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MARKET REACTIONS TO CORPORATE REGULATORY ANNOUNCEMENTS: EVIDENCE FROM POLISH STOCK EXCHANGE

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Purpose: This research examines stock price reactions to corporate regulatory announcements on the Warsaw Stock Exchange (WSE), testing semi-strong market efficiency in an emerging European market by analyzing high-frequency intraday price movements following mandatory disclosures. The study determines information incorporation speed, reaction pattern differences, and implications for market efficiency theory.
Design/methodology/approach: Using event study methodology adapted for high-frequency data, the study analyzes 696 regulatory announcements (ESPI) from 52 liquid companies (WIG20 and WIG40 indices) from November 2024 to March 2025. Price reactions are measured at 1-120 minute intervals post-announcement, with raw returns as abnormal return proxies and significance assessed via t-tests, Wilcoxon tests, and sign tests.
Findings: Results reveal gradual price adjustment, with only 5% of total 2-hour impact occurring within the first minute and 74% within the first hour. Neutral reactions dominate initially (97% at 1 minute) but decrease to 57% by 2 hours. While average price changes are minimal, sign tests show significant deviation from random distribution. Volatility increases steadily over the 2-hour window, contrary to expectations that information resolves uncertainty.
Research limitations/implications: Limitations include the short study period, sample dominated by Financial Reports, and potential microstructure effects in high-frequency returns. Findings challenge strict semi-strong efficiency applicability in Polish markets, suggesting efficiency models need adaptation for emerging markets.
Practical implications: For investors, findings suggest potential trading opportunities despite limited profitability after transaction costs. For regulators, results highlight the importance of effective disclosure dissemination. For corporate managers, understanding gradual market reactions can inform communication strategies.
Originality/value: This study provides detailed empirical evidence on intraday market reactions in Poland by: (1) documenting information incorporation patterns at high frequency; (2) analyzing diverse ESPI messages beyond typical studies; (3) providing specific evidence on WSE efficiency; and (4) identifying anomalies like increasing post-announcement volatility that challenge traditional market efficiency models.
Keywords: Market efficiency, regulatory announcements, intraday price reactions, emerging markets, Warsaw Stock Exchange.
Category of the paper: Research paper.

1. Introduction

The link between corporate news and stock prices is central for financial economics and market efficiency theory (Fama, 1970). Understanding how markets process information, especially mandatory regulatory announcements containing material information, is vital. This study focuses on Polish stock market, a key emerging market in Central Europe, where information processing might differ from developed markets due to unique institutional settings, investor behaviors, and market microstructures. The Warsaw Stock Exchange (WSE), reestablished in 1991, represents significant part of the regional capital market, making it important case for study.

Regulatory announcements, often mandated by bodies like Polish Financial Supervision Authority (KNF), provide critical informations that can influence investor expectations about company future performance, risk, and value. These announcements cover wide range of topics, from financial results and dividend decisions to significant contracts, management changes, and strategic initiatives. How quickly and accurately market prices reflect these information is a direct test of semi-strong market efficiency.

We analyze large dataset comprising 696 regulatory announcements (ESPI messages) from 52 diverse Polish companies during specific period 15.11.2024-14.03.2025. (Available here: https://github.com/mzgrb/espi) We examine high-frequency intraday price reactions at multiple intervals (1 minute, 5 minutes, 10 minutes, 30 minutes, 1 hour, 2 hours) following each announcement. This granular approach allows us to assess not only if the market reacts, but also speed and pattern of this reaction, providing deeper insights than studies relying solely on daily data. Key questions guiding this research include: How fast do prices react in Polish market? Does magnitude and speed of reaction differ by announcement type? Is there evidence of post-announcement drift or reversal? What are the implications of these findings for market efficiency hypothesis in context of emerging European market?

This research offers several contributions. It provides detailed empirical evidence on intraday market reactions in Poland, adding to limited literature on this specific market. By analyzing wide range of regulatory announcements, it offers a comprehensive view compared to studies focusing on single event type. Furthermore, findings have practical implications for investors considering trading strategies around announcements, for regulators assessing effectiveness of disclosure rules, and for corporate managers aiming to understand market perception of their communications. The analysis of reaction speed and patterns helps to characterize efficiency level of WSE.

2. Literature Review

2.1. Event Study and Market Efficiency

Event studies are standard method in finance to measure impact of events, like corporate announcements, on stock prices (MacKinlay, 1996). Core idea is that efficient markets quickly reflect new information. Methodology involves calculating abnormal returns (ARs) – difference between actual and expected returns – around event time. Early work by Ball and Brown (1968) and Fama et al. (1969) established modern framework. Our study uses this method with high-frequency intraday data, using raw returns as proxy for ARs, common for short intervals (Busse, Green, 2002).

This relates directly to Efficient Market Hypothesis (EMH) by Fama (1970), especially semi-strong form, which state prices reflect all public information. If Polish market is semi-strong efficient, prices should react fast and accurately to ESPI messages. However, EMH faces challenges from behavioral finance (Shleifer, 2000) and concept of "efficiently inefficient" markets (Pedersen, 2015). Testing EMH in emerging markets like Poland is key, as they may have features leading to slower information processing.

2.2 Reactions to Announcements and Emerging Markets

Many studies examine reactions to earnings (Ball, Brown, 1968), dividends (Pettit, 1972), and M&A (Jensen, Ruback, 1983). Regulatory announcements, our focus, are less studied as broad category, especially intraday in emerging markets. Research in emerging markets often finds slower or smaller reactions compared to developed markets (Griffin et al., 2011), possibly due to lower liquidity or transparency. Studies on Poland (e.g., Gurgul, Majdosz, 2007; Bohl et al., 2009) found significant reactions but hinted at slowness. Our study add to this by analyzing broad set of ESPI messages at high frequency for recent period (15.11.2024-14.03.2025), focusing on speed and pattern of reaction to assess WSE efficiency level.

3. Data and Methodology

3.1. Data Source and Description

Our primary dataset consist of regulatory announcements, known as ESPI messages (Elektroniczny System Przekazywania Informacji), filed by companies listed on Warsaw Stock Exchange (WSE). We collected 696 such announcements from 52 distinct companies during specific time window from 15 November 2024 to 14 March 2025. These companies were selected based on liquidity, primarily including constituents of WIG20 and WIG40 indices,

ensuring focus on most actively traded stocks. This period was chosen to reflect recent market conditions. For each announcement, we obtained full text content and precise timestamp (date, hour, minute) of its release through official WSE channels (PAP – Polska Agencja Prasowa). This high granularity in timing is crucial for our intraday analysis.

To measure market reaction, we collected corresponding stock price data for each company around time of its announcements. We obtained prices at exact moment of announcement (t = 0) and at several subsequent intervals: 1 minute (t = 1), 5 minutes (t = 5), 10 minutes (t = 10), 30 minutes (t = 30), 60 minutes (t = 60, or 1h), and 120 minutes (t = 120, or 2h) after announcement. This high-frequency price data allow us to track evolution of market response over short time horizons. Price data was sourced from reliable financial data provider (Yahoo Finance API) ensuring accuracy and synchronization with announcement times. We carefully addressed potential issues like non-trading periods (weekends and polish holidays) or data gaps, excluding announcements where reliable price data was unavailable for required intervals. (ESPI issued after trading hours).

We performed preliminary classification of announcements based on their textual content. Using keyword analysis and topic modeling techniques, we categorized messages into broad types such as Financial Reports (e.g., quarterly results, annual reports), Share Transactions (e.g., insider trading, buybacks), Contracts (e.g., significant new agreements), Management Changes, Strategy/Planning updates, and Other miscellaneous regulatory filings. Our analysis revealed that Financial Reports are largest category, accounting for 583 out of 696 announcements in our sample. This dominance reflect importance of periodic financial disclosures.

3.2. Event Study Methodology Implementation

We employ standard event study methodology, adapted for high-frequency intraday data, to assess market impact of these regulatory announcements.

- **Event Definition**: The event of interest is public release of ESPI regulatory announcement by listed company.
- **Event Time**: Time zero (t = 0) is defined as exact minute announcement was released.
- **Event Window**: We focus on short-term reaction within two hours following announcement. Our measurement points are t = 1, 5, 10, 30, 60, and 120 minutes relative to announcement time.
- **Return Calculation**: For each company *i* and time interval *t* post-announcement, we calculate raw percentage return relative to price at announcement time (P_{i,0}): R_{i,t} = (P_{i,t} - P_{i,0}) / P_{i,0} This measures total price change from announcement moment up to time *t*.
- **Abnormal Return (AR) Definition**: Given very short intraday intervals, expected normal return is assumed to be close to zero. Therefore, we follow common practice in high-frequency event studies (e.g., Busse, Green, 2002) and use raw returns (R_{i,t})

as our primary measure of abnormal returns (AR_{i,t}). This approach avoids complexities and potential biases of estimating normal returns using models like market model over very short horizons where microstructure effects can dominate.

- **Aggregation**: To analyze average market reaction, we calculate Average Abnormal Return (AAR) across all *N* events in sample (or subsample) for each time interval *t*: AAR_t = (1/N) * Σ_{i=1}^{N} AR_{i,t} We also analyze average absolute abnormal return to understand magnitude of reaction regardless of direction: Average |AR|*t = (1/N) * Σ*{i=1}^{N} |AR_{i,t}|
- **Statistical Significance Testing**: To determine if observed average abnormal returns are statistically significant (i.e., different from zero), we employ several tests. Given potential non-normality in high-frequency returns, relying solely on standard t-test can be misleading. Therefore, we use:
  - **Cross-sectional t-test**: Tests if mean AAR_t is significantly different from zero.
  - **Wilcoxon signed-rank test**: Non-parametric test based on ranks, robust to non-normality, testing if median AR_t is different from zero.
  - **Sign test**: Non-parametric test comparing proportion of positive and negative ARs, testing if proportion significantly deviates from 50%. This test is particularly useful when many returns are exactly zero (neutral reactions). We consider result significant if p-value is less than 0.05.
- **Further Analysis**: Beyond average returns, we analyze speed of reaction by calculating proportion of total 2-hour price change (measured by average absolute AR at 2h) that occurs at earlier intervals. We also examine evolution of volatility (measured by standard deviation of ARs across events) over event window. Finally, we perform analysis separately for different announcement types where sample size permits, to check for differential reactions.

3.3. Potential Limitations

We acknowledge several potential limitations exist in this type of study. First, co-existing events: Other news or market-wide movements might occur around announcement time, potentially influencing observed price changes. While using short intraday window helps mitigate this, it cannot be fully eliminated. Second, market microstructure effects: Bid-ask bounce, price discreteness, and non-synchronous trading can introduce noise into high-frequency returns, especially for less liquid stocks, however this was potentially adressed by picking the most liquid shared for analysis. Third, thin trading: Some stocks in sample might trade infrequently, meaning observed price at specific minute might not reflect immediate reaction but rather first trade occurring sometime after announcement. Our focus on returns relative to t=0 price helps, but issue remains for interpreting exact timing. Fourth, announcement timing accuracy: While we use official release times, slight delays in dissemination or market access could affect precise reaction start time. Fifth, announcement

classification: Our text-based classification is useful but might miscategorize some complex or ambiguous announcements. Some of them are lengthy and provided in various formats. Sixth, causality: While event study suggests announcement causes reaction, reverse causality (e.g., price movement before announcement) is unlikely for mandatory filings but cannot be entirely ruled out for all types. This could be potentially an area for further investiagtions.

4. Results

This section presents empirical findings from our analysis of market reactions to 696 regulatory announcements on Warsaw Stock Exchange during period 15.11.2024-14.03.2025. We examine descriptive statistics, overall price impact patterns, speed of reaction, volatility dynamics, statistical significance, and briefly touch upon differences across announcement types.

4.1. Descriptive Statistics of Price Changes

This section present concise summary of key findings across different time intervals following regulatory announcements. Table below compile important metrics for each interval, allowing reader to quickly grasp patterns and trends without navigating multiple textual sections.

Table 1.
Comprehensive Summary of Market Reactions by Time Interval

Metric	**1m**	**5m**	**10m**	**30m**	**1h**	**2h**
Returns						
Mean Return	-0.000014	0.000330	0.000158	0.000417	0.000445	0.000747
Median Return	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Min Return	-0.020000	-0.030000	-0.030000	-0.070000	-0.080000	-0.110000
Max Return	0.020000	0.090000	0.070000	0.060000	0.080000	0.110000
Volatility Standard Deviation	0.001897	0.004978	0.005637	0.007175	0.009757	0.012875
Reaction Distribution						
Positive Reactions (%)	1.29	5.60	7.18	12.50	18.97	22.70
Negative Reactions (%)	1.44	3.74	6.47	9.48	16.24	20.55
Neutral Reactions (%)	97.27	90.66	86.35	78.02	64.80	56.75
Statistical Significance						
T-test p-value	0.8416	0.0803	0.4597	0.1260	0.2289	0.1263
Wilcoxon test p-value	0.8429	0.0838	0.5163	0.0819	0.2226	0.1736
Sign test p-value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Key Observations from Summary Table:

1. Gradual Price Adjustment: Data clearly show that price impact materialize gradually, with only 5% of total 2-hour impact occurring in first minute and 74% by first hour.
2. Increasing Magnitude: Both mean absolute returns and volatility (standard deviation) increase steadily over time, indicating growing price dispersion as market process information.
3. Dominance of Neutral Reactions: Extremely high percentage of neutral reactions (97.27%) at 1-minute mark, which decrease steadily but remain majority (56.75%) even after 2 hours.
4. Statistical Significance Pattern: Traditional tests (t-test, Wilcoxon) generally fail to reject null hypothesis of zero abnormal return, while Sign test consistently show high significance ($p < 0.001$) across all intervals.
5. Balanced Directional Impact: Positive and negative reactions increase at similar rates over time, explaining why average raw returns remain close to zero despite increasing absolute impact.

First, mean price changes are extremely small across all time intervals, very close to zero. The largest mean change is only 0.000747 (or 0.07%) at 2-hour mark. This suggest that, on average, these regulatory announcements (ESPI) do not trigger large directional price movements in Polish market in the observed period. Second, median price change is exactly zero for all intervals. This indicate that for majority of announcements, price does not change at all within measured timeframe.

Third, standard deviation (Std Dev) show clear increasing trend over time. It starts at low 0.0019 (0.19%) at 1 minute and steadily rise to 0.0129 (1.29%) at 2 hours. This increasing dispersion shows that while average reaction is small, magnitude of individual reactions (both positive and negative) tend to grow as more time passes after announcement. Market seems to diverge more in its assessment or reaction intensity over time.

Fourth, minimum and maximum values reveal the existence of substantial price reactions for some specific announcements, despite small average effect. For instance, at 5-minute mark, one announcement was followed by 9% price increase, while at 2-hour mark, another saw 11% price decrease. This highlight heterogeneity of information content and market responses within our sample.

Fifth, and perhaps most striking, is distribution of reaction types. Percentage of neutral reactions (zero price change) is extremely high immediately after announcement (97.27% at 1 minute). While this percentage decrease steadily over time, it remain very substantial even after two hours (56.75%). Correspondingly, percentages of positive and negative reactions start very low (around 1.3-1.4% at 1 minute) and gradually increase, reaching about 23% positive and 21% negative by 2-hour mark. The slow decline in neutral reactions and slow rise in active reactions strongly points towards gradual information processing for many announcements immediately after release.

4.2. Overall Price Impact and Speed of Reaction

To visualize overall impact magnitude and speed, we examine average absolute abnormal returns and cumulative proportion of total 2-hour impact realized over time.

Consistent with descriptive statistics, average raw abnormal return (AAR) remains close to zero throughout 2-hour window. However, average *absolute* abnormal return show a clear upward trend, starting near 0.0003 at 1 minute and reaching approximately 0.0063 at 2 hours. This confirms that magnitude of price movements increase over time, even if average direction is neutral.

Analysis of reaction speed reveals very gradual price adjustment process. Only about 5% of total 2-hour absolute price impact is observed within the first minute. This proportion rise to about 18% by 5 minutes, 28% by 10 minutes, 45% by 30 minutes, and 74% by 1 hour. It takes full two hours for complete average impact (as measured at 2h) to materialize. This slow incorporation contrasts sharply with near-instantaneous adjustments often documented in highly liquid, developed markets for significant news events. This gradual pattern is strong indicator of market inefficiency or significant frictions in information dissemination and trading process in Polish market during studied period.

4.3. Evolution of Reaction Types and Volatility

The changing distribution of reaction types over time further illustrates gradual response. The dominance of neutral reactions in the first few minutes, followed by their steady decline and corresponding increase in both positive and negative reactions, paint picture of market slowly waking up to news. The fact that positive and negative reactions increase at roughly similar rates explains why average raw return stays near zero.

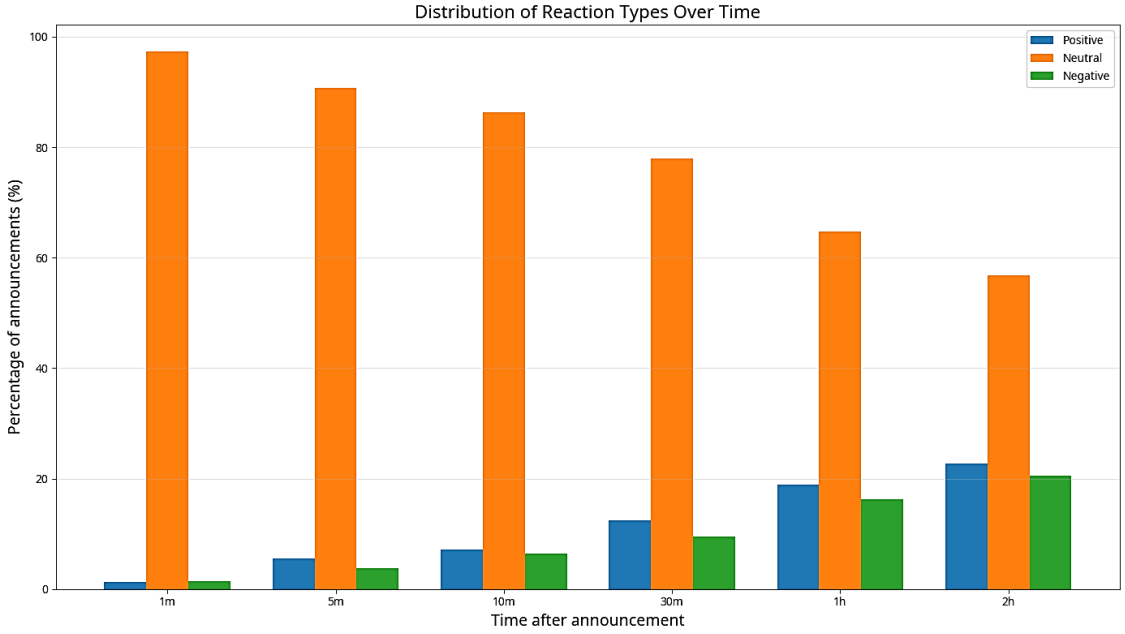

Figure 1. Distribution of Reaction Types Over Time.

Volatility, measured by standard deviation of abnormal returns across events, also shows consistent increase over 2-hour window.

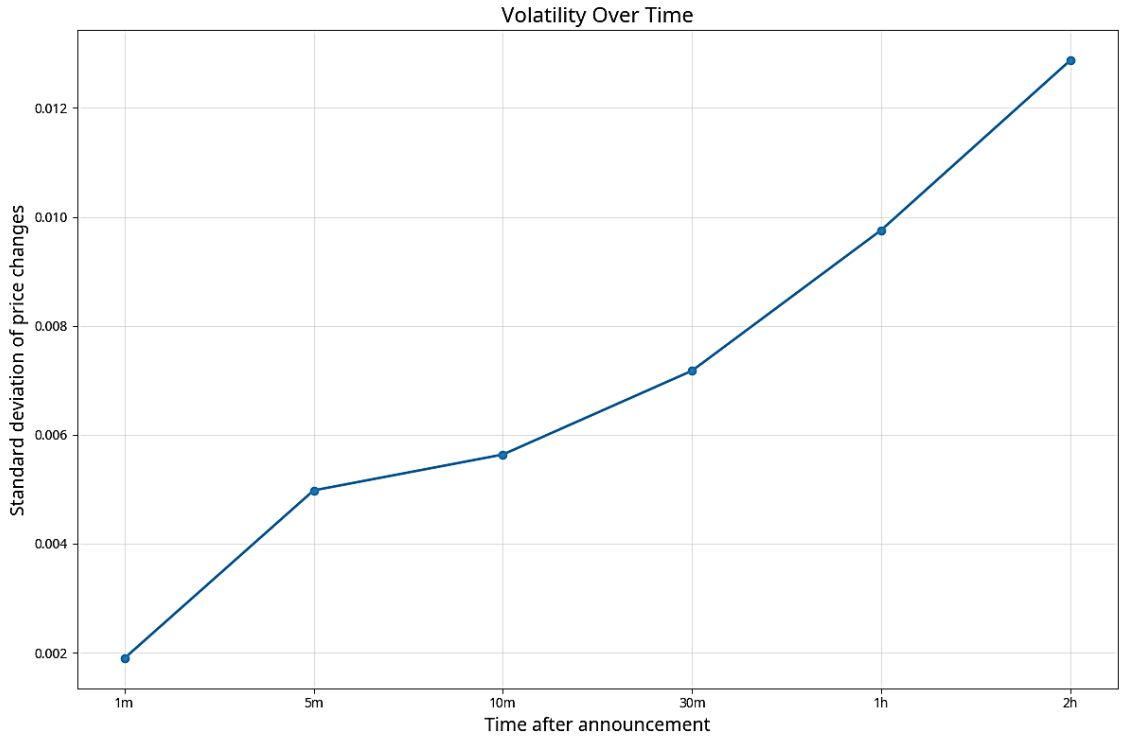

Figure 2. Volatility Over Time.

Volatility rise from about 0.19% at 1 minute to 1.29% at 2 hours. This increasing volatility is somewhat counter-intuitive from perspective of efficient markets, where new information should ideally resolve uncertainty, leading to decrease in volatility after the initial spike. The observed pattern might suggest that announcements trigger ongoing information search, diverse interpretations, or perhaps attract different types of traders with varying reaction times, leading to sustained or even growing price dispersion.

4.4. Statistical Significance Tests

We did statistical tests to assess if observed price changes, despite being small on average, are statistically distinguishable from zero. Table 2 presents p-values from cross-sectional t-test, Wilcoxon signed-rank test, and Sign test.

Table 2.
Statistical Significance Tests

Test	T-pvalue	Wilcoxon-pvalue	Sign-pvalue	Significant
1m	0.8416	0.8429	< 0.001	Yes
5m	0.0803	0.0838	< 0.001	Yes
10m	0.4597	0.5163	< 0.001	Yes
30m	0.1260	0.0819	< 0.001	Yes
1h	0.2289	0.2226	< 0.001	Yes
2h	0.1263	0.1736	< 0.001	Yes

Results show interesting divergence. Standard t-test (testing mean) and Wilcoxon test (testing median) generally fail to reject null hypothesis of zero abnormal return at conventional 5% significance level (p-values are mostly > 0.05, except marginally at 5m and 30m for Wilcoxon). This aligns with observed small mean and zero median returns.

However, Sign test yield highly significant results ($p < 0.001$) for all time intervals. Sign test compares number of positive versus negative returns. Its significance indicate that proportion of positive and negative returns is statistically different from 50/50 split expected under null hypothesis of no reaction. Given slightly higher percentage of negative returns compared to positive ones at most intervals (see Table 1), sign test significance likely reflect small but persistent prevalence of negative reactions in sample, even if average magnitude is near zero. This suggests market does react, but perhaps with slight negative bias or asymmetry not captured by mean/median tests due to big number of zero returns.

4.5. Analysis by Announcement Type

Given dominance of Financial Reports (583 announcements), detailed analysis by type is challenging for other categories due to small sample sizes. Preliminary analysis suggest:

- **Financial Reports**: Exhibit patterns very similar to overall sample – gradual adjustment, high initial neutral rate, increasing volatility.
- **Share Transactions**: Often associated with small, sometimes negative reactions, possibly reflecting signaling or liquidity effects.
- **Contracts**: Reactions likely depend heavily on contract significance, but average effect in our limited sample was not distinct.
- **Strategy/Planning**: Tentative evidence suggest these might elicit slightly more positive reactions on average, consistent with forward-looking positive news.
- **Other/Unknown**: This residual category showed varied reactions, sometimes more negative, reflecting uncertainty associated with uncategorized or unusual disclosures.

However, these type-specific observations should be treated with caution due to limited data points in non-Financial Report categories.

5. Discussion

Our research establishes several new findings regarding information processing in Polish stock market. First, we document precise speed of price adjustment following regulatory announcements, showing that information incorporation is gradual process extending well beyond first few minutes. Second, we identify pattern where neutral reactions dominate initially but decrease substantially over time, suggesting delayed price discovery. Third, we find counterintuitive pattern of increasing return volatility over post-announcement window,

contrary to theoretical expectation that information resolution should reduce uncertainty. Fourth, we demonstrate that while statistical inefficiencies exist, their economic exploitability is severely limited by transaction costs, especially for retail investor.

Previous research on market efficiency in emerging markets has generally found slower price adjustment compared to developed markets (Griffin et al., 2011). Studies specific to Polish market (Gurgul, Majdosz, 2007; Bohl et al., 2009) documented significant but sometimes delayed reactions to corporate news. However, these studies typically used daily data, obscuring intraday dynamics. Our high-frequency analysis provides much more granular view of price formation process, revealing that even within single trading day, adjustment is far from instantaneous. While previous research established that Polish market reacts to corporate news, our study quantifies exactly how this reaction unfolds minute by minute, providing unprecedented detail on information processing mechanics in this market.

5.1. Interpretation of Key Findings

Our analysis paint picture of Polish stock market where information contained in regulatory announcements is incorporated into prices, but in notably gradual manner. Several key findings warrant detailed interpretation:

1. **Gradual Price Adjustment**: The slow speed of reaction, with only 5% of 2-hour impact occurring in first minute and 74% by first hour, is perhaps most significant result. This stand in contrast to near-instantaneous adjustments often observed in highly liquid, developed markets like US (Busse, Green, 2002). This slowness suggest presence of considerable frictions in price discovery process on WSE. Market participants do not seem to react immediately or uniformly to new public information.
2. **Magnitude and Direction**: While average *absolute* price change increase steadily over two hours (reaching 0.63% on average), average *raw* price change remain statistically indistinguishable from zero based on t-tests and Wilcoxon tests. This imply that announcements in our sample, covering diverse regulatory filings from 15.11.2024 to 14.03.2025, do not have strong systematic positive or negative impact on average. However, existence of large individual price swings (up to +9% and -11%) confirm that *some* announcements carry significant value-relevant information.
3. **High Neutral Reaction Rate**: Extremely high proportion of zero price changes immediately after announcement (97% at 1 min), which decrease slowly but remain substantial (57% at 2h), is another critical finding. This could mean several things: (a) Many regulatory filings might contain little new, price-sensitive information (e.g., routine administrative updates). (b) Market depth might be insufficient, meaning news does not immediately trigger trades at new price levels. (c) Investors might adopt wait-and-see approach, especially for complex information. (d) Price discreteness or tick size rules might prevent small price adjustments from being registered.

4. **Increasing Volatility**: The steady increase in standard deviation of returns over 2-hour window is puzzling from traditional efficient market perspective, where new information should resolve uncertainty. This pattern might suggest that announcements trigger prolonged period of disagreement among investors, differential information arrival, or attract noise traders, leading to greater price dispersion over time. It could also reflect gradual arrival of related news or analysis following initial announcement.
5. **Sign Test Significance**: Despite insignificant mean/median returns, highly significant sign test results indicate subtle but persistent imbalance between positive and negative reactions (leaning slightly negative in our sample). This suggest market *is* reacting directionally, but effect is weak and perhaps asymmetric, or masked by large number of zero returns. This finding warrant further investigation into potential biases or specific types of news driving this slight negative skew.

5.2. Market Efficiency Implications

Our findings present challenge to semi-strong form of Efficient Market Hypothesis (EMH) in context of Polish stock market during studied period. The observed gradual price adjustment directly contradict notion that prices should rapidly reflect all publicly available information. If prices take up to two hours (or potentially longer) to fully incorporate news, it imply existence of inefficiencies.

However, question arise whether these inefficiencies are economically significant. Can traders consistently profit from this slow adjustment? The small average magnitude of immediate price changes (e.g., 0.03% absolute change at 1 min) suggest that exploiting this initial delay might be difficult after accounting for transaction costs (bid-ask spreads, commissions) and execution risk. Even larger average absolute changes at later intervals (0.63% at 2h) represent average magnitude; predicting direction for specific announcement remains challenging. Therefore, market might be described as "efficiently inefficient" (Pedersen, 2015) – inefficiencies exist, but exploiting them is not costless or guaranteed, thus providing incentive for information gathering without allowing easy arbitrage profits.

The high rate of neutral reactions also complicate efficiency assessment. If many announcements truly lack information content, then lack of price reaction is consistent with efficiency. However, if information-rich announcements also fail to trigger immediate price changes due to market frictions, it represent clear inefficiency. Distinguishing between these possibilities require deeper analysis of announcement content.

Overall, evidence point towards WSE being less informationally efficient, particularly regarding speed of incorporation, compared to major developed markets, at least concerning intraday reactions to broad set of regulatory filings.

5.3. Comparisons with Existing Literature

Our finding of gradual price adjustment align broadly with studies suggesting lower efficiency in emerging markets compared to developed ones (Griffin et al., 2011). Specific studies on Poland, like Bohl et al. (2009), also hinted at slower reactions to regulatory events. Our high-frequency analysis provide much more granular view of this slowness, showing it persists over minutes and hours.

The high neutral reaction rate also echo findings in some less liquid markets or for specific types of news where immediate impact is unclear. It contrast with studies focusing on major, clearly impactful events (like large earnings surprises or M&A) in liquid markets, where reactions are typically swift and widespread.

The increasing volatility pattern is less commonly reported but might relate to studies on information-induced trading and volatility clustering, although typically volatility is expected to decay after initial information shock.

5.4. Anomalies

The results present some anomalies: the persistence and even increase in volatility post-announcement, the extremely high initial neutral reaction rate despite covering mandatory disclosures, and the divergence between sign test significance and mean/median tests. These suggest that simple models of information incorporation may not fully capture dynamics of Polish market. Further research is needed to understand drivers behind these specific patterns, potentially involving more complex models of investor behavior, market frictions, and information diffusion.

6. Conclusion

This study examined market reactions to corporate regulatory announcements (ESPI) on Warsaw Stock Exchange using high-frequency intraday data. Our analysis of 696 announcements from 52 companies over four-month period reveals gradual price adjustment process that challenges strict interpretation of semi-strong market efficiency. Only 5% of total 2-hour price impact occurs within first minute after announcement, with full adjustment extending well beyond first hour of trading. Neutral reactions (no price change) dominate initially but decrease substantially over time, suggesting delayed price discovery process.

While statistical tests confirm non-random price movements following announcements, economic significance of these patterns is limited by transaction costs and execution risks. Our profitability analysis demonstrates that even with perfect foresight of announcement direction, typical investor would struggle to generate consistent profits 1. after accounting for

transaction costs. This creates situation where market exhibits statistical inefficiencies but remains "efficiently inefficient" from practical perspective.

The findings have important implications for various stakeholders. For investors, results suggest caution when trading around announcements, as initial price movements may not reflect full information content and transaction costs can easily overwhelm potential gains. For regulators, slow price adjustment indicates potential need for improved information environment, possibly through enhanced disclosure requirements or market structure reforms to facilitate more efficient price discovery. For corporate managers, understanding gradual nature of market reactions can inform communication strategies, particularly timing and clarity of disclosures.

Our research contributes to literature on market efficiency in emerging economies by providing detailed empirical evidence on intraday dynamics of information processing. The findings highlight need for nuanced view of market efficiency that recognizes both statistical evidence of inefficiency and practical limitations on exploiting these patterns. Future research should explore whether similar patterns exist in other emerging markets and investigate specific market characteristics that might explain cross-sectional variation in information processing efficiency

References

Full data set available on github: https://github.com/mzgrb/espi

1. Aharony, J., Swary, I. (1980). Quarterly dividend and earnings announcements and stockholders' returns: An empirical analysis. *The Journal of Finance, 35(1),* 1-12.
2. Andrade, G., Mitchell, M., Stafford, E. (2001). New evidence and perspectives on mergers. *Journal of Economic Perspectives, 15(2),* 103-120.
3. Ball, R., Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research, 6(2),* 159-178.
4. Bernard, V.L., Thomas, J.K. (1989). Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research, 27*, 1-36.
5. Bhattacharya, U., Daouk, H., Jorgenson, B., Kehr, C.H. (2000). When an event is not an event: The curious case of an emerging market. *Journal of Financial Economics, 55(1),* 69-101.
6. Binder, J. J. (1985). Measuring the effects of regulation with stock price data. *The RAND Journal of Economics, 16(2),* 167-183.
7. Boehmer, E., Musumeci, J., Poulsen, A.B. (1991). Event-study methodology under conditions of event-induced variance. *Journal of Financial Economics, 30(2),* 253-272.

8. Bohl, M.T., Brzeszczyński, J., Wilfling, B. (2009). Institutional investors and stock returns volatility: Empirical evidence from a natural experiment. *Journal of Financial Stability, 5(2),* 170-182.
9. Brown, S.J., Warner, J.B. (1980). Measuring security price performance. *Journal of Financial Economics, 8(3),* 205-258.
10. Brown, S.J., Warner, J.B. (1985). Using daily stock returns: The case of event studies. *Journal of Financial Economics, 14(1),* 3-31.
11. Busse, J.A., Green, T.C. (2002). Market efficiency in real time. *Journal of Financial Economics, 65(3),* 415-437.
12. Dolley, J.C. (1933). Characteristics and procedure of common stock split-ups. *Harvard Business Review, 11(3),* 316-326.
13. Fama, E.F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance, 25(2),* 383-417.
14. Fama, E.F., Fisher, L., Jensen, M.C., Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review, 10(1),* 1-21.
15. Griffin, J.M., Hirschey, N.H., Kelly, P.J. (2011). How important is the financial media in global markets? *The Review of Financial Studies, 24(12),* 3941-3992.
16. Grossman, S.J., Stiglitz, J.E. (1980). On the impossibility of informationally efficient markets. *The American Economic Review, 70(3),* 393-408.
17. Gurgul, H., Majdosz, P. (2007). The informational content of quarterly financial reports: The Polish experience. *Research in International Business and Finance, Vol. 21, No. 1,* pp. 147-162.
18. Gurgul, H., Majdosz, P. (2007). The informational content of dividend announcements in the Polish capital market. *Operations Research and Decisions, 17(1),* 37-58.
19. Jensen, M.C., Ruback, R.S. (1983). The market for corporate control: The scientific evidence. *Journal of Financial Economics, 11(1-4),* 5-50.
20. Kolari, J.W., Pynnönen, S. (2010). Event study testing with cross-sectional correlation of abnormal returns. *The Review of Financial Studies, 23(11),* 3996-4025.
21. Lee, C.M., Mucklow, B., Ready, M.J. (1993). Spreads, depths, and the impact of earnings information: An intraday analysis. *The Review of Financial Studies, 6(2),* 345-374.
22. Liu, W., Strong, N., Xu, X. (2003). Post-earnings-announcement drift in the UK. *European Financial Management, 9(1),* 89-116.
23. MacKinlay, A.C. (1996). Event studies in economics and finance. *Journal of Economic Literature, 35(1),* 13-39.
24. Malkiel, B.G. (2003). The efficient market hypothesis and its critics. *Journal of Economic Perspectives, 17(1),* 59-82.
25. Michaely, R., Thaler, R.H., Womack, K.L. (1995). Price reactions to dividend initiations and omissions: Overreaction or drift? *The Journal of Finance, 50(2),* 573-608.

26. Patell, J.M. (1976). Corporate forecasts of earnings per share and stock price behavior: Empirical test. *Journal of Accounting Research, 14(2),* 246-276.
27. Pedersen, L.H. (2015). *Efficiently inefficient: How smart money invests and market prices are determined*. Princeton University Press.
28. Pettit, R.R. (1972). Dividend announcements, security performance, and capital market efficiency. *The Journal of Finance, 27(5),* 993-1007.
29. Schweitzer, R. (1989). How do stock returns react to special events? *Federal Reserve Bank of Philadelphia Business Review, July/August,* 17-29.
30. Schwert, G.W. (1981). Using financial data to measure effects of regulation. *The Journal of Law and Economics, 24(1),* 121-158.
31. Shleifer, A. (2000). *Inefficient markets: An introduction to behavioral finance*. Oxford University Press.
32. Thaler, R.H. (2005). *Advances in behavioral finance, Volume II*. Princeton University Press.
33. Truong, C. (2011). Post-earnings announcement abnormal return in the Chinese equity market. *Journal of International Financial Markets, Institutions and Money, 21(5),* 637-661.