**Economics**

The Effect of Market and Technological Turbulence on Innovation Performance in Nascent Enterprises: The Moderating Role of Entrepreneur's Courage

--Manuscript Draft--

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The Effect of Market and Technological Turbulence on Innovation Performance in Nascent Enterprises: The Moderating Role of Entrepreneur's Courage

Abstract

Adapting to market and technological turbulence is essential for survival in a developing enterprise and requires making changes. Firms may need to increase their innovation performance to keep up and struggle with these changes to gain a competitive advantage. We believe that the courage of the entrepreneur emerges as a catalyst in such a struggle. Depending on resource-based view (RBV) theory, contingency theory, dynamic capabilities theory and upper echelon, the current study investigates the effect of market and technological changes, which are part of environmental changes, on innovation performance in nascent enterprises and the moderating role of courage in this effect. The authors collected data from 331 innovative companies acting in free trade zones by using the convenience sampling method via HR department managers. The results showed that market and technological changes were significantly and positively related to innovative performance, and the entrepreneur's courage moderated this relationship. It can be stated that entrepreneurs with high courage responded to changes with more innovation than those with low courage.

Keywords: market turbulence, technological turbulence, innovation performance, courage, innovation performance

1 Introduction

New initiatives are vital in improving and developing countries' social and economic situations. They impact creating new job opportunities for people, developing innovation potential, and providing added value (Revuelto-Taboada et al., 2021). Moreover, it is also possible for enterprises to gain sustainable competitive advantages and increase prosperity in their respective countries through the skills the entrepreneurs possess (Eniola et al., 2014). However, today, the change in customer preferences and, in turn, the shortening of the product life cycle, technological turbulence, and intense competition leave entrepreneurs to navigate severe market turbulence (Tufan, 2019). Initiatives can adapt to the environment by honing two abilities, namely, adaptation and innovation, from a resource-based view (Dixon, Meyer, and Day, 2014).

In this context, contingency theory, which argues that companies must adapt to environmental changes, suggests that company performance depends on the organization's harmony with the environment (external) and the harmony between the organizational elements themselves (internal) (Wilden et al., 2013). Furthermore, it asserts that this adaptation also creates a competitive advantage of innovation based on the assumption that the company is trying to adapt to a specific environment and situation. Innovation is among the most important sources of competitive advantage in a fast-changing environment (Abdi et al., 2018). Startups must innovate to take advantage of the opportunities offered by the changing markets and technology (Chakravarty, 2022; Gilsing et al., 2014). However, market opportunities offered by new technologies are uncertain. Thus, entrepreneurs must also foresee technology-related demands and expectations and make innovative changes to meet them (Kashefi, 2016).

The dynamic capabilities theory may explain the environment that experienced intense and rapid developments. Dynamic capabilities enable enterprises to reorganize their resources according to the conditions of a given environment. The organization of the uncertain and variable environment is contingent on its perception and evaluation by the entrepreneur as well
as its behavior and performance (Gilinsky et al., 2019). Market and technology turbulence perceived by the entrepreneur creates a push towards dynamic capabilities and urges the entrepreneur to take advantage of market opportunities with innovative products (Slavec Gomezel & Aleksić, 2020). One of the most important qualities necessary to overcome the difficulties faced by an entrepreneur, which is a crucial mechanism for successfully implementing and managing innovation (Pinchot, 1985), is courage (Miller & le Breton–Miller, 2017). The high variability increases the risk the entrepreneur takes, increasing the importance of entrepreneurial courage (Slavec Gomezel & Aleksić, 2020). In this context, the upper-echelon theory can explain courageous entrepreneurs’ effect on innovation performance. The upper-echelon theory states that entrepreneurs’ experiences, values, and perspectives on the current situation affect their decisions (Hambrick and Mason, 1984).

The studies mentioned above have been carried out to gauge the effect of market and technological change on company performance. However, there is a gap in the literature regarding the role technological change plays as an intermediary (Jaworski & Kohli, 1993; Kohli & Jaworski, 1990) when it comes to the relationship between market change and innovative performance. To fill this gap, we examined the relationship between market and technological change and innovation performance and the moderating role of entrepreneurial courage in this relationship.

2 Theoretical Framework

In this context, contingency theory, which argues that companies must adapt to environmental changes, suggests that company performance depends on the organization’s harmony with the environment (external) and the harmony between the organizational elements themselves (internal) (Wilden et al., 2013). Furthermore, it asserts that this adaptation also creates a competitive advantage of innovation based on the assumption that the company is trying to adapt to a specific environment and situation. Innovation is among the most important sources of competitive advantage in a fast-changing environment (Abdi et al., 2018). Startups must innovate to take advantage of the opportunities offered by the changing markets and technology (Chakravarty, 2022; Gilsing et al., 2014). However, market opportunities offered by new technologies are uncertain. Thus, entrepreneurs must also foresee technology-related demands and expectations and make innovative changes to meet them (Kashefi, 2016).

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2 Literature Review

2.1 Market Turbulence and Technological Turbulence

Environmental turbulence is a concept that describes the relentless changes and unpredictability companies face (Zhang, 2006). Environmental turbulence is a set of variables shaped by factors such as markets, customers, competitors, or laws outside of an existing environmental structure that will present threats of different types and magnitudes (Leblebici, 2004). The dimensions that constitute environmental turbulence are competitor, market, and technological turbulence (Jaworski and Kohli, 1993). This study focuses on market and technology turbulence.

According to contingency theory, it is not the strategy that determines a company's performance but rather the match between the environment and the strategy (Donaldson, 2001; Su et al., 2013). For this reason, the environment has been taken as one of the elements of contingency in strategic management literature.

Calantone et al. (2003) referred to environmental turbulence as an environment in which unpredictable technological or market changes are frequently observed. In another study, Liu (2013) defined business environments with high environmental turbulence as containing uncertainties and changes that are difficult to predict in advance. The environment's uncertainty and turbulence also bring companies threats and opportunities, which naturally impacts commercial organizations' business approaches. Therefore, coupled with the uncertainty in customer demands, managers who are situated within high levels of environmental turbulence must be careful when it comes to following long-term decisions regarding the most appropriate market and technology and how to allocate their resources (Santos et al., 2020).

Market turbulence is constant changes in price and cost structures, customer demands and expectations, and competitor distribution (Senbeto and Hon, 2020; Kohli, Jaworski, and Kumar, 1993). Market turbulence is essential for companies due to the uncertainty and risk it presents in business processes and the increased rate of causality it creates between strategy and company performance.

In their study, Wang et al. (2015) state that market turbulence is an important environmental factor that plays a role in the organizational performance of dynamic capabilities. Hooley et al. (2003) stated that market turbulence includes some elements, e.g., the speed of change in customer needs, the degree of competition, the various stages of the product life cycle, and the rate of change in the technologies utilized.

Jaworski and Kohli (1993) defined technological turbulence as the rate and speed of technological changes and innovations that cause technological uncertainty around the company. Companies operating in a technologically turbulent environment must adapt to technological changes that include various uncertainties and risks. (Gomezel andAleksić, 2020). Koh (1996) stated that entrepreneurs and managers tend to make decisions that lean towards taking risks in uncertain situations. Tsai and Luan (2016) demonstrated that risk-taking positively correlated with technological turbulence and innovation performance. However, Nicholson et al. (2005) showed that individuals' risk-taking behaviors, when presented with different situations, were also relatively inconsistent. Thus, the authors argued that technological turbulence affects the perception of risk-taking among entrepreneurs and managers.
On the other hand, technological turbulence shortens existing products' life cycles and weakens well-established companies' competitive advantages (Arora et al., 2015). Technological turbulence also creates entrepreneurial opportunities with this aspect and presents a challenge to well-established companies in the market and the norms they have established (Martin et al., 2020).

As a result, market turbulence can also trigger environmental turbulence by increasing the speed of change in technological innovation. In other words, new technologies take the place of old technologies, making products obsolete faster, and thus companies will be able to achieve a temporary competitive advantage (Santos et al., 2020). As emerging new technologies will increase the innovation capabilities of managers, this will also allow managers to increase their market share and develop products and new business models (Pandit et al., 2018). Frank et al. (2022) state that companies learn to conduct business by integrating technological and market knowledge proportionally to the degree of environmental turbulence. In sum, the presence of market and technological turbulence increases the effects of managers and, therefore, companies on innovation performance (Iqbal et al., 2021). With this background, we evaluate that there will be a positive relationship between market turbulence and technological turbulence.

H1: Market turbulence is positively correlated with technological turbulence.

2.2 Market Turbulence and Innovation Performance

Looking at strategic management literature, we observe that innovation is the key factor for companies to maintain their competitive advantages by continuing their activities by creating value in dynamic environments (Tidd and Bessant, 2014). Ardito et al. (2021) defined innovation performance as the sum of the innovations of an enterprise. Ferraris et al. (2019) described innovation performance as taking advantage of a company's competencies in terms of its new services and products. Innovation emerges when resources and talents are transformed into creativity and new ideas and when unique products are developed (Niroumand et al., 2020).

Innovation performance can be divided into two categories: radical and incremental. Radical innovation is the type of performance that causes fundamental changes in the company's technologies, processes, products, and organizational structure. Incremental innovation performance, on the other hand, is the improvements made to the existing technology, process, product, and organizational structure (Coccia, 2016). De Visser and Faims (2015) stated that companies should appropriately combine incremental and radical innovation to maintain their competitive edge in the long term.

Market turbulence refers to consumers' constant introduction into and exit out of the market, their wide-ranging needs and expectations, and rapid changes in their preferences (market dynamism), the consistent provision of new products, and presenting innovation (Qiu et al., 2020).

It is only possible for a business to sustain itself by continuously monitoring its environment and adapting to the changes. Previous research states that innovation is paramount for enterprises in the face of changes to their environment and the markets in which they operate (Wang et al., 2015). It is becoming increasingly difficult to define the evolution of environmental forces in dynamic markets, and preferences regarding products and services change constantly. In this context, the products and services companies introduce become unable to meet the needs and expectations of customers after a while (Zhang and Watson, 2020). To overcome this, companies must anticipate new customer demands and show proactive
behaviors, such as innovation and creativity, that can direct customer demands (Miles & Snow, 1978). Innovative enterprises are expected to develop strategies to turn this into an opportunity by taking advantage of the changes in customer demands and expectations and entering niche markets by introducing new products. For this reason, innovation becomes very important for enterprises in environments where the market turbulence rate is high to meet customers' changing needs and expectations (Ding and Ding, 2022).

When examined through the lens of the dynamic capabilities perspective (Teece et al., 1997), innovation allows enterprises to combine and restructure their tangible and intangible assets with new methods. Thus, enterprises take advantage of the opportunities created by market turbulence and develop dynamic capabilities that they can use to counteract threats. In other words, as Rhee, Park, and Lee (2010) also stated, companies use innovation as a strategic tool that they can utilize to counteract changes in their markets.

As a result, when the speed of market turbulence in a company's particular market increases, it needs to engage in innovation activities at a higher level to perform better (Hult et al., 2004). Companies with innovative performance can take advantage of the change in customer needs and expectations, find new solutions to their problems, and restructure their assets to manage the market changes effectively (Peng et al., 2021).

A study by Rundquist (2012) on R&D managers found that information integration had a more significant impact on innovation performance in environments with the higher market and technological turbulence. Further, a study conducted by Gök and Peker (2016) on 305 top-level managers concluded a positive relationship between innovation performance and market performance. Feng et al.’s (2022) study on 253 enterprises in China found that market dynamism moderated the relationship between information management and innovation performance. Moreover, in their research on SMEs in China, Kim et al. (2020) found that environmental uncertainty positively affected innovation. Al-Nuaimi et al.’s (2014) study on five-star hotel managers in Jordan found that environmental turbulence positively affected innovation performance. Conducted at 266 small and medium-sized companies in Korea, Seo et al.’s (2020) study found a positive relationship between environmental dynamism and innovation.

Based on the body of literature discussed above, the following hypothesis argues that enterprises will show higher innovation performance in cases where market turbulence is high.

H2: Market turbulence is positively correlated with innovation performance.

2.3 Technological turbulence and innovation performance

The differences between the technological turbulence intensity in a company's operating environment influence the synergy between the company and its environment, information and materials exchange, and its organizational structure and strategy (Li et al., 2018).

In stable environments with a lower level of technological turbulence, companies can utilize existing resources, capabilities, and knowledge for longer (Sheng et al., 2011). They strive to obtain information to maintain their current competitive situation (Achrol and Kotler, 2022). However, when unpredictable technological changes start to increase technological turbulence, operating with the information available to companies can lead to several problems, such as organizational inertia (Azeem et al., 2021). Environments with a higher level of technological turbulence may lead to the company's information structure becoming obsolete and their existing capabilities becoming insufficient in meeting customers' changing needs and expectations over time, leading the company towards losing its relevance. For this reason, companies may have to resort to quickly re-combining their capabilities and knowledge (Baofeng et al., 2022; Cai et al., 2021; Hung and Chou, 2013). Edmondson and Nembhard
(2009) state that in cases where the level of technological turbulence increases, businesses should develop new products to maintain their existence.

Technological turbulence also presents some opportunities for companies. Coccia (2012) states that technological turbulence leads to changes in demand, a necessary driving force of innovation. In other words, technological turbulence can increase innovation performance by driving enterprises to develop new products based on new and advanced technology (Baofeng et al., 2022). Indeed, previous literature demonstrated that technological turbulence positively affected innovation performance (Baofeng et al., 2022; Li et al., 2018; Song, Van Der Bij, and Weggeman, 2005).

Based on these statements and theoretical foundations, the following hypothesis was created:

H3: Technological turbulence is positively correlated with innovation performance.

2.4 The Mediating Effect of Technological Turbulence

In an environment with a high speed of market turbulence, it becomes difficult for the companies' existing production line to respond to these changes, as customer preferences change frequently. In such environments, businesses may not be able to adequately access reliable and accurate information about the state of their industry and the changes in customer preferences by using conventional analysis methods. Thus, it becomes difficult to react to these changes using traditional product development methods (Santos et al., 2020). Such cases make it necessary for businesses to resort to aggressive and proactive behaviors to accelerate technological innovation and present reactive behavior by creating new services and products to create customer value (Zhang et al., 2016).

Tsai et al. (2016) noted that in the face of changes in customer preferences, companies should resort to creativity and innovation to constantly change their products and services through technological change and adapt their operations accordingly. Thus, businesses with high innovation performance will benefit from the speed of change in customer preferences appropriately. They will also need to restructure their technological assets to develop better solutions to their customers' problems and successfully manage market turbulence (Iqbal et al., 2021). In sum, changes to the market in which a company carries out its activities will make its existing products obsolete and decrease demand for these products. Businesses will have to offer new products and services using new technologies to cope with this situation. The change in the market will lead to an increase in the speed of technological change, which will effectively increase the company's innovation performance.

Based on these arguments, we put forward the following hypothesis:

H4: Technological turbulence has a mediating role in the relationship between market turbulence and innovation performance.

2.5 The Moderating Role of Courage

Since consumers enter and leave markets more, and as a result of changing consumer profiles, consumer expectations become more diverse. Thus, meeting consumers' wide-ranging needs and expectations becomes possible through the organization's orientation towards an innovative practice. In other words, offering new products to consumers and innovating came to the forefront in responding to market turbulence (Qiu et al., 2020). However, it is necessary to take the changes market turbulence brings with it and to be able to manage those changes. It takes constant courage to take risks in an environment where the volatility of a situation and the effect of its consequences on business goals and strategies are not known in advance (Miller & Le
In the emergence of innovative performance as a response to market turbulence, it is necessary to embrace change. Courage is required to embrace change and, as a result, scrutinize the organizational activities and goals with long-term successes in mind (Perel, 2002). Thus, courage may have a diminishing or amplifying effect on the emergence of innovative performance, which appears as a necessity and a reaction due to the increase in market turbulence. Any innovation brings with it risks and difficulties. Courage comprises accepting challenges and taking the risk of failure when achieving organizational goals (Kilmann et al., 2010).

Failure due to uncertainty is always a possibility in business. Courage means going beyond the traditional ways of goal setting and management authority. Moving beyond conventional business methods means getting rid of passive decisions and practices. Further, it means engaging in higher-risk, more uncertain endeavors. It requires performing actions while considering the possible consequences of failure, something very few people are willing to try (Perel, 2002). Courage enables companies to make spontaneous, improvised changes to increase efficiency and effectiveness (Schilpzand et al., 2015).

Courage is critical for organizational innovation: it is the basis of innovative efforts that support organizational success, especially those that involve the risk of financial loss. Courage sometimes requires the ability to improvise since it consists in making progress despite danger and the risk of failure (Koerner, 2014). Courage will also significantly impact the technological and market turbulence perceived by businesses. This is because innovation performance constitutes a company's competencies in creating new services and products (Ferraris et al., 2019). Courage, a managerial competence (Sekerka et al., 2009), can effectively strengthen this innovative performance.

When we consider that technological turbulence refers to the magnitude and speed of the technological changes and innovations within the company's field, in an environment where technological change is intensive and fast, the industry has to adapt quickly to technological changes (Gomezel and Aleksic, 2020). However, technological systems can create risks at the social and organizational levels or bring about negative consequences depending on the different socio-economic organizational styles (Hellström, 2003). Thus, risk has long been an important determinant of technological adjustments (Bamforth & Bleed, 1997). A lack of courage can lead to excessive caution and unwillingness to take risks (Pavlou and El Sawy, 2010). Therefore, it is essential to accept innovation as a requirement for technological change's ability to increase innovative performance. It is only possible to see innovation as an opportunity and facilitator through courage (Perel, 2002).

Our review of the literature has thus led to the following hypotheses:

H5: Courage plays a moderating role in the relationship between market turbulence and innovation performance.

H6: Courage plays a moderating role in the relationship between technological turbulence and innovation performance.

3. Methodology

The study is an exploratory and cross-sectional study aiming to test the relationships between variables in a theoretical context empirically. Figure 1 illustrates the research model.
Innovative-entrepreneurial companies engaged in production, patent production and R&D activities in 18 free zones across Turkey constitute the study population. Companies that do not have an R&D department but are engaged in innovative activities are also included in the research sample. However, companies that have the status of "production companies" with license to operate in a free zone but do not continue their activities, as well as companies that buy, sell, rent or stock within free zones were not included in the research sample.

The authors conducted the study in free zones. Free zones positively contribute to the economy and macroeconomic status of the country they operate in, help the country's economy by attracting direct foreign investment, and are centers of attraction for entrepreneurial businesses due to the advantages they present, such as tax breaks and incentives. According to 2021 data, the number of domestic and foreign companies engaged in production with a license to operate in free zones in Turkey is 1115 (Republic of Turkey Ministry of Trade, 2022). Only 800 of these companies, which have operating licenses, continue their operations. The survey was sent to these operating companies via e-mail. Among the 800 organizations surveyed via e-mail, 331 responses were obtained. Table 1 illustrates the distribution of the companies that returned the surveys by sectors and free zones.

Table 1: Distribution by sector (sample companies)

<table>
<thead>
<tr>
<th>Free Zone</th>
<th>Number of Surveys Returned</th>
<th>Distribution by Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adana Yumurtalik Free Zone</td>
<td>9</td>
<td>Industry (2), Chemistry (5), Yacht (2), Electricity and Electronics (6), Industry (9), Medical (6), Automotive (1), Textile (2), Yacht (16)</td>
</tr>
<tr>
<td>Antalya Free Zone</td>
<td>40</td>
<td></td>
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</tbody>
</table>
Table 2 shows the descriptive statistics of the enterprises included in the sample. The majority of the participants were men, and they were between the ages of 36-45. Most of them were university graduates and worked in expert positions.

Table 2: Characteristics of the sample

<table>
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<tr>
<th>Descriptive Information</th>
<th>Groups</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>211</td>
<td>74.3</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>120</td>
<td>25.7</td>
</tr>
</tbody>
</table>

Table 2 shows the descriptive statistics of the enterprises included in the sample. The majority of the participants were men, and they were between the ages of 36-45. Most of them were university graduates and worked in expert positions.
### 3.2 Scales

Innovation performance: The innovation performance of the participants was measured with a 5-point unidimensional scale created by Tomlinson and Fai (2016) and Dai, Byun and Ding (2019) and adapted by and Yu et al. (2022). The participants expressed their opinions through a five-point Likert (1=Completely disagree, 5=Completely agree). The scale contains items such as "The improvements we make to existing products are better than that of our competitors" and "Our process of adapting to new technologies is better than that of our competitors". The high scores on the scale indicate that the innovative performance is high.
Market turbulence: A five-point unidirectional scale, developed by De Clercq, Thongpapanl, and Voronov (2018), was used to measure market turbulence. The scale measures the change in customer demands in a competitive market. The participants rated items such as "The demands and preferences of our customers change unpredictably" and "The sector in which we operate has intense competition" on a five-point Likert scale (1=Completely disagree, 5=Completely agree). Thus, high scores indicate that market turbulence perceptions are high.

Technological turbulence: The study used a four-point unidimensional scale developed by Ye, Hao, and Patel (2016) to measure participants' perceptions of the speed of technological turbulence. Some items on the scale are as follows: "The technologies used in the sector in which we operate change quickly" and "It is quite difficult to predict the trends of technological development in our industry". The high perceptions collected through the 5-point Likert scale (1=Completely disagree, 5=Completely agree) indicate that technological turbulence is perceived as high.

Entrepreneurial courage: The study used the scale developed by Norton and Weiss (2009), adapted by Ginevra et al. (2020) adapted into Turkish by Mert and Köksal (2022). The scale consists of six items. Examples are "I tend to face my fears" and "I will do things even though they seem dangerous." Participants rated the courage items using the 5-point Likert scale (1=never, 5=always).

4. Empirical Results

4.1 Common Method Variance

Due to the cross-sectional data collection, we first checked for common method variance through using the unconstrained and zero constrained model. Since the chi-square difference between the generated models is insignificant, it has been shown that the two models are the same or invariant (Δχ² = 77,000, sd = 171, p > 0.05), so it can be stated that there is no common method variance in the model.

4.2 Validity and Reliability

The construct validity, convergent and discriminant validity, and reliability of the measurement model were checked with construct reliability and Cronbach's alpha. The coefficients and significance of the factor loads of all of the items were examined to measure convergent validity. It was found that all factor loads were significant and were between the values 0.819 and 0.973. The average variance extracted (AVE), maximum shared variance (MSV), and composite reliability (CR) (see Table 3) were above the cut point. In addition, the internal consistency of the scales is also at an adequate level.

Finally, the fit between the measurement model and the data set was checked through confirmatory factor analysis (CFA). Results showed that the measurement model had fit values (χ² = 345,035, sd = 164, χ²/sd = 2,104, CFI = 0.974, SRMR = 0.031, RMSEA = 0.058, PClose = 0.063).

Table 3: Validity and Reliability of the Measurement Model

<table>
<thead>
<tr>
<th>Variables</th>
<th>CR</th>
<th>AVE</th>
<th>MSV</th>
<th>Cronbach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courage</td>
<td>0.937</td>
<td>0.714</td>
<td>0.070</td>
<td>0.937</td>
</tr>
<tr>
<td>Innovation Performance</td>
<td>0.969</td>
<td>0.862</td>
<td>0.139</td>
<td>0.969</td>
</tr>
</tbody>
</table>
4.3 Descriptive Statistics

Table 4 presents the variables' mean, standard deviation, and correlation values. The average perceptions of all variables were above the midpoint (3). The relationships between market turbulence and the other variables were positive and significant at a low level. There was a medium-level positive relationship between technological turbulence and innovation and a low-level positive relationship between technological turbulence and courage. Moreover, there was a medium-level positive relationship between innovation and courage. Hypotheses H1, H2 and H3 were accepted according to these results.

Table 4: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>St. deviation</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Market turbulence</td>
<td>4.06</td>
<td>0.71</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Technological turbulence</td>
<td>4.35</td>
<td>0.75</td>
<td>0.110*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3-Innovation performance</td>
<td>4.21</td>
<td>0.91</td>
<td>0.132*</td>
<td>0.370**</td>
<td>-</td>
</tr>
<tr>
<td>4-Courage</td>
<td>4.14</td>
<td>0.77</td>
<td>0.165**</td>
<td>0.279**</td>
<td>0.385**</td>
</tr>
</tbody>
</table>

*p < 0.05, **p<0.01

4.4 Regression Analysis

Linear hierarchical regression analysis was performed using the least squares method to test the relationship between mediation and moderation. Before the analysis, the data were checked for normal distribution and collinearity as part of the main regression analysis assumptions. The skewness and kurtosis values of the variables (ranging from -0.975 to 3.186) were acceptable, the highest variance inflation factor (1,011) and the condition index (16,32) were within acceptable limits (Kline, 2011), and the plot graph shows that the error distributions are normal. Table 5 presents the results of the hierarchical regression analysis.

The mediating effect was examined according to the method proposed by Baron and Kenny (1986). Results showed that market turbulence significantly positively affects technological turbulence ($\beta = 0.116$, s.e. =0.058, $p = .046$), and market turbulence had a significant positive effect on innovation performance. After adding technological turbulence to the model in the second stage of the regression analysis, while technological turbulence had a statistically significant positive effect on innovation performance, market turbulence did not have a statistically significant effect. Results suggested that technological turbulence had a full mediating effect. This result confirmed hypothesis four.

In the third stage of hierarchical regression, courage was added as a moderator variable. Courage had a statistically significant positive effect on innovation performance. The moderating effect of courage was examined with the interaction variables. In comparison, there was no significant effect of the first interaction variable (technological turbulence x courage) but a significant effect of the second interaction variable (market turbulence x courage).
According to these results, hypothesis H5a of the research was rejected, and hypothesis H5b was accepted.

Table 5: Results of the Hierarchical Regression Analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>St. error</th>
<th>$t$</th>
<th>$P$</th>
<th>$R^2$/$\Delta R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.529</td>
<td>0.290</td>
<td>12.165</td>
<td>0.000</td>
<td>0.017*</td>
</tr>
<tr>
<td>Market turbulence</td>
<td>0.169</td>
<td>0.070</td>
<td>2.406</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.823</td>
<td>0.364</td>
<td>5.006</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Market turbulence</td>
<td>0.118</td>
<td>0.066</td>
<td>1.791</td>
<td>.074</td>
<td>0.146**/0.128**</td>
</tr>
<tr>
<td>Technological</td>
<td>0.439</td>
<td>0.063</td>
<td>7.007</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Stage 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.396</td>
<td>0.399</td>
<td>2.789</td>
<td>.006</td>
<td></td>
</tr>
<tr>
<td>Market turbulence</td>
<td>0.030</td>
<td>0.064</td>
<td>1.038</td>
<td>.074</td>
<td></td>
</tr>
<tr>
<td>Technological</td>
<td>0.338</td>
<td>0.062</td>
<td>5.386</td>
<td>.000</td>
<td>0.241**/0.096**</td>
</tr>
<tr>
<td>Turbulence (P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Courage (C)</td>
<td>0.302</td>
<td>0.064</td>
<td>5.168</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Interaction (TxC)</td>
<td>0.075</td>
<td>0.039</td>
<td>0.880</td>
<td>.379</td>
<td></td>
</tr>
<tr>
<td>Interaction (PxC)</td>
<td>0.174</td>
<td>0.072</td>
<td>2.411</td>
<td>.016</td>
<td></td>
</tr>
</tbody>
</table>

The authors drew an interaction graph according to one plus and minus standard deviation from the mean to interpret the moderating effect of courage (Figure 2). The graph showed that when market turbulence increases, innovation performance tends to decrease in companies with low courage while it increases in companies with high courage. It can be stated that companies with high courage may also present high innovation performance.

![Interaction graph](image-url)

Figure 2: Interaction graph

5. Discussion
This study has demonstrated that the market and technological turbulence perceived by enterprises participating in the study is high. It can be stated that the changes the pandemic brought, which affected the world as a whole, have also been felt severely in Turkey. The current account balance was in deficit due to high inflation rates, high deficits in foreign trade, and rising energy costs in the year this study was conducted (TC Ministry of Commerce, 2022).

It has been determined that entrepreneurs have a high perception of courage and innovation performance due to the high perception of turbulence in the market and technology. The study found that market turbulence has a positive effect on innovation performance. These findings support the existing studies in the field (Bodlaj et al., 2012; Feng et al., 2022; Gök & Peker, 2017; Kim et al., 2020; Rundquist, 2012; Seo et al., 2020; Tsai & Yang, 2013). Enterprises operating in the free zone maintain their operations by converting their resources and capabilities into new products when they perceive market turbulence. Another study finding was the positive effect of technological change on innovation performance. This finding suggested that when entrepreneurs perceive technological turbulence, they want to take advantage of the innovation opportunities it offers more.

The current study results supported previous empirical studies (Baofeng et al., 2022; Song et al., 2005). The effect of market turbulence on innovation performance became insignificant when technological turbulence happened. In other words, technological turbulence fully mediated the relationship between market turbulence and innovation performance. Jaworski and Kohli (1993) stated that adaptation to market turbulence would lose its effect when there was technological turbulence. Companies could gain a competitive advantage through the innovation opportunities technological change offers. Yu et al. (2022) found technological turbulence rather than market turbulence mediated the relationship between strategic flexibility, entrepreneurial leadership, and innovative performance. The final finding of the study was the moderating effect of entrepreneurial courage on the relationship between market turbulence and innovative performance. The finding suggests that when the perceived market turbulence is high, high entrepreneurial courage leads to higher innovation performance, while low courage causes innovation performance to drop. Miller and le Breton-Miller (2017) emphasized that entrepreneurial courage and imagination were the basis of the value creation process and the necessity for courage when taking risks in uncertain situations. Therefore, in the event of uncertainty caused by market turbulence, it can be expected that entrepreneurs with high courage will increase their innovative behavior, and those with low courage will avoid innovation.

Interestingly, while we expected a similar result regarding the relationship between technological turbulence and innovation performance, the results showed that courage did not moderate this relationship. Gomezel and Aleksić (2020) explained the effect of technological change on innovative performance within the scope of flow theory. In this context, they claimed that entrepreneurs' passion for their goals would negate the efforts spent and fear of failure. They would tend toward innovation to succeed when there was technological turbulence. As a result of their study, they found that when there was high technological turbulence, the flow experience affected innovative performance. No such effect was present when there was low technological turbulence. Therefore, we anticipated that entrepreneurial courage also plays a role in the relationship between technological turbulence and innovation performance. It has been determined that the companies within our sample perceive technological turbulence as high. Therefore, we can state that increasing innovation performance in an environment with such high technological turbulence is equivalent to survival. Courage is especially involved when some risk can be taken (Rate et al., 2007). To this end, we assess that the companies in the sample did not associate innovation with survival when it comes to market turbulence but presented such an outlook regarding technological turbulence.
6. Conclusion

This study examined the relationship between market turbulence and innovative performance and the mediating role of technological turbulence in this relationship by examining innovative companies operating across free zones. Moreover, it investigated the moderating role of entrepreneurial courage in the relationship between market and technology turbulence and innovation performance. The results indicated that market and technological turbulence were related to innovation performance and that technological turbulence fully mediated the relationship between market turbulence and innovation performance. In other words, technological turbulence diminishes the effect of market turbulence on innovation performance. Participants evaluated that when they perceive the market and technological turbulence, they respond to this change with innovative products.

Furthermore, high entrepreneurial courage increased the innovation performance of entrepreneurs when there was perceived market turbulence, while low entrepreneurial courage reduced it. However, it has also been found that courage does not have the same effect regarding technological turbulence. We explain this situation by arguing that technological turbulence pushes companies to innovate more than market turbulence, which is seen as equivalent to the company's survival.

This study had some limitations. Firstly, it isn't easy to establish a causal relationship between the variables since it is a cross-sectional study. Future studies can test causality with longitudinal analysis. The study sample focuses on innovative entrepreneurs within free zones in Turkey only. Other events within a country may also affect the perception of market and technological turbulence. By collecting data across different countries, future studies can examine whether location moderates the relationship between market and technology turbulence and innovative performance. Finally, other empirical studies must emphasize the moderating effect of courage between the perception of technological turbulence, especially low turbulence, and innovation performance.

REFERENCES


