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PREDICTING THE ENTRY OF ESTONIAN EXPORTERS INTO NON-EUROPEAN MARKETS USING FINANCIAL AND INTERNATIONALISATION BEHAVIOUR VARIABLES

Master's Thesis

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I have written this master's thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

Abstract

This thesis aims to assess how accurately financial and internationalisation variables are able to predict the entry of Estonian exporters into non-European markets (NEM). Building on several theoretical perspectives, including the Uppsala model, resource-based view and behavioural theory of firm, the research utilises indicators of firms' prior internationalisation and financial performance. The analysis is based on Estonian exporting firms, drawn from the Estonian Business Registry, that either entered or did not enter non-European markets between 2010 and 2022. The methods applied include logistic regression, exploratory factor analysis, and artificial neural network modelling. The findings indicate that internationalisation variables, particularly export scale and scope, are more significant predictors of NEM entry than traditional financial ratios. In the case of entrants, the European export scale and scope increased shortly before NEM entry. Financial indicators, by contrast, are less significant, likely due to exporters' generally healthy financial condition, which limits variation among firms. However, NEM entrants witnessed short-term financial strain before the event, portrayed by lower liquidity and solvency. NEM entry is predictable with excellent accuracy, especially when firms remain functional and have remarkable intensity on the NEM.

Keywords: new continent entry, internationalisation, exporting firms, prediction, financial performance.

CERCS codes: S180, S181, S186.

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Introduction

As a small and highly trade-dependent economy, Estonia relies heavily on international markets for sustained growth and competitiveness (Benkovskis et al., 2020; Masso & Vahter, 2015). Understanding which firms are likely to expand beyond the European market has become increasingly important in this context. As traditional markets reach saturation and competition intensifies, more Estonian exporters seek to grow beyond the home continent. However, entering distant markets reveals opportunities and challenges as firms navigate unfamiliar environments. Successfully competing in the non-European market (NEM) requires a clear understanding of the key financial and export performance indicators that signal a firm's readiness for expansion.

This thesis aims to assess how accurately financial and internationalisation variables can predict the entry of Estonian exporters into non-European markets. The primary motivation of this study refers to the exhausted capacity of the European market, which has made it more difficult for exporters to sustain high growth rates and expand their customer base. Based on a resource-based view (RBV), export market entry is not just a demonstration of financial strength. It can also be a strategic response to challenges like shrinking demand or rising competition, where export expansion is used to acquire new resources from abroad and compete in existing markets more effectively (Hessels & Parker, 2013; Hitt, Tihanyi, et al., 2006; Nason & Wiklund, 2018). Firms may also enter new markets make better use of existing resources and capabilities (Arbelo et al., 2024; Helfat & Eisenhardt, 2004; Matsusaka, 2001; Ruzo et al., 2011). Both motives are relevant for Estonian exporters, given the constraints of a small domestic market and a saturated European environment.

Among traditional internationalisation theories, the Uppsala model (Johanson & Vahlne, 1977; Johanson & Vahlne, 1990) provides a particularly relevant lens for this context. It suggests that firms internationalise incrementally, building capabilities over time through knowledge accumulation. This model aligns well with the behaviour of Estonian exporters, who often begin with nearby markets before going further.

While extensive research exists on initial internationalisation and export strategies, to the author's knowledge, there is still a lack of predictive models that combine financial and internationalisation variables to predict which established exporters will enter NEM. The available studies mainly focus on disclosing the significant effects, often looking either on earlier internationalisation or financial performance, rather than outlining the predictive potential of variables reflecting both of these domains. Therefore, this thesis fills this gap by

focusing on Estonian firms' underlying capabilities and assessing their likelihood of entering non-European markets. It contributes to the academic literature by identifying which indicators hold the most predictive power and constructing models to predict NEM entry.

Therefore, the research analyses the set of financial and internationalisation indicators to better assess a company's capabilities. Ratios like liquidity, solvency, profitability (Chaney, 2016; Görg & Spaliara, 2014; Manova, 2013) provide a deeper understanding of how internal financial strength influences a firm's ability to expand internationally. Meanwhile, another stream of the literature suggests that financial health is more often a consequence of export activity rather than a driver (Bernard & Bradford, 1999; Greenaway et al., 2007; Stiebale, 2011), with productivity indicator emerging as a more reliable predictor of market entry (Bernard et al., 2007; Ganotakis & Love, 2012; Wagner, 2007). This is consistent with the Melitz model of firm heterogeneity in international trade (Melitz, 2003), which argues that only the most productive firms can cover the sunk costs of exporting and succeed in international markets. Accordingly, firms with higher productivity are more likely to expand beyond their domestic base and sustain competitive advantages abroad. In addition, firms with prior international market presence are generally better positioned to expand (Brouthers et al., 2009; Love et al., 2016). Empirical evidence suggests that both export scale and intensity are important determinants of new market entry, as growing export revenues enhance a firm's capacity to manage internationalisation costs (Boehe et al., 2016; Fabling & Sanderson, 2013; Fryges & Wagner, 2010).

The data for this thesis comes from the Estonian Business Registry, which contains annual financial reports from 2010 to 2022, including export revenue by geographic region. The study uses several dependent variables to capture various dimensions of NEM and export behaviour. The base dependent variable reflects whether a firm has entered a NEM or continues exporting only to Europe. Additional dependent variables are included to assess the durability and significance of that entry. These distinctions help to differentiate between short-term, sustained and significant plus sustained export activity. Analysing these dependents separately enables a more holistic analysis of whether firms internationalise and how meaningfully and durably they do so. This distinction is supported by prior evidence showing that many Estonian exporters engage in only brief or sporadic export activity, while long-term and substantial engagement is relatively rare (Vissak & Masso, 2015).

This study applies a combination of statistical and machine learning methods to evaluate indicators and make predictions with meaningful accuracy. Descriptive statistics examine trends and distributions across financial and internationalisation variables among

NEM entrants and non-entrants. Univariate logistic regressions provide baseline models for assessing each variable's significance, enabling them to reach unbiased conclusions about their behaviour. Furthermore, exploratory factor analysis addresses multicollinearity among export and financial ratios, reducing dimensionality while showing key information. The factor scores are used in the multivariate logistic regression. Finally, artificial neural network (ANN) models are used for NEM entry prediction as they capture complex, non-linear relationships, therefore enabling to reach more accurate prediction results than logistic regression. Moreover, comparing prediction accuracy across different dependent variables adds further value, as it highlights how predictors perform differently depending on the specific type of market entry. Also, using the SHAP (SHapley Additive Explanations) plot for analysis helps to identify key contributors to the ANN models' output.

The results of this study show that internationalisation variables are the strongest predictors of NEM entry among Estonian exporters. Firms entering markets outside home continent have broader internationalisation experience and are active in more European markets than non-entrants. While most exporters maintain good financial health, limiting the stand-alone predictive power of financial indicators, some patterns suggest that short-term financial strain often precedes NEM entry. Such patterns were not fully captured by univariate or multivariate regression models, which struggled to reflect the complex behaviour of financial variables. To address this, ANN models were used for prediction. Sustained and revenue-significant entry was the most distinct and consistent type, making it the focus of SHAP analysis based on the ANN model results. SHAP analysis confirms the dominant role of internationalisation variables across model setups. Financial indicators, while generally less significant NEM entry predictors on their own, become more relevant when combined with other variables.

By examining firm-level indicators that determine new market entry, this research provides insights for policymakers and firms. For example, government grant providers responsible for selecting firms for financial support can apply these models to identify firms most likely to achieve long-term and significant export activity. This ensures a more effective allocation of public funding toward high-potential exporters. From the business perspective, this research shows that a temporary drop in financial performance, especially when combined with limited growth opportunities in current markets, can be an early sign of upcoming international expansion. Recognising and responding to this signal in time may help firms adjust their strategy and improve their financial position before it worsens.

The rest of the thesis is structured as follows. The literature review is conducted in

Section 1, which consists of the results of studies on prior internationalisation and financial performance as determinants of new export market entry. The data, variables and methods are described in Section 2. The results and discussion are presented in Section 3. The last section concludes, including research limitations, from which future research directions partly emerge.

1. Literature review

1.1. Results of studies on prior internationalisation performance as a determinant of new export market entry

Prior internationalisation performance is widely recognised as an important determinant of a firm's expansion into new markets. This section reviews studies that examine how past export activities, defined through scope (number of markets served), scale (export revenue), and intensity (share of export revenue in total sales), relate to the NEM entry. These indicators reflect the experience and knowledge firms gain through earlier international activity, especially within gradual expansion (Boehe et al., 2016).

One of the most influential frameworks for understanding this expansion is the Uppsala Model presented by Johanson and Vahlne (1977, 1990), which describes internationalisation as a gradual process, where firms incrementally increase their foreign market engagement, starting from a neighbouring country, based on accumulated knowledge and reduced uncertainty. An extensive amount of empirical evidence exists for supporting the Uppsala Model, especially its evolution and the importance of gaining experience in internationalisation processes (Coviello et al., 2017; Sandberg, 2013; Vahlne & Johanson, 2017). However, critics argue that the model heavily relies on the assumption of homogeneous learning, overlooking internal differences within the company. Also, it underestimates the role of external networks and learning from competitors' experience (Forsgren, 2002). This critique highlights the need for a more comprehensive and flexible approach to understanding the drivers of successful internationalisation.

Because of the small size of Estonia's domestic market, firms naturally pursue a gradual internationalisation process, starting with lower-risk nearby European markets before expanding into more distant and complex environments. This staged approach is particularly important for firms from small, open economies like Estonia, where access to foreign markets is essential not only for companies' growth but also for achieving economies of scale, upgrading technologies, and improving productivity (Benkovskis et al., 2020). It supports the broader narrative that internationalisation acts as a driver of capability development in highly

trade-dependent economies.

This research focuses on Estonian firms that already export to the European market and are considering expanding beyond the home continent. Firms that follow the Uppsala model pattern when entering markets outside their home continent often outperform others in export activity, particularly in terms of the export scope (Johanson and Vahlne, 1977, 1990). However, the relationship between gradual expansion and other indicators like export intensity and scale is less straightforward, as they can be highly volatile due to unforeseen reasons, like halting of international orders (Majocchi et al., 2005).

Moreover, export scope, intensity, and scale are not only outcomes of internationalisation but also demonstrate a firm's commitment to international activities and act as proxies of the accumulated international knowledge (Boehe et al., 2016). This knowledge, gained through prior experience, can facilitate further expansion into unfamiliar markets. Prior international experience plays a crucial role, but varies depending on strategic priorities. It can reduce entry risks through knowledge accumulation, whether from a firm's own historical patterns or insights gained from competitors' market presence (Boehe & Becerra, 2022; Casillas et al., 2012). In addition, the exporting experience lowers entry costs (Alvarez et al., 2013), improving the ability to enter new markets. This points to the idea that while experience is necessary, its value depends on what the firm aims for – risk reduction through knowledge accumulation or achieving cost efficiency in expansion. Firms with broader prior international experience and a larger number of served destinations are generally better positioned to expand further (Bernard et al., 2007; Fabling & Sanderson, 2013). Nonetheless, firms are more likely to increase their market presence until a certain level, but after that point, the likelihood of further expansion tends to decline (Brouthers et al., 2009; Love et al., 2016). It emphasises that focusing on a limited number of markets can enable firms to develop targeted expertise, build stronger distribution networks, and manage export activities more effectively.

Firm-specific characteristics also influence export performance. Larger firms naturally achieve higher export scales and can aggregate more resources for future expansion (Hitt, Bierman, et al., 2006; Powell, 2014; Sinani & Hobdari, 2008; Zhao & Hsu, 2007), but the firm size does not consistently predict export intensity (Bonaccorsi, 1992). Therefore, export intensity might depend on whether the company is also active in its home market.

Firms with growing export revenues are more likely to sustain expansion, as their capacity allows them to manage the costs and complexities of entering new markets (Fabling & Sanderson, 2013). However, evidence suggests that the marginal benefits tend to diminish

at high levels of export intensity, which may reduce the motivation to enter additional markets (Fryges & Wagner, 2010) – concluding that these internationalisation variables also carry a dual interpretation. On the one side, they reflect export capability and learning. On the other, they may signal that the firm has reached a market capacity limit or an aspirational target, as suggested by the behavioural theory of the firm, where companies adjust their behaviour once performance meets internal goals.

Furthermore, institutional factors significantly impact export enlargement, as explored by Manolopoulos et al. (2018), who argued that the negative home-country institutional context particularly shapes firms' export decisions. Thus, it can be derived that a weak and corrupt institutional environment, for instance, often prompts firms to allocate their resources toward the international market rather than keep them in the country. However, evidence from Estonian firms suggests a different dynamic. Despite Estonia's developed institutional framework, many companies still prioritise exports as a proactive competitive strategy (Benkovskis et al., 2020). This suggests that while weak institutions may serve as push factors for exporting, firms in well-functioning economies can also engage in export-driven growth based on innovation, scalability, and access to global markets (Masso & Vahter, 2015).

1.2. Results of studies of financial performance as a determinant of new export market entry

For Estonian exporters, global expansion presents an opportunity to utilise production capacity more comprehensively and remain competitive. However, entering distant markets beyond Europe might require substantial sunk costs, operational risk management, and capital-intensive investments. Therefore, a firm's ability to allocate financial and operational resources is crucial in determining whether it can undertake such a move.

The general assumption is that financially constrained firms with high debt levels often face difficulties securing capital for export expansion due to costly debt obligations, lack of collateral, and lender risk aversion (Görg & Spaliara, 2014; Manova, 2013; Minetti & Zhu, 2011). In addition, firms with higher liquidity are generally better positioned to finance the market expansion (Forlani, 2010), as it provides access to financial resources and helps to manage the costs of internationalisation (Bellone et al., 2010; Chaney, 2016; Chen & Guariglia, 2013). As long-term financial stability affects the willingness to take risks, financially constrained firms may perceive exporting as a burden rather than a growth opportunity.

However, indicators such as solvency and liquidity tend to be similarly and

consistently high among established exporters. Chen and Guariglia (2013) and Greenaway et al. (2007) emphasise that the financial health of continuous exporters is a result of export activity and not a driver. Moreover, Bernard and Bradford (1999), Bernard et al. (2007), and Stiebale (2011) claim that financial variables are not strong causal predictors of new market entry and define positive productivity dynamics before the new market entry as the most valuable indicator.

In parallel, the Melitz model of firm heterogeneity in trade (Melitz, 2003) explains the impact of productivity on the firm's decision to stay in the new market. Only a highly productive fraction of the firms can cover sunk costs to enter the foreign market. This self-selection mechanism into exporting leads to a reallocation of resources towards more productive firms (Hallak & Sivadasan, 2013; Melitz, 2003; Wagner, 2007), which empowers higher aggregated production and welfare. Additionally, building on the Melitz model, trade liberalisation amplifies more effective resource reallocation across (Melitz, 2003; Santos-Paulino & Thirlwall, 2004) and within industries (Bernard et al., 2007) by lowering trade costs, allowing more firms to export, intensifying competition and increasing goods quality (Fan et al., 2015), further driving less productive firms out of the market.

Productivity, when measured as sales-to-total assets, intersects with financial health. Firms that generate more sales from their existing assets are more likely to accumulate internal resources, thereby, ceteris paribus, improving liquidity and, over time, solvency. Also, profitability, measured by net income-to-total assets, can be defined as the delta of solvency when a firm's debt remains constant and equity is not reduced by dividend payouts. So, an increase in equity through retained net income improves solvency (Abdul Rahman, 2017). However, the existing literature highlights a limited effect of profitability on export expansion. Both Fryges and Wagner (2010) and Powell (2014) find only moderate support for the idea that more profitable firms are more likely to export, instead identifying an inverse U-shaped relationship where only moderately profitable firms are most willing to expand abroad. Those with very high financial performance could be quite well off with their status quo and do not want to make additional market expansion moves (Kotiloglu et al., 2021; Lin, 2014).

The resource-based view (RBV) provides an alternative perspective and highlights the critical role of firm-specific resources and capabilities in driving competitive advantage in the foreign market. This view strongly contradicts the concept of financial constraints described above. RBV suggests that poor financial performance caused by a shrinking existing market, decreased demand, and failed competition may lead firms to enter a new market for: 1) acquiring versatile resources to enhance the potential growth to compete with challenges

within existing markets where the firm is already active (Hessels & Parker, 2013; Hitt, Tihanyi, et al., 2006; Nason & Wiklund, 2018); 2) alternative leverage of existing resources (Arbelo et al., 2024; Helfat & Eisenhardt, 2004; Matsusaka, 2001; Ruzo et al., 2011). In this respect, a next phenomenon could occur, for instance, because of negative dynamics of financial performance or even worse performance than comparable peers, entrants may pursue a non-European market as a strategy to regain growth and get back on track. Moreover, previous research suggests that firms preparing for export often invest heavily in developing internal capabilities, which can lead to short-term financial constraints during the preparation phase (Forlani, 2010; Gerschewski et al., 2020). These upfront commitments are viewed as part of building export readiness. Therefore, financial ratios alone may not be decisive indicators in determining further expansion, as their interpretation depends on a broader understanding of the firm's strategic context and surrounding environment. In the literature, financial health is commonly captured through liquidity and solvency indicators, typically measured at a fixed point in time. While these static measures may be helpful, they fail to reflect evolving financial conditions. To address this issue, the present study includes deltas – changes in liquidity and solvency – to account for financial dynamics.

Further, market expansion can be defined by a firm's ability to assess and allocate resources effectively. Such activity has been outlined in the behavioural theory of the firm, which highlights that performance relative to aspiration levels (planned and established performance results) plays a key role in shaping internationalisation decisions (Ref & Shapira, 2017). This framework explains that firms that stay close to their aspiration level are less likely to export since their performance is meeting their expectations. Conversely, moderate underperformers look for new strategies (Manzaneque et al., 2020; Schimmer & Brauer, 2012), and therefore, are likely to take a risk and enter new markets to improve financial results (Ref & Shapira, 2017). Likewise, moderate overperformers may expand to allocate surplus resources. However, the studies offer mixed evidence on whether firms exceeding their aspiration levels take a proactive approach, as some indicate they tend to maintain contentment with current strategies and show reduced motivation to alter existing operations (Kotiloglu et al., 2021; Lin, 2014).

1.3 Examples of earlier empirical studies and summary of the literature review

Building on the theoretical foundations explained in the previous subsections, it is crucial to examine how these ideas have been applied and tested in earlier empirical research. This provides context for the variables used in the present study and helps to identify common

findings and controversy in the literature. Table 1 presents selected empirical studies that support the key variables discussed in subsections 1.1 and 1.2. It summarises important assumptions and findings on the determinants of new market entry, focusing on the direction and significance of observed effects. These examples help to synthesise the theoretical discussion and provide a foundation for the empirical modelling in this study.

Table 1
Results of earlier studies concerning proxies of internationalisation and financial performance as determinants of new export market entry.

Domain	Proxies used	Theoretical explanation	Examples of empirical studies	Found effect in studies
Profitability	Profit-per-partner, profit margin	Moderate profitability encourages expansion, but too high or too low profitability discourages new market entry	Germany (Fryges & Wagner, 2010), USA and China (Powell, 2014)	Positive but limited
	Net income to assets, net income to equity, their Δ	Gaining short-term losses pushes to export	USA (Ref & Shapira, 2017), Spain (Arbelo et al., 2024; Ruzo et al., 2011)	Mixed
Solvency	Solvency, leverage ratios	Higher solvency and lower leverage incentivise exporting	107 countries (Manova, 2013), UK and France (Görg & Spaliara, 2014), Italy (Minetti & Zhu, 2011)	Positive
Productivity	Labour productivity, total factor productivity, assets' productivity	The most productive firms can cover the sunk costs associated with exporting	UK (Ganotakis & Love, 2012; Greenaway et al., 2007), USA (Bernard & Bradford, 1999; Bernard et al., 2007), China (Pan et al., 1999), collection of existing studies about 34 countries (Wagner, 2007)	Positive

Continued on next page

Domain	Proxies used	Theoretical explanation	Examples of empirical studies	Found effect in studies
Liquidity	Liquidity ratio, cash stock	Higher liquidity supports export expansion	France (Bellone et al., 2010), Italy (Forlani, 2010)	Positive
Export Intensity	Share of export revenue in total sales	Drives firm expansion, but the effect weakens once a high level is reached	Germany (Fryges & Wagner, 2010), Brazil (Boehe et al., 2016)	Positive but limited
Export Scale	Export revenue, ∆export revenue	Firms which are growing their export revenue are more likely to enter new market	New Zealand (Fabling & Sanderson, 2013)	Positive
Market Scope	Number of markets	Firms with more served destinations are better positioned to expand, but the effect weakens when many markets are already covered	UK (Love et al., 2016), Greece and Caribbean countries (Brouthers et al., 2009), Brazil (Boehe et al., 2016)	Positive but limited
Firm Size	Total sales, total assets, number of partners, number of employees	Larger firms generate more resources for the future expansion	Taiwan and China (Zhao & Hsu, 2007), USA and China (Powell, 2014), USA (Hitt, Bierman, et al., 2006), Estonia (Sinani & Hobdari, 2008)	Positive

Source: compiled by the author.

In conclusion to the literature review, existing research presents two dominant perspectives on the determinants of export market entry. One part of the studies focuses on financial ratios as the primary determinant of export market entry, suggesting that firms with good financial performance are more likely to expand internationally and that poor financial health is seen as a barrier to covering the sunk costs of entering foreign markets. Another stream of literature highlights firm's prior export-related experience as stronger predictors, suggesting that financial ratios play a secondary or indirect role. This contradiction remains

unresolved, particularly in the context of small open economies like Estonia, where access to external markets is crucial for sustained growth.

The extensive amount of literature covers initial internationalisation strategies, but infrequently considers further international expansion of already exporting firms. Furthermore, to the author's knowledge, most available research concentrates on identifying significant relationships, often isolating either early internationalisation or financial performance, instead of exploring the predictive value of variables that integrate both aspects. Therefore, the literature gap exists regarding creating predictive models that combine financial and internationalisation variables to define which variables hold more predictive power and, based on them, forecast which established exporters will enter NEM. Thus, this study addresses this gap by focusing on the capabilities of Estonian exporters and evaluating the likelihood of their entry into NEM. It contributes to the literature by identifying the best predictive indicators and developing forecasting models that better capture patterns of future internationalisation.

2. Study design

2.1. Data and variables

The data[1] for this research originates from the Estonian Business Registry, covering the period from 2010 to 2022, including annual financial reports and export revenue categorised by geographic regions. A five-year observation window defines the event of NEM entry at time T: T−2, T−1, T, T+1, and T+2. The two years before entry (T−2 and T−1) are used to confirm that the firm had no prior exports outside Europe, ensuring that any activity in T represents a genuine new entry. At time T, the sample splits into two groups: firms that start exporting beyond Europe (entrants) and those that continue exporting but do not expand beyond Europe (non-entrants). Pools of entrants and non-entrants are composed of unique firms. However, a firm can appear more than once in one pool, e.g., entrants can appear up to three times[2], while non-entrants up to five[3].

For entrants, the two years following the entry (T+1 and T+2) are analysed to assess

[1]The author gratefully acknowledges the help she received from Oliver Lukason, Associate Professor of International Business and Finance, who prepared the initial dataset and provided valuable guidance for utilising the data.

[2]For the studied 13 years, this is the maximum number of outside-Europe entrances a firm can make, taken it leaves that market after one year and does not make the entrance during two following years.

[3]For the studied 13 years, this is the maximum number of only European five-year sequences for a firm, taking that T is shifted forward with a two-year step.

the stability and significance of their market presence. This time frame captures whether the expansion is sustained or temporary. In contrast, non-entrants maintain zero non-European export values throughout the whole five-year period. To ensure comparability, all firms in the sample must be constant exporters throughout the five years, not deinternationalisers.

Using only one year before and after entry may not capture fluctuations adequately due to the low frequency of financial reporting and potential delays in revenue or resource allocation, which could impact financial statements. Conversely, analysing a very long period is also not ideal, as international trade is highly sensitive to business cycle fluctuations and economic distortions. Extending the time frame too far may introduce external shocks that obscure the true effects of market entry.

Firms that didn't disclose the export appendix during the five-year sequence were excluded from the dataset. Also, firms exporting outside Europe in either 2010 or 2011 were excluded, as these are earlier entrants according to the definition outlined above. Therefore, aside from the intentional choices, like focusing on constant exporters, the reduction in the dataset due to missing information happened randomly and without any systematic bias.

The dataset is structured at the firm-year level, with variables capturing yearly observations. It covers a range of variables described in the Table 2, including firm size, export performance indicators, and key financial ratios. Each observation captures firm-specific characteristics at the relevant time point. It also includes year-on-year changes (deltas, marked with "D", e.g., DSALES) for each indicator to capture growth dynamics, calculated as value from T–1 minus value from T–2.

Export revenue, total sales, total assets, and their deltas were transformed with natural logarithms to manage scale differences. Financial ratios were winsorised using the 1st and 99th percentiles to mitigate the impact of extreme values. More specifically, since the minimum is 0 for STA, it was winsorised only on the upper end. For TETA and WCTA, the maximum is 1, so they were smoothed only on the lower end. NITA and deltas of all financial ratios were winsorised on both ends since they have no strict upper or lower limits.

Furthermore, five dependent variables are constructed to capture different forms of export market entry. These include ENTRY, ESTAB, and ESTAB10, representing the increasingly stricter definition of market entry: from basic entry to stable and stable with significant export intensity, respectively. However, the original variable structure does not account for overlap across entry types. For instance, firms classified under ESTAB10 are also included in ESTAB and ENTRY. This overlap can obscure the actual behaviour of predictors, as it becomes unclear whether results reflect general or specific types of entry. To address this,

two filtered, mutually exclusive variables are introduced. ENTRYun excludes all cases that also satisfy the criteria for ESTAB, while ESTABun excludes cases that meet the ESTAB10 definition.

Table 2
Description of variables

Variable	Description	Performance domain
	Dependent variables	
ENTRY	Base dependent: 1 if a firm enters a NEM at T, 0 – not-NEM. The company remained exporting in T+1 and T+2, but not necessarily outside Europe	All entrants to non-European markets (NEM)
ESTAB	Stability dependent: 1 – if the firm stayed outside Europe for T, T+1 and T+2; 0 – didn't enter NEM	All entrants remaining functional at NEM
ESTAB10	Stability and significance dependent: stability + at least 10% of export revenue from NEM in T, T+1, and T+2; 0 – didn't enter NEM	All entrants remaining functional with significant intensity at NEM for three consecutive years
ENTRYun	1 – firm entered NEM in T, but does not stay there for both T+1 and T+2; 0 – didn't enter NEM	Only unique entrants not remaining functional at NEM
ESTABun	1 – firm entered NEM for three consecutive years, but not all of them have at least 10% of export revenue; 0 – didn't enter NEM	Only unique entrants remaining functional at NEM for three consecutive years, but without significant intensity for all of them
	Independent variables	
EXPORT	Natural logarithm of export revenue	Export scale
ESHARE	Export share in total revenue	Export intensity
EMARKET	Number of export markets, all European, excluding domestic	Export scope
WCTA	(Current assets - Current liabilities) / Total assets	Liquidity
TETA	Total equity / Total assets	Solvency
NITA	Net income / Total assets	Profitability
STA	Total sales / Total assets	Productivity
SALES	Natural logarithm of total sales	Firm size
ASSETS	Natural logarithm of total assets	Firm size

Note: t1 and t2 indicate values at periods T-1 and T-2 respectively in the further tables.
Source: compiled by the author.

This approach ensures that each group represents a distinct entry type without contamination from more committed exporters. The need to distinguish between these types is supported by prior evidence that many Estonian exporters exhibit only short-lived or sporadic international activity, while sustained or significant engagement has been relatively rare (Vissak & Masso, 2015).

In addition, the Table 3 shows the number of observations for each dependent variable group. The number of non-entrants remains constant throughout all dependents. This table helps to clarify the structure of the analysis by showing that the entry types are distinct and well-represented.

Table 3
Number of observations for dependent variables including non-entrants and 5 types of entry

Variables	**Entry types**					**Non-entrants**
	ENTRY	ESTAB	ESTAB10	ENTRYun	ESTABun	
Observations	1,208	402	134	797	277	19,732

Source: compiled by the author.

By distinguishing five dependent variables, the analysis can isolate the effect of predictors for each type of export behaviour and directly compare how firm characteristics vary across different types of entries. This adjustment enables a dual analytical approach. First, it allows an incremental comparison: examining how the behaviour of predictors changes as the definition of entry becomes stricter. Second, it supports a holistic view by testing predictor performance across clearly distinct entry types, revealing which firm characteristics are most informative in forecasting different patterns of export market engagement.

2.2. Methods

Methods[4] in this research were designed to define new export market entry determinants from financial and internationalisation variables and, based on them, predict which Estonian exporters can expand into non-European markets.

As the first stage, descriptive statistics were used to examine the distribution and general patterns of financial and internationalisation variables. Summary tables and kernel

[4]The artificial neural network models were developed using Python, whereas descriptive statistics, logistic regressions and exploratory factor analysis were carried out in R.

density plots were employed to compare firms that entered NEM with those that continued exporting only within Europe. This helped identify early differences and similarities between the two groups.

During the second stage, a series of univariate logistic regressions with robust standard errors were conducted to capture the behaviour and significance of each predictor. The Breusch-Pagan test (p-value $< 2.2 \times 10^{-16}$) indicated the presence of heteroskedasticity, justifying the use of robust standard errors. Each regression included only one independent variable at a time, as the simultaneous inclusion of multiple predictors led to distorted results due to multicollinearity – the variance inflation factors are presented in Appendix A. Accordingly, each model was estimated separately for the five dependent variables: ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun.

In the third stage, an exploratory factor analysis (EFA) was conducted to extend the univariate analysis to a multivariate framework. It addressed multicollinearity issues and helped to uncover latent structures within the dataset. The factors are latent constructs derived from multiple observed variables with common patterns or correlations. Unlike individual variables, which represent specific measured attributes, factors summarise and reduce data complexity by capturing the common variance among related variables, making them suitable for inclusion in models because of the absence of multicollinearity. Therefore, the EFA was performed using the minimum residual extraction method with varimax rotation. The analysis was applied separately to two groups of variables: financial and internationalisation. The identified factors and the variables loading on them are summarised in Table 4.

Table 4
Identified factors, variables mainly loading them and cumulative variance explained (CVE)

Factor	Variables	CVE
Export_F1	EXPORTt1, EXPORTt2, ESHAREt1, ESHAREt2	76%
Export_F2	EMARKETSt1, EMARKETSt2	
Finance_F1	WCTAt1, WCTAt2, TETAt1, TETAt2, NITAt2	72%
Finance_F2	STAt1, STAt2	
Finance_F3	NITAt1	

Note: Factors derived from internationalisation variables are named Export factors for simplicity.
Source: compiled by the author.

Based on the Kaiser criterion, which suggests retaining factors with eigenvalues greater than 1, two factors were extracted from the internationalisation variables, together

explaining approximately 76% of the cumulative variance. Similarly, the factor analysis of financial indicators identified three interpretable factors, accounting for 72% of the cumulative variance among the financial ratios. The detailed rotated factor matrices for both financial and internationalisation variables are provided in Appendix B.

As a result, the extracted factors were used in the multivariate logistic regressions for five individual dependent variables. Such multivariate analysis provides a general understanding of whether internationalisation or financial variables are more beneficial in predicting the relevant phenomenon of NEM entry.

The last fourth stage involved building prediction models using machine learning methods. Artificial neural network (ANN) models were used in this study because they are widely recognised as effective tools for prediction tasks, especially compared to traditional statistical methods like logistic regression. Unlike regression, ANN models can capture complex, non-linear relationships and interactions between variables. This makes them well-suited for identifying key predictors and forecasting different types of new export market entry with higher accuracy.

A series of models was conducted separately using five dependent variables (ENTRY, ESTAB, ESTAB10, ESTABun, and ENTRYun) to evaluate the predictive performance of ANN models. The independent variables for the models were grouped into four categories corresponding to time periods, yielding a total of 20 models: 1) T-1 period – using only independent variables from the prior year; 2) T-2 period – using independent variables from the second prior year; 3) Δ – only deltas of independent variables; 4) T-1+T-2+Δ – all independent variables from both periods along with computed deltas.

To overcome the class imbalance visible in Table 3 earlier, the synthetic minority oversampling technique (SMOTE) was applied before training process to balance class distribution and reduce bias in model predictions. SMOTE increases the number of minority class instances using a k-nearest neighbours approach to generate synthetic observations. This method is preferred over majority underrepresentation, as eliminating observations from the majority class could risk the loss of valuable information critical to the model and the biased choice of deleted observations.

Data was randomly divided into two separate samples with an 80 to 20 ratio for isolating test samples from data used to train the neural network. The ANN models architecture consisted of the input layer, a normalisation layer, two hidden layers, and an output layer. The input layer has varying neurons depending on the number of independent variables. The normalisation layer performs data normalisation with a mean of 0 and a

standard deviation of 1. Normalisation is essential because it ensures all input independent variables are converted to a similar scale, stabilising the training process. It should be noted that the data normalisation process does not affect the data itself and is purely a computational operation performed by a neural network. Two hidden layers with decreasing sizes (40-32 neurons) were all activated using the hyperbolic tangent (tanh) function. The output layer used a sigmoid activation to handle multi-class predictions.

Performance metrics included accuracy and the area under the ROC curve (AUC), which were evaluated on a test sample. Furthermore, SHAP (SHapley Additive exPlanations) analysis (Lundberg & Lee, 2017) was conducted on a test sample to interpret the contribution of individual independent variables to model predictions, using SHAP beeswarm plot. There, the independent variables are listed on the vertical axis in order of importance in the model outcome from top to bottom. The horizontal axis represents the SHAP value, the direction and magnitude of their impact on the model's output, which indicates the degree of change in log odds. Coloured dots represent individual data points, indicating whether the independent variable value is low (blue) or high (red). Each point represents a row of data from the original test dataset. Overall, SHAP plots offer an intuitive and detailed view of the inner workings of complex models.

3. Results and discussion

3.1 Descriptive statistics

Before the econometric analysis, it's helpful to get a basic overview of the sample. This section looks at some key firm characteristics to highlight general trends in firm size, export behaviour, and financial performance and spot any early differences between firms exporting only to Europe and those that expand to non-European markets. Since all companies in the sample are exporters, they experience strong performance results, as reflected in Table 5 in the relatively similar export metrics and financial ratios.

However, firms that entered non-European markets show a clear distinction in scale-related metrics. Their broader international presence is associated with notably higher averages in a number of markets, export revenue, total sales, and total assets. This confirms the idea that larger firms (Hitt, Bierman, et al., 2006; Powell, 2014; Sinani & Hobdari, 2008; Zhao & Hsu, 2007) and with broader prior international experience (Bernard et al., 2007; Fabling & Sanderson, 2013) are typically better equipped to pursue further market expansion.

Table 5
Descriptive statistics: entrants (ENTRY=1) vs non-entrants (ENTRY=0)

Variables	Entrants			Non-entrants		
	Mean	Median	SD	Mean	Median	SD
Internationalisation variables for T-1, T-2, and their deltas						
EXPORTt1	11.861	11.970	2.378	11.226	11.367	2.158
ESHAREt1	0.473	0.408	0.381	0.494	0.444	0.401
EMARKETSt1	3.839	3	3.022	1.959	1	1.545
EXPORTt2	11.712	11.762	2.368	11.094	11.236	2.194
ESHAREt2	0.475	0.421	0.385	0.488	0.432	0.401
EMARKETSt2	3.544	3	2.800	1.925	1	1.517
DEXPORT	2.221	8.837	10.843	1.456	7.559	10.133
DESHARE	−0.002	0.000	0.153	0.005	0.000	0.146
DEMARKET	0.295	0	1.737	0.033	0	0.848
Financial ratios for T-1, T-2, and their deltas						
WCTAt1	0.371	0.384	0.352	0.367	0.377	0.368
TETAt1	0.561	0.599	0.308	0.595	0.645	0.298
NITAt1	0.095	0.074	0.227	0.097	0.073	0.239
STAt1	2.251	1.705	2.044	2.289	1.771	1.980
WCTAt2	0.373	0.376	0.359	0.356	0.368	0.374
TETAt2	0.554	0.596	0.310	0.581	0.628	0.304
NITAt2	0.117	0.083	0.266	0.106	0.076	0.259
STAt2	2.298	1.725	2.122	2.329	1.771	2.057
DWCTA	−0.002	0.008	0.200	0.010	0.013	0.210
DTETA	0.008	0.004	0.168	0.013	0.009	0.167
DNITA	−0.022	−0.009	0.284	−0.010	−0.004	0.300
DSTA	−0.052	−0.010	1.305	−0.035	−0.009	1.181
Size variables for T-1, T-2, and their deltas						
SALESt1	13.336	13.373	1.929	12.795	12.775	1.693
ASSETSt1	12.939	13.024	1.816	12.350	12.324	1.683
SALESt2	13.206	13.294	1.893	12.699	12.684	1.709
ASSETSt2	12.782	12.853	1.858	12.236	12.212	1.718
DSALES	3.378	10.401	11.325	2.732	9.540	10.738
DASSETS	3.971	10.009	10.327	2.930	9.092	10.038

Note: N = 1,208 (entrants), N = 19,732 (non-entrants).
Source: compiled by the author.

Next, deltas of variables capture growth dynamics in firm performance, meaning the year-on-year changes of each indicator. These deltas in Table 5 reveal differences between NEM entrants and non-entrants. Entrants exhibit larger average positive changes in export indicators, particularly in export revenue and number of markets, along with higher positive

dynamics of firm size measurements through total sales and assets.

In contrast, financial ratio changes show relatively smaller or even negative shifts for NEM entrants, suggesting short-term deterioration in financial health. These findings align with two perspectives discussed in the literature. First, the behavioural theory of the firm suggests that firms experiencing moderate underperformance may seek new strategies, including market expansion, to improve results (Manzaneque et al., 2020; Ref & Shapira, 2017; Schimmer & Brauer, 2012). Second, the resource-based view explains this behaviour as a strategic reallocation of internal resources to pursue more profitable opportunities (Arbelo et al., 2024; Helfat & Eisenhardt, 2004; Matsusaka, 2001; Ruzo et al., 2011).

Alternatively, firms with extensive European market experience may exhibit short-term financial decline not because of underperformance but due to sunk costs and investment efforts linked to earlier stages of expansion. This might reflect a longer-term strategy to build resource capabilities to support future growth and strengthen competitiveness in markets firms already serve (Hessels & Parker, 2013; Hitt, Tihanyi, et al., 2006; Nason & Wiklund, 2018).

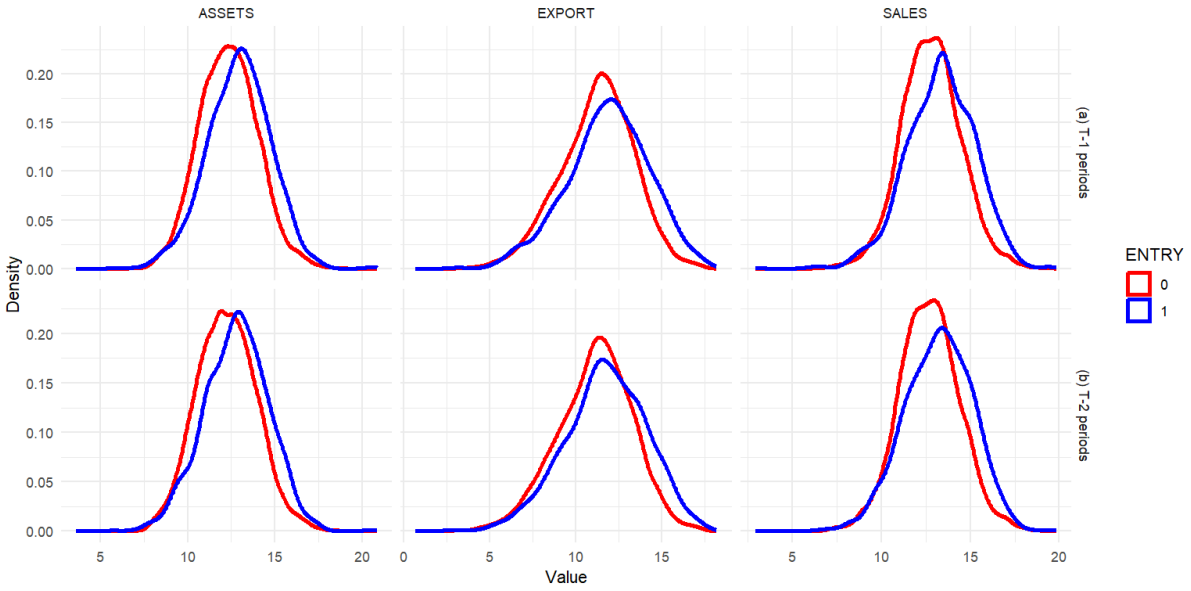


Figure 1. Kernel density estimation of total sales, total assets and export revenue for NEM entrants (1) and non-entrants (0) at T-1 and T-2.
Source: compiled by the author.

Figure 1 presents kernel density plots comparing firm-level total sales, assets, and export revenue distributions between entrants and non-entrants before the entry event at time T–1 and T-2. Across all three variables, the density functions for entrant firms are shifted to the right, relative to those of non-entrants. This indicates that firms entering non-European markets tend to have higher pre-entry sales, assets, and export revenue levels than those that

do not. A lower peak in the density curve for entrants indicates slightly more variability in the distribution of values. Entrants are more heterogeneous, mainly because their export revenues and total sales are more dispersed across firms. While plots illustrate differences in central tendency, variation in distribution shape is relatively minor and does not clearly suggest greater dispersion.

3.2. Univariate logistic regressions explaining the behaviour of variables

Table 6 presents the results of univariate logistic regressions with robust standard errors, estimated separately for five types of dependents of NEM entry: ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun. For most dependent variables, internationalisation variables such as the number of export markets, export revenue and export intensity show consistently positive and statistically significant associations with entry outcomes. Firms with growing export revenue are more likely to sustain expansion, as their capacity allows them to manage the costs and complexities of entering new markets (Fabling & Sanderson, 2013).

Although, the ENTRY and ENTRYun models reveal a negative relationship with prior export intensity. It suggests that firms experiencing recent increases in export intensity are less likely to engage in short-term or trial entries into NEM. This may indicate that such firms are focusing on consolidating gains or reaching their current export capacity limits, reducing the incentive to pursue additional, potentially less meaningful expansion (Fryges & Wagner, 2010). In contrast, export intensity is positively associated with ESTAB and ESTABun, reflecting that when firms do consider further international expansion, it is more often with the aim of establishing lasting market presence rather than testing new markets (Boehe et al., 2016).

Size-related indicators, such as total sales and total assets, are also significant and positively associated with the likelihood of entry. This result was predictable due to the earlier conclusion that larger firms statistically have more resource and are willing to aggregate them for future expansion (Hitt, Bierman, et al., 2006; Powell, 2014; Sinani & Hobdari, 2008; Zhao & Hsu, 2007).

Interestingly, for the strictest definition, ESTAB10, which requires all entrants to be functional with significant intensity at NEM for three consecutive years, none of the financial or size-related variables remains significant. Only the variables reflecting the number of markets, their dynamics, and the liquidity delta (with borderline significance) are statistically significant. It aligns with Bernard et al. (2007) and Fabling and Sanderson (2013), who claimed that firms with prior international experience and a larger number of served

destinations are better equipped to sustain operations abroad.

Table 6
Univariate logistic regressions with robust standard errors for ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun as dependent variables and individual independent variables

Variable	ENTRY	ESTAB	ESTAB10	ENTRYun	ESTABun
Internationalisation variables for T-1, T-2, and their deltas					
EXPORTt1	0.139***	0.211***	-0.030	0.105***	0.341***
ESHAREt1	-0.128*	0.291**	-0.081	-0.347***	0.471***
EMARKETSt1	0.349***	0.322***	0.141***	0.334***	0.368***
EXPORTt2	0.131***	0.182***	-0.060	0.107***	0.313***
ESHAREt2	-0.084	0.322***	0.006	-0.296***	0.476***
EMARKETSt2	0.33***	0.295***	0.093***	0.325***	0.345***
DEXPORT	0.007**	0.015***	0.000	0.004	0.023***
DESHARE	-0.329	-0.243	-0.656	-0.374	-0.044
DEMARKET	0.263***	0.384***	0.272***	0.212***	0.428***
Size variables for T-1, T-2, and their deltas					
SALESt1	0.184***	0.190***	-0.069	0.183***	0.313***
ASSETSt1	0.202***	0.211***	0.006	0.198***	0.309***
SALESt2	0.17***	0.166***	-0.090	0.174***	0.287***
ASSETSt2	0.18***	0.177***	-0.022	0.183***	0.271***
DSALES	0.006*	0.006	-0.001	0.006	0.009
DASSETS	0.011***	0.014***	0.003	0.009**	0.02***
Financial ratios for T-1, T-2, and their deltas					
WCTAt1	0.036	0.073	-0.056	0.017	0.136
TETAt1	-0.365***	-0.365**	-0.288	-0.363***	-0.401**
NITAt1	-0.026	0.109	0.028	-0.094	0.148
STAt1	-0.010	-0.002	-0.004	-0.014	-0.001
WCTAt2	0.128	0.125	0.139	0.129	0.118
TETAt2	-0.29***	-0.33**	-0.154	-0.268**	-0.412**
NITAt2	0.169	0.103	-0.400	0.205	0.356
STAt2	-0.008	0.013	0.018	-0.019	0.011
DWCTA	-0.277**	-0.209	-0.624*	-0.311**	-0.003
DTETA	-0.183	-0.100	-0.334	-0.227	0.014
DNITA	-0.134	-0.062	0.283	-0.171	-0.231
DSTA	-0.012	-0.041	-0.039	0.002	-0.043
Observations	20,940	20,134	19,866	20,529	20,009

Note: Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: author's calculations.

Financial ratios, by contrast, show limited and inconsistent effects. However, solvency stands out with a significant negative relationship in several models, suggesting that firms

with weaker financial positions may be more motivated to seek new markets to cover declining performance or escape saturated conditions on the existing markets. This effect disappears in the strictest model (ESTAB10), likely because only firms with sufficient financial stability can sustain long-term, high-committed export activity.

Year-on-year changes in financial indicators (delta variables) also show weak or marginal significance. One notable exception is liquidity growth (DWCTA), which is negatively associated with the likelihood of entering NEM, particularly for less committed forms of entry (ENTRY and ENTRYun). This pattern is consistent with the behavioural theory of the firm, where firms in a comfortable financial position, without signs of market pressure, are less likely to disrupt the status quo (Kotiloglu et al., 2021; Lin, 2014). Conversely, recent declines in financial health, reflected in decreased solvency or liquidity, may act as triggers for expansion, as firms attempt to recover performance by reallocating resources or tapping new growth opportunities (Arbelo et al., 2024; Hessels & Parker, 2013; Hitt, Tihanyi, et al., 2006; Manzaneque et al., 2020; Ref & Shapira, 2017; Schimmer & Brauer, 2012). Alternatively, these findings may suggest that firms preparing for market expansion may experience a temporary financial constraints, potentially due to upfront resource commitments related to export preparation (Forlani, 2010; Gerschewski et al., 2020).

The results highlight that internationalisation and size variables, reflecting prior export experience and firm capacity, are stronger predictors of NEM entry, particularly under broader definitions. In contrast, financial variables show weaker and less consistent effects. For more sustained and significant forms of entry, financial characteristics may either play a minimal role or determine outcomes in ways that are not easily captured by simple univariate regressions, underscoring the need for a more complex approach.

3.3. Multivariate logistic regressions with financial and export factors

The univariate approach is extended into a multivariate framework to capture more complex relationships and account for correlations between variables. This next step uses factor-based logistic regression to assess the predictive power of internationalisation and financial variables regarding different types of NEM entry. Therefore, based on the extracted factors in Table 4, a correlation matrix was created to verify that the factors were sufficiently distinct and captured independent dimensions of the data.

Low correlations between factors (Table 7) support the validity of the factor structure and justify their inclusion as separate predictors in regression analysis. Thus, standardised factor scores were used as independent variables in multivariate logistic regression models

with robust standard errors. These models were estimated separately for each of the five dependent variables representing different types of export market entry outlined in the Table 2.

Table 7
Correlation matrix of finance and export factors

	Finance_F1	**Finance_F2**	**Finance_F3**	**Export_F1**	**Export_F2**
Finance_F1	1.000	-0.020	0.018	0.035	-0.082
Finance_F2	-0.020	1.000	0.005	0.092	0.019
Finance_F3	0.018	0.005	1.000	0.032	-0.030
Export_F1	0.035	0.092	0.032	1.000	0.001
Export_F2	-0.082	0.019	-0.030	0.001	1.000

Note: Factors derived from internationalisation variables are named Export factors for simplicity.
Source: author's calculations.

As shown in Table 8 across all five models, the most consistent and statistically significant predictor is Export Factor 2, which captures the number of export markets served, as defined in Table 4 and Appendix B.

Table 8
Logistic regressions with robust standard errors for ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun as dependent variables and factors as independent variables.

	ENTRY	**ESTAB**	**ESTAB10**	**ENTRYun**	**ESTABun**
Finance_F1	0.033	0.019	−0.004	0.038	0.024
Finance_F2	−0.013	0.015	0.034	−0.019	0.012
Finance_F3	0.026	0.056	0.028	0.010	0.072
Export_F1	0.043	0.244***	−0.073	−0.059	0.419***
Export_F2	0.645***	0.579***	0.185***	0.639***	0.680***
Constant	−2.993***	−4.071***	−5.000***	−3.407***	−4.621***
Observations	20,940	20,143	19,866	20,529	20,009
Log Likelihood	−4,225.468	−1,860.377	−800.809	−3,102.764	−1,285.934
Akaike Inf. Crit.	8,462.935	3,732.753	1,613.618	6,217.527	2,583.867

Note: *p<0.1; **p<0.05; ***p<0.01.
Source: author's calculations.

Coefficients of Export Factor 2 are positive and highly significant in all cases, suggesting that broader prior export scope is strongly associated with a higher probability of entering NEM (Bernard et al., 2007; Fabling & Sanderson, 2013). Export Factor 1, reflecting export revenue and intensity, is also positively associated with the probability of entry, but its

significance is more limited. It is statistically significant only for the ESTAB and ESTABun models, suggesting that export intensity and scale may play a more relevant role in stable market presence. In contrast, financial factors show limited explanatory power across all models. Although often considered important in firm internationalisation strategies, financial factors do not seem influential in entry decisions, at least when captured through aggregated factors. The aggregation could mask more nuanced financial conditions affecting internationalisation.

3.4. Predicting non-European market entry with artificial neural network models

The artificial neural network (ANN) models were employed to address the complexity of firm behaviour and the limitations of traditional econometric approaches. Because ANN models can capture non-linear, more complex patterns and interactions between variables, they are a good fit for studying NEM entry among constant Estonian exporters. Using ANN models in this thesis helps provide a deeper understanding of the indicators determining NEM entry and achieving higher prediction accuracy. Table 9 presents the performance of ANN models trained to predict five export entry types in NEM: ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun. The results demonstrate that models trained using only variables from the single time period or only deltas perform worse than combined models. Concerning the latter, combining all independent variables from Table 2 from all periods and deltas (T–1+T–2+Δ) yields the highest predictive performance across all dependents. It confirms that incorporating firm-level dynamic changes enhances the predictive power of the models.

Table 9
Results of artificial neural network models for ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun as dependent variables

Periods of variables	**ENTRY**		**ESTAB**		**ESTAB10**		**ENTRYun**		**ESTABun**	
	Acc.	AUC	Acc.	AUC	Acc.	AUC	Acc.	AUC	Acc.	AUC
T-1+T-2+Δ	0.80	0.88	0.86	0.93	0.91	0.95	0.82	0.91	0.90	0.94
T-1	0.72	0.81	0.77	0.86	0.86	0.92	0.74	0.83	0.83	0.91
T-2	0.70	0.77	0.75	0.83	0.83	0.90	0.72	0.80	0.81	0.89
Δ	0.63	0.69	0.71	0.80	0.82	0.90	0.66	0.72	0.79	0.87

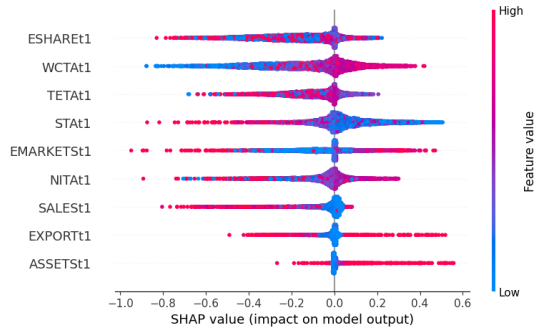
Notes: (a) Periods consist of the independent variables from Table 2 with respect to the point of time. *(b)* The synthetic majority under sampling provides similar results, and therefore, the oversampling is not biased. *(c)* Acc. means accuracy, AUC - area under ROC curve.
Source: author's calculations.

The ENTRY models achieve slightly lower performance than all others, which may reflect greater heterogeneity among all NEM entrants. However, it is important to acknowledge that not all firms classified as entrants under the broad ENTRY definition follow the same strategic trajectory. For example, some firms may engage in trial export activity without maintaining a long-term presence in the new market. Pragmatically, such firms may not differ significantly from non-entrants regarding capabilities or existing resources. This can add noise to the ENTRY group and partially explain the comparatively lower predictive performance of models using ENTRY as the dependent variable. Thus, this observation supports the rationale for examining stricter and mutually exclusive definitions of export entry. Notably, such models – ESTABun and ESTAB10 perform better, suggesting that ANN models are highly effective at capturing patterns in firm behaviour that predict stable or stable and significant export activity.

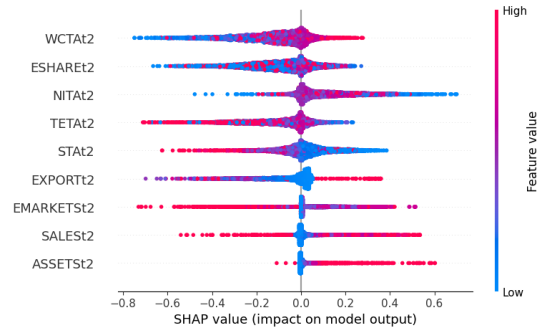
Figure 2 illustrates SHAP beeswarm plots that identify the most influential independent variables in predicting the ESTAB10 outcome. The ESTAB10 shows a sustained and significant entry by Estonian exporters into NEM for three consecutive years with a minimum of 10% export revenue from that market. Each subplot corresponds to a different model input configuration: Figure 2a includes only T-1 independent variables from the Table 2, Figure 2b – only T−2 values, Figure 2c – only deltas, and Figure 2d presents the combined model with T−1, T−2, and delta variables. The beeswarm plot is particularly effective for interpreting ANN models' outputs, as it simultaneously displays the magnitude and direction of each variable's impact on predictions. Variables are ordered by importance on the vertical axis. SHAP values on the horizontal axis indicate their impact on the log odds of a positive outcome (i.e., meeting the ESTAB10 criteria). Each point represents a test observation, with blue indicating low and red indicating high values of variables.

For example, in the model with all variables Figure 2d, the solvency (TETAt1) emerges as one of the most significant factors, where lower values (in blue) consistently push the model toward predicting sustained NEM entry. This finding aligns with the behavioural theory of the firm, which suggests that firms experiencing moderate underperformance relative to their aspiration levels are more likely to pursue strategic shifts such as market expansion (Manzaneque et al., 2020; Ref & Shapira, 2017; Schimmer & Brauer, 2012). It is also consistent with the RBV, which posits that firms may enter new markets to reallocate or better utilise internal resources in response to declining financial performance in their existing markets (Arbelo et al., 2024; Hessels & Parker, 2013; Hitt, Tihanyi, et al., 2006). In contrast, this pattern can demonstrate that firms preparing for sustained market expansion may

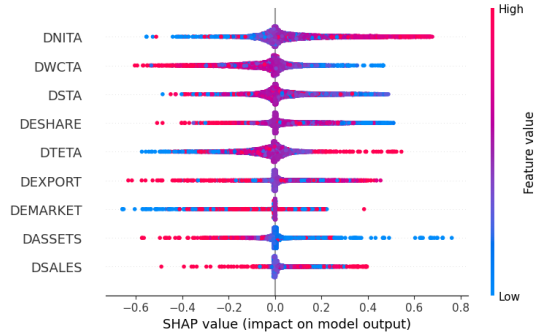
experience a temporary decline in financial health, potentially due to upfront resource investments (Forlani, 2010; Gerschewski et al., 2020).



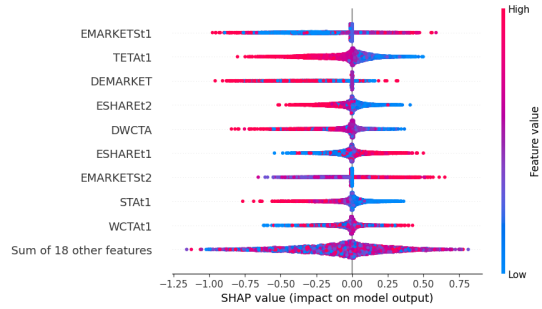
(a) T–1, accuracy 0.86, AUC 0.92



(b) T–2, accuracy 0.83, AUC 0.90



(c) Δ, accuracy 0.82, AUC 0.90



(d) T-1+T-2+Δ, accuracy 0.91, AUC 0.95

Figure 2. SHAP beeswarm plots for ESTAB10: variable importance and direction in T-1, T-2, Δ, and combined (T-1+T-2+Δ) models.
Source: compiled by the author.

The number of export markets (EMARKETSt1, EMARKETSt2) also plays a dominant role in predicting ESTAB10 in the model with all variables, as seen in Figure 2d. This reinforces earlier findings from univariate and multivariate analyses that prior internationalisation experience, particularly broader market scope, is the strongest and most consistent predictor of sustained and significant NEM engagement (Bernard et al., 2007; Fabling & Sanderson, 2013). Export intensity (ESHAREt1, ESHAREt2) appears among the most impactful variables in Figure 2, but the direction of its impact is mixed, highlighting complex interdependencies with other predictors. This contrasts with the univariate logistic regression results, where export intensity demonstrated a clear and more consistent directional effect.

The impact of firm size indicators (total sales and total assets) is less dominant than internationalisation variables. However, higher asset values (in red) tend to push the prediction toward a positive ESTAB10 outcome, as shown in Figure 2a and Figure 2b. This supports previous findings that larger firms, with greater capacity and resource availability, are

generally better positioned for sustained international expansion (Hitt, Tihanyi, et al., 2006; Sinani & Hobdari, 2008; Zhao & Hsu, 2007). Additionally, Figure 2c shows that negative asset changes are associated with a higher likelihood of sustained NEM entry, possibly indicating that firms made prior investments in preparation for expansion.

It is important to note that it is impossible to conclude that certain variables are entirely uninfluential. The importance of each predictor is highly contingent on the model setup and the presence of more dominant predictors, meaning their impact may be overshadowed or revealed depending on the interaction structure within the model. For instance, in the delta-only model (Figure 2c), profitability change (DNITA) strongly influences the outcome, with higher values (positive change) driving predictions toward ESTAB10. Similarly, lower values of productivity and export intensity changes (DSTA and DESHARE) also contribute significantly to the prediction. Yet, in the model with all variables (Figure 2d), these deltas are overshadowed by stronger predictors like export scope and solvency, reducing their relative influence.

Interestingly, financial indicators such as solvency, liquidity, and profitability, which showed weak or inconsistent effects in the univariate (Table 6) and multivariate regressions (Table 8), emerge as influential in the ANN models. This supports the idea that while financial metrics may not be individually strong predictors, their influence emerges in interaction with other variables in non-linear models. SHAP analysis thus reveals that independent variables overlooked in linear models gain explanatory power when embedded in neural network structures. It can also point to the existence of various types of firms, as, for instance, firms with a large number of European markets can vary by export scale or intensity, while their financial performance could also be different.

Overall, the SHAP plots offer a multidimensional perspective on variable importance. They confirm the dominant role of internationalisation variables, revealing that although less informative in isolation, financial indicators become more influential in complex, non-linear relationships. Regarding the ESTAB10 dependent variable, SHAP beeswarm plots help make ANN models more interpretable by showing how different firm-level characteristics influence the prediction of sustained and significant entry into non-European markets.

The use of multiple analytical approaches in this study offers a layered understanding of the predictors behind different types of NEM entry. Univariate logistic regressions (Table 6) show that internationalisation and size variables are strong individual predictors of export behaviour, while financial indicators are generally weaker. Multivariate models using derived factors (Table 8) address multicollinearity and confirm that export-related factors

remain the most influential.

However, when applying ANN models, the nature of variable influence shifts due to the model's ability to capture complex, non-linear relationships. In the case of the ESTAB10 dependent variable, the SHAP plots reveal that several financial indicators, such as solvency, liquidity, and profitability, become more impactful despite their limited role in the earlier regression models. This suggests that while these variables may not be strong predictors on their own, they gain importance when interacting with other firm characteristics in a more complex predictive environment.

This comparison across methods highlights how each analytical tool offers a different lens on the same data. Linear models help clarify baseline relationships and the relative strength of individual variables, while ANN models, interpreted through SHAP, reveal variables' conditional and often hidden importance in interaction. Together, these approaches confirm the central role of internationalisation variables while also uncovering the latent influence of financial metrics, demonstrating that firm-level predictors cannot be fully understood without considering the complexity of their interconnections.

Conclusion

This thesis explored which firm-level financial and internationalisation variables most accurately predict the entry of Estonian exporters into non-European markets (NEM). Building on several theoretical perspectives, including the Uppsala model, resource-based view and behavioural theory of the firm, the research utilises indicators of firms' prior internationalisation and financial performance.

The results consistently show that internationalisation variables such as export scale, intensity, and scope are the most significant determinants of NEM entry. Larger firms being already active exporters, especially those operating in multiple markets, are more likely to expand further. This idea supports the Uppsala model, which posits that firms accumulate knowledge from previous export experience, facilitating gradual internationalisation over time. In contrast, financial indicators played a less consistent role, likely because most exporters are in good financial health, which reduces differences across firms. Still, NEM entrants can be subject to certain financial constraints by means of lower solvency and liquidity. This finding aligns with the behavioural theory of the firm and the resource-based view, suggesting that firms may pursue international expansion as a response to underperformance or to reallocate internal resources more effectively.

Among all artificial neural network models, the ESTAB10 model achieved the highest prediction accuracy, indicating that stable and significant entry into the NEM market is more predictable than trial or short-term ones. These long-term entries are associated with stronger and more consistent patterns in firm-level characteristics. While models based solely on either the first or second time period performed slightly worse, using information from both periods together led to the highest overall accuracy and AUC, demonstrating the benefit of a longer-term view in predictive modelling.

This thesis combines traditional statistical methods with interpretable machine learning models and provides predictive insights and theoretical interpretation of market entry dynamics. A key novel contribution lies in integrating internationalisation and financial variables to predict non-European market entry by established exporters. Unlike prior research primarily focusing on initial export decisions or strategies, this study examined the export market entry of continuous exporters outside their home continent. The approach in this research provides an important distinction between different types of entry – trial, stable, and stable with significant export intensity – demonstrating that their predictors are not uniform.

Nevertheless, this study is subject to several limitations, caused mainly by the dataset design and the primary research purpose. One key limitation is the absence of information on what the exact product or service the firm offers, as this can have an impact on the internationalisation prospects and processes, and firms functioning in different industries can be subject to varying financial performance as well. Similarly, the lack of information on ownership structures, managerial characteristics, or their international experience limits understanding of certain internal firm-level drivers of internationalisation. Thus, future research could build on this work by incorporating more detailed firm-level data (e.g., sector and specifics of good or service offered, exact destination country or different aspects of corporate governance), or the role of external shocks, such as COVID-19 or tariff wars, could be analysed to assess how resilient different firm types are under export uncertainty.

Overall, this study underscores that internationalisation is likely not a random activity but a strategic process shaped mainly by a firm's past export performance, but also by certain financial characteristics. Understanding this process is essential for policymakers and business leaders who aim to support sustained global engagement.

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Appendices

Appendix A. VIF

Table 10
Variance inflation factors (VIF) for independent variables used in separate logistic regression models with ENTRY, ESTAB, ESTAB10, ENTRYun, and ESTABun as dependent variables

Variable	VIF
EXPORTt1	16.82
ESHAREt1	13.54
EMARKETSt1	4.53
SALESt1	38.84
ASSETSt1	51.04
EXPORTt2	15.70
ESHAREt2	13.40
EMARKETSt2	4.56
SALESt2	40.11
ASSETSt2	55.95
DEXPORT	2.31
DSALES	2.13
DASSETS	1.70
WCTAt1	92.48
TETAt1	62.88
NITAt1	20.52
STAt1	27.00
WCTAt2	94.60
TETAt2	65.01
NITAt2	24.28
STAt2	30.24
DWCTA	31.73
DTETA	19.48
DNITA	29.41
DSTA	10.52

The table excludes DESHARE and DEMARKETS because these variables are perfectly collinear, causing aliasing, as some coefficients are not uniquely estimable.

Appendix B. Rotated factor matrices

Table 11
Rotated factor matrix for internationalisation variables

	Factor 1	**Factor 2**
EXPORTt1	0.768	0.338
ESHAREt1	0.862	-0.213
EMARKETSt1	0.010	0.886
ESHAREt2	0.865	-0.212
EXPORTt2	0.772	0.337
EMARKETSt2	0.016	0.889

Table 12
Rotated factor matrix for financial variables

	Factor 1	**Factor 2**	**Factor 3**
WCTAt1	0.825	0.033	0.187
TETAt1	0.801	-0.218	0.207
NITAt1	0.156	0.014	0.990
STAt1	-0.098	0.884	-0.027
WCTAt2	0.878	0.033	-0.032
TETAt2	0.852	-0.221	-0.038
NITAt2	0.357	-0.011	0.198
STAt2	-0.056	0.884	0.033

Resümee

EESTI EKSPORTIVATE ETTEVÕTETE VÄLJASPOOL EUROOPAT ASUVATELE TURGUDELE SISENEMISE ENNUSTAMINE RAHVUSVAHELISTUMISE JA FINANTSMUUTUJATE ABIL

Anastasiia Yarmolenko

Käesoleva magistritöö eesmärk on välja selgitada kui täpselt suudavad finants- ja rahvusvahelistumise muutujad ennustada Eesti eksportivate ettevõtete sisenemist väljaspool Euroopat asuvatele turgudele (VEAT). Kasutades nii traditsioonilisi statistilisi meetodeid kui ka tehisnärvivõrkusid, annab magistritöö mitmekülgse ülevaate VEAT sisenemise prognoosimise võimalikkusest, tuues välja ka muutujate käitumise seosed varasemate teoreetiliste seisukohtadega. Olulised uuenduslikud aspektid magistritöös on nii finants- ja rahvusvahelistumise näitajate kombineerimine VEAT sisenemise prognoosimiseks kui ka eri tüüpi VEAT sisenemiste käsitlemine. Erinevalt varasematest uuringutest, mis keskenduvad peamiselt eksporttegevusega alustamisele, uurib käesolev magistritöö juba eksportivate ettevõtete turule sisenemist väljaspool kodumandrit. Analüüs tugineb mitmekülgsele teoreetilisele raamistikule, sealhulgas Uppsala rahvusvahelistumise mudelile, ressursipõhisele vaatele (resource-based view - RBV) ja ettevõtte käitumisteooriale (behavioural theory of the firm - BTOF). Ettevõtete andmed pärinevad Eesti Äriregistrist (2010–2022), sisaldades nii finantsandmeid kui ka eksporditulusid piirkonniti. Uuring eristab erinevat tüüpi VEAT sisenemisi: katsetavad (st turgudel ollakse ajutiselt), stabiilsed (st turgudele jäädakse püsivalt) ja märkimisväärse tuluga stabiilsed (st turgudele jäädakse püsivalt ja piisavalt suure osakaaluga ettevõtte müügitulust). Selline eristamine võimaldab saada tervikliku ülevaate, kas prognoositäpsused ning ennustavate muutujate roll sõltuvad sisenemise tüübist. Meetoditest on kasutusel kirjeldav statistika, ühe ja mitme muutujaga logistilised regressioonid, avastav faktoranalüüs ning tehisnärvivõrgud (ANN). Ühe muutujaga logistiliste regressioonide abil tuvastatakse muutujate olulisus, sest kõrge multikollineaarsus takistab nende samaaegset kasutamist. Mitme muutujaga logistilised regressioonid kasutavad sisendina mitte korreleeritud finants- ja rahvusvahelistumise faktoreid. ANN on kasutusel prognoositäpsuste leidmiseks, sest see võimaldab erinevalt logistilisest regressioonist arvesse võtta keerukaid mittelineaarseid seoseid ennustavate muutujate vahel. Muutujate käitumist ANN mudelites analüüsitakse SHAP (Shapley additive explanations) graafikute abil, mis visualiseerivad iga muutuja panuse suuna ja tugevuse. Tulemused näitavad, et rahvusvahelistumise muutujad, eriti eksporturgude arv, on kõige kasulikumad VEAT sisenemise ennustajad. Ettevõtted, mille

laialdane rahvusvaheline kogemus pärineb mitmetelt Euroopa turgudelt, laienevad oluliselt tõenäolisemalt Euroopast väljapoole, toetades Uppsala mudeli järkjärgulise rahvusvahelistumise seisukohta. Finantsnäitajate seosed logistilistes regressioonides olid nõrgemad ja vähem järjepidevad, tõenäoliselt viidates eksportivate ettevõtete üldisele tugevale finantsseisundile. ANN mudelid võimaldasid eelnevale lisaks saada palju mitmekülgsema vaate. Näiteks viitasid SHAP graafikud sellele, et ettevõtted, millel on madalam solventsus, on tõenäolisemad VEAT sisenejad. See võib tähendada, et lühiajaline finantsseisundi halvenemine võib käivitada uute turgude otsingu, toetades nii RBV kui ka BTOF seisukohtasid. VEAT sisenemine on prognoositav kõrge täpsusega, mis täpseima mudeli puhul oli 91%. Vastava mudeli AUCi 0.95 loetakse üldtunnustatud klassifikatsiooni alusel suurepäraseks. Prognoosimudelite põhjal selgusid mitmed erinevad seaduspärad. Mida olulisem on rahvusvahelistumine, seda täpsemini on see prognoositav. Seega on stabiilne ja intensiivne rahvusvahelistumine prognoositav kõige täpsemini ning katsetav kõige halvemini. VEAT sisenemise aastast (T) kaugema perioodi (T-2) näitajad prognoosivad seda halvemini kui lähema (T-1). Samas annab parima prognoositäpsuse vastava kahe perioodi ja nende vahel toimunud muutuste kombineerimine. Kokkuvõttes annab magistritöö olulise panuse teaduskirjandusse, näidates millised erinevate teoreetiliste seisukohtadega seotud muutujad võimaldavad prognoosida ettevõtete laienemist kodumandrist kaugemale. Töös saavutatud kõrged prognoositäpsused võimaldavad vastavaid mudeleid rakendada ka praktikas, näiteks riiklike institutsioonide poolt eksporditoetuste jagamisel.

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