi '11T Pro' smartphone.

Table 4. Spearman *rho* coefficient of Xiaomi offered smartphones before and during war periods

Smartphone	Spearman *rho*	t	p-value
Mi 9T	-0.023	3,736.82	0.909
Mi 9T Pro	-0.468 *	5,362.60	0.012
Mi 10T	-0.237	4,520.30	0.224
Mi 10T Pro	-0.055	3,854.66	0.781
Mi 11 Lite	-0.005	3,674.05	0.978
11T Pro	0.390 *	2,228.28	0.040
Redmi 8	0.163	3,058.42	0.407
Redmi Note 8 Pro	0.662 *	1,233.38	<0.001
Redmi 9A	-0.825 *	6,666.89	<0.001
Redmi Note 9 Pro	0.564 *	1,592.77	0.002
Redmi 10	-0.829 *	6,681.83	<0.001
Redmi Note 10	-0.881 *	6,874.44	<0.001
Mi (Group)	**-0.182**	**4,318.18**	**0.355**
Redmi (Group)	**-0.568 ***	**5,728.00**	**0.002**
Total	**0.451 ***	**2,006.00**	**0.017**

*p<0.05

Among the Redmi sub-brand, there is an increased number of devices negatively correlated between studied periods. 'Redmi Note 10' (-0.881), 'Redmi 10' (-0.829), and 'Redmi 9a' (-0.825) showed strong negative correlation. 'Redmi Note 8 Pro' showed a positive moderate correlation (0.662), so did 'Redmi Note 9 Pro' (0.564).

Smartphones in the Redmi group also achieved a statistically significant correlation value (-0.568). A moderate effect would indicate that military conflict affects lower positioned devices. In contrast to the result for the Redmi group, combined offers of all smartphones showed positive correlation (0.451) and, in that perspective, more frequent than before the war issuing of offers.

B. During war period migration and smartphone offers analysis

During the first four weeks of the war, the number of people crossing the border reported by the Polish Border Guard was more than 2 million (2,198,749), and the number of evacuees was more than 1.6 million (1,675,505). This represents 5,78% and 4,40% of Poland population, respectively. The total number of offers and the number of people crossing the border are shown on fig. 5.

Data obtained from the Polish Statistical Office [20] were then further used to calculate the Spearman rho coefficient between Xiaomi smartphone offers and the number of people crossing the Polish border from Ukraine. The results are shown in table 6.

The results of the correlation of the number of people crossing the border from Ukraine to Poland may indicate that migration may be in some part related to the smartphone offering. The group of higher-positioned devices (Mi group) and the group of lower-positioned devices (Redmi group) showed a moderate correlation value.

For the Mi group, the correlation was 0.422 and for the Redmi group it was 0.518. The correlation of both groups was statistically significant. In that perspective, the combined group of offers also showed positive moderate correlation strength of 0.503. However, not all smartphone models behaved the same way. 'Redmi Note 10', the most offered smartphone during the war period (an average of 16.82% of all offers), showed a strong negative correlation of -0.772. This is the high tier model of the 10th generation of Redmi smartphones and the most advanced analyzed model of the Redmi sub-brand. Other negatively correlated smartphones are 'Mi 10T Pro' (-0.584), and 'Mi 9T Pro' (-0.482). They represent high tier models of previous generations of the Mi brand. However, they accounted for only 5% of the market's offers.

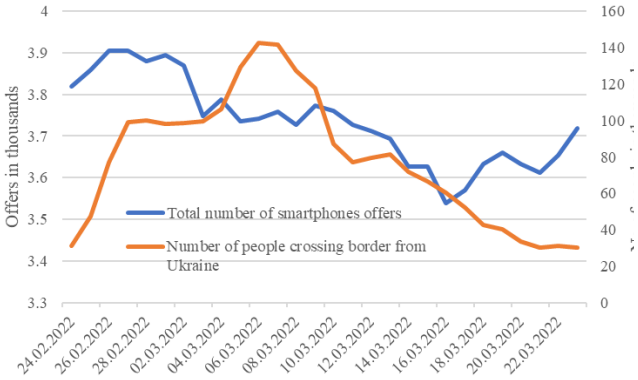

Fig. 6. Total offers of smartphones and number of people crossing the border from Ukraine (Author's own work)

Offers of several other models showed different behavior. 'Redmi 9A', 'Redmi 10' revealed positive correlation of 0.584 and 0.581. In the same way 'Mi 11 lite' and 'Mi 10T' correlated with a coefficient of 0.520, and 0.473, respectively.

V. DISCUSSION

The total number of smartphone offers increased from before to during the war period by 2,70%. A value lower than 3% may indicate, that full military conflict in a neighboring country has not changed the market for high-tech offers in

Table 5. Spearman *rho* coefficient between Xiaomi smartphones offers and number of people crossing Poland border from Ukraine during war period

Smartphone	Spearman *rho*	t	p-value
Mi 9T	0.016	3,595.49	0.936
Mi 9T Pro	-0.482 *	5,416.67	0.009
Mi 10T	0.473 *	1,924.12	0.011
Mi 10T Pro	-0.584 *	5,786.12	0.001
Mi 11 Lite	0.520 *	1,752.96	0.005
11T Pro	0.070	3,399.83	0.725
Redmi 8	0.178	3,002.84	0.364
Redmi Note 8 Pro	-0.347	4,923.70	0.070
Redmi 9A	0.584 *	1,520.42	0.001
Redmi Note 9 Pro	0.163	3,059.10	0.408
Redmi 10	0.581 *	1,530.84	0.001
Redmi Note 10	-0.772 *	6,474.86	<0.001
Mi (Group)	**0.422** *	**2,111.79**	0.025
Redmi (Group)	**0.518** *	**1,760.00**	0.005
Total	**0.503** *	**1,817.75**	0.006

*p<0.05

the short term. This assumption was also pointed out by Grabara in his work [2], where the market disruption in iPhone 11 category was related to problem of supplies. While this is true for globally supplied goods, in the context of regionalization problematic changes in selected markets, it may be of different kind.

Another interesting finding is the change observed among smartphone generations. 'Mi 9T Pro' premiered two generations earlier in 2019 and '11T Pro' in 2021, but their correlations had a different sign. While the older generation 'Mi 9T Pro' was negatively correlated, the '11T Pro' was positively correlated, meaning that customers can expect more offers of newer generation and higher-priced smartphones. According to Primanto et.al [22] price is negatively correlated with sales. Findings may indicate that cheaper products, like the previous generation 'Mi 9T Pro', will sell out at a much higher rate than '11T Pro', leaving the market with higher-priced products. Hwang and Su [11] observed that the average sustained smartphones' usage time among customers ranged from 14 to 18 months. 'Mi 9T Pro' and '11T Pro' are close enough to that distance in time, suggesting that negative correlation may be the result of switching smartphones to newer versions.

Another reason for the lower volume of the previous generation's offers are fears of inflation. According to intelligence analysts [1], the global smartphone market will be hampered. Negatively correlated results for the 'Mi 9T Pro', 'Redmi 9A', 'Redmi 10' and 'Redmi Note 10' smartphones suggest that the military conflict is affecting the smartphone market in the same way i.e., cheaper positioned smartphones will sell faster.

The volume of offers has changed with the type of smartphone. Changes in the market may be due to the number of people migrating. An unprecedented wave of migration with more than 3 million people in 2 months may shake the stabilized ecommerce market. Migration may be responsible for changing smartphone offers in the ecommerce market in Poland. Allegro trading platform saw an opportunity to attract new customers and made its services in Ukrainian [23]. However, availability of another language is not provided in the short term.

The rapidly escalating conflict and its impact on the smartphone market can be seen in terms of social media crises. Social media is considered as one of the key players in brand promotion. Study like Zahid and Dastane [24] shows that social influence would mostly affect purchase intentions. With more people crossing the border, the need for good quality smartphones in the starting point of their lifecycles would be a good investment. In that perspective, the 'Redmi Note 10' plays its role with a strong negative correlation between number of people crossing the border from Ukraine and volume of the offers.

'Redmi Note 10' was also the one that had a larger growth in perspective of the number of offers from before the war period to during the war period. On average the number of offers increased from 535 to 644. As study of Gao et al. [25] shows, the appearance of new sellers can be responsible for such event. The arrival of new potential active users of the ecommerce platform may be one of the reasons for the increase.

Brose argues in his work that high-tech plays the key role not only in future military conflicts, but also in current ones [24]. The scarcity of high-tech implementation in the armed forces make the US war simulations lost to China. What is more, all the needed technologies are in use by America's military men and women. Its importance in the retail market during the war is also evidenced by differences in the availability of smartphones through changes in the number of offers for a higher-positioned device such as the 'Mi 11 lite' (down 12.6%, from nearly 700 BWP to an average of 611 DWP offers).

In the context of discussed results, the statistically significant correlation partially supported hypothesis H1.1 stating that the volume of offers changed before and during the war

periods. Hypothesis H1.2 stating that the existing correlation between the volume of offers and the number of people crossing the border from country affected by military conflict was also true for the total number of offers and group of brands, but not for each smartphone model.

VI. Limitation of the Study

One of the key assumptions of the study was to track the offerings of the selected brand. While the Xiaomi brand provides variety of products with appropriate positioning strategy, Xiaomi is not taking over the smartphone market. The resulting changes are interesting but should be further enhanced with the analysis of different brands.

The other limitation of the study is the segmentation process. Xiaomi offers a wide variety of smartphones, thus finding representative by selecting the most offered model is one of the key assumptions of the analysis. However, providing different kind of segmentation may bring new type of findings in future studies.

VII. Conclusions and Further Research Directions

The regional conflict did not affect high-tech smartphones market in the short term. On the contrary the market grew steadily. However, the details are important. To find the changes, one need to look at smartphone features needed by customers, and these are provided by specific smartphone models. Then significant changes in number of offers of key player models may be observed.

High-tech is available through different devices, but one type is for sure known to all people – smartphones. In this context, the Xiaomi smartphone study showed that military conflicts changed availability of high-tech to retail customers. Another conclusion is that importance of availability of high-tech is not only valid for military forces but also for the customers during regional military conflicts.

VIII. References

[1] D. Wu, "Global Smartphone Market Had Worst Drop Since Virus Outbreak", *Bloomberg*. (2022) 1. https://www.bloomberg.com/news/articles/2022-04-20/global-smartphone-market-had-worst-drop-since-virus-outbreak (accessed April 30, 2022).

[2] D. Grabara, "iPhone 11 premium mobile device offers on e-commerce auction platform in the context of Marketing Mix framework and COVID-19 pandemic", in: *Procedia Comput. Sci. 192C*, 2021: pp. 1720–1729.

[3] Straż Graniczna, „Straż Graniczna na Twitterze", (2022). https://twitter.com/Straz_Graniczna/status/1520643611192619008?cxt=HHwWgMDTsdjTtJoqAAAA (accessed May 1, 2022).

[4] Statistics Poland, "Basic data", (2022). https://stat.gov.pl/en/basic-data/ (accessed April 15, 2022).

[5] Ecommerce News, "Allegro enters global top 10 biggest ecommerce websites", *Ecommerce News Eur.* (2020). https://ecommercenews.eu/allegro-enters-global-top-10-biggest-ecommerce-websites/ (accessed November 10, 2020).

[6] Y. Chen, Y. Sun, "Determinants of platform ecosystem health: An exploration based on grounded theory", *J. Bus. Econ. Manag.* 22 (2021) 1142–1159. https://doi.org/10.3846/jbem.2021.15047.

[7] C. H. Yeh, Y. S. Wang, K. Yieh, "Predicting smartphone brand loyalty: Consumer value and consumer-brand identification perspectives", *Int. J. Inf. Manage.* 36 (2016) 245–257. https://doi.org/10.1016/j.ijinfomgt.2015.11.013.

[8] International Economy, "Party Hacks and the End of the Deng Era", *Int. Econ.* 33 (2019) 4–4.

[9] G.-Y. Wang, "The Brand Effect: A Case Study in Taiwan Second-Hand Smartphone Market", *J. Soc. Econ. Stat.* 10 (2021) 30–42. https://doi.org/10.2478/jses-2021-0003.

[10] S. Chatrattikorn, N. Buavaraporn, "Investigating factors affecting purchase", *UTCC Int. J. Bus. Econ.* 7 (2015) 113–130.

[11] Y. Su, J. S. Hwang, "Integration of customer satisfaction and sustained use of a product for value assessment", *Total Qual. Manag. Bus. Excell.* 31 (2020) 1760–1773. https://doi.org/10.1080/14783363.2018.1509697.

[12] B. Z. Zilberfarb, "The short- and long-term effects of the Six Day War on the Israeli economy", *Isr. Aff.* 24 (2018) 785–798. https://doi.org/10.1080/13537121.2018.1505476.

[13] F. Svenson, "Smartphone crises and adjustments in a virtual P3 community–doing sustainability oriented smartphone consumption", *J. Mark. Manag.* 34 (2018) 664–693. https://doi.org/10.1080/0267257X.2018.1464495.

[14] W. Chmielarz, "The usage of smartphone and mobile applications from the point of view of customers in Poland", Inf. 11 (2020). https://doi.org/10.3390/INFO11040220.

[15] N. A. Brabo, A. I. Karif, S. D. Lestari, A. Sriyanto, "The Effect of Brand Page Commitment, Brand Awareness, Electronic Word Of Mouth and Brand Image on Purchase Intention of Xiaomi Smartphone on Social Media", *GATR J. Manag. Mark. Rev.* 6 (2021) 235–244. https://doi.org/10.35609/jmmr.2021.6.4(4).

[16] P. S. Dabrowski, "Accuracy of Geopotential Models Used in Smartphone Positioning in the Territory of Poland", *IOP Conf. Ser. Earth Environ. Sci*. 221 (2019). https://doi.org/10.1088/1755-1315/221/1/012080.

[17] R. Tabassum, S. Ahmed, "Xiaomi invades the smartphone market in India", *Decision.* 47 (2020) 215–228. https://doi.org/10.1007/s40622-020-00242-w.

[18] Serwis Rzeczypospolitej Polskiej, „Dane statystyczne osób ewakuowanych do Polski z terytorium Ukrainy", (2022). https://dane.gov.pl/pl/dataset/2705,dane-statystyczne-dotyczace-sytuacji-na-granicy-z-Ukraina/resource/37768/chart?page=1&q= (accessed June 01, 2022).

[19] Orange, „Najpopularniejsze marki telefonów, czyli jak wygląda rynek smartfonów na świecie i w Polsce", (2022), https://www.orange.pl/poradnik/smartfony-i-inne-urzadzenia/najpopularniejsze-marki-telefonow-czyli-jak-wyglada-rynek-smartfonow-na-swiecie-i-w-polsce/, (accessed July 07, 2022).

[20] International Data Corporation, „Smartphone Market Share, Updated: 23 June 2022", (2022), https://www.idc.com/promo/smartphone-market-share, (accessed July 08, 2022).

[21] E. van den Heuvel, Z. Zhan, "Myths About Linear and Monotonic Associations: Pearson's r, Spearman's ρ, and Kendall's τ", *Am. Stat.* 76 (2022) 44–52. https://doi.org/10.1080/00031305.2021.2004922.

[22] A. B. Primanto, M. K. ABS, A. R. Slamet, "A Study of The Best Selling Smartphone in The Two Biggest Marketplace in Indonesia*", J. Terap. Manaj. Dan Bisnis.* 4 (2018) 17–24. https://doi.org/10.26737/jtmb.v4i1.487.

[23] Allegro, „Allegro od teraz również po ukraińsku", (2022).

[24] W. Zahid, O. Dastane, "Factors affecting purchase intention of South East Asian (SEA) young adults", *Asean Mark. J.* (2016) 66–84. https://www.researchgate.net/publication/313250323_Factors_Affecting_Purchase_Intention_of_South_East_Asian_SEA_Young_Adults_towards_Global_Smartphone_Brands.

[25] B. Gao, W. K. Chan, L. Chi, X. Deng, "Size and growth dynamics of online stores: A case of China's Taobao.com", Electron. Commer. *Res. Appl.* 17 (2016) 161–172. https://doi.org/10.1016/j.elerap.2016.04.005.

[26] C. Brose, "The Kill Chain: Defending America in the Future of High-Tech Warfare", Hachette Books, 2020.