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DOES THE PROCESSING TIME OF e-RESIDENCY CARDS AFFECT PROBABILITY OF FORMING COMPANIES? A STUDY OF THE ESTONIAN e-RESIDENCY PROGRAMME

Master's Thesis

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I have written this Research paper independently. Any ideas or data taken from other authors or other sources have been fully referenced.

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Abstract

This study augments the existing body of research on the Estonian e-Residency program by utilizing newly available data to investigate a relationship between e-Residency processing time and the likelihood of applicants establishing firms. Furthermore, we attempt to control for additional variables, such as applicants' country of residency and EU membership status. Our findings reveal a statistically significant relationship between processing time and the probability of firm creation. For each additional day of processing, the likelihood of establishing a firm decreases by around 0.22%. Moreover, EU residents exhibit a 10.51% higher probability of creating firms compared to non-EU residents, ceteris paribus. The Estonian e-Residency program enables the EU country to expand its national startup infrastructure to citizens or residents of other nations, providing these individuals access (via the e-Residency Card) to establish Estonian-based firms without residing in the country. Estonia, and other countries that run an e-Residency Program can leverage the insights from this study to inform data-driven business decisions in their respective programs.

Keywords: Estonian e-Residency, e-Residency Card, Firm Creation, Processing Time, Marginal Effects.

1. Introduction

The phenomenon of globalization has facilitated increased interaction among people of diverse nationalities, thereby transforming the world into a global village. This transformation has been facilitated by several factors, among which technology plays a crucial role. In 2014, Estonia became the first nation to institute an e-Residency program, allowing nationals of other countries to become e-Residents (Sullivan & Burger, 2017). Since then, other countries like Lithuania, Azerbaijan, and Portugal, have followed suit in setting up their e-Residency program. This paper examines the relationship between the processing time of the Estonian e-Residency card and the probability of e-Residents creating companies.

Most e-Residency holders are entrepreneurs, although applicants to the program often belong to one of the following categories: business owners, entrepreneurs, freelancers, and consultants ("Become an E-Resident | Learn the Benefits & Apply," n.d.). The Estonian e-Residency program provides successful applicants with several options, including the ability to set up and manage an online location-independent company from anywhere in the world, establish an EU company online within one day, manage the resulting company fully online, apply for a business bank account and conduct secure e-banking, access international payment service providers, digitally sign and transmit documents, and declare Estonian taxes online. It is noteworthy, however, that e-Residency does not confer the right to enter Estonia or the European Union physically, nor does it bestow upon holders the rights of Estonian citizens or physical residents of the state. The Estonian e-Residency program grants successful applicants the e-Residency card, which enables e-Residents to access all services associated with their new status. As of February 2023, the program had more than 100,000 e-Residents and more than 25,000 e-Resident companies. The e-Residency application process involves the applicant gathering required documents, submitting the application and paying a fee of €100-€120, and the Estonian Police & Border Guard Board reviewing the application with a processing time of three to eight weeks. Once approved, the e-Residency card is available for pickup.

While there have been several studies on the Estonian e-Residency program and its implications (Blue, 2021; Sullivan & Burger, 2017), few have explored the factors that influence the probability of e-Resident company creation and tax payments. This gap in research may be attributed to data privacy regulations that make it challenging to obtain the necessary data for such studies. To contextualize the study, attention is paid to previous

research on the theories of firm creation and factors affecting company formation. For instance, Kim et al. (2022) explore the role of industrial characteristics in regions as drivers of firm creation, with a particular focus on dynamic competition, diversity, and technological specialization. Fotopoulus (2014) considers various factors that affect company creation, such as access to capital and home ownership, unemployment, and demand-side factors.

Given the unique context of the Estonian e-Residency program, however, there is a dearth of research on how the duration of e-Residency card processing time affects the rate of firm creation. This study fills this gap and provides insights into the potential relationship between processing time and e-Resident company creation probability.

An in-house study conducted by the Estonian e-Residency Program demonstrated that the likelihood of establishing a company decreases significantly as the time it takes to obtain the required e-residency card increases. However, this finding has a significant limitation as it measured the time from the application for e-residency until the receipt of the card, which may involve self-selection bias. Those individuals who are truly interested in establishing a company are more likely to collect their e-residency card promptly, while those who lack such intentions may delay their collection. The data used in this research addresses this limitation and provides information on the time it takes for the e-residency card to arrive at the embassy or other designated pickup location, which does not depend on the behaviour of the e-resident; And we use this new data to examine how the time impacts the probability of an e-resident to create a company. This inquiry is pertinent to the e-residency program as facilitating the creation of firms is one of its key objectives. Therefore, the findings of this study can assist in prioritizing future developments within the program.

The remainder of this paper is organized as follows: section 2 examines relevant literature on Estonian e-Residency and the digital transformation of Estonia while also considering various entry barriers influencing firm creation. In section 3, the paper describes the dataset utilized in this study and outlines the methodology employed for data analysis. Section 4 presents analysis results while section 5 discusses the findings, recommendations, and/or arguments.

2. Literature Review

2.1. Studies on the Estonian e-Residency Program

The relatively new e-Residency program pioneered by Estonia (and introduced in 2014) has been the subject of examination in numerous scholarly articles. To conduct this research, the present author has analyzed the literature of other writers on the topic of the e-Residency program, which encompasses the program's history, rationale for implementation, advantages, risks, and lessons learned, as well as its implications and effects on other aspects of the Estonian (and EU) ecosystem. However, prior to delving into the intricacies of the e-Residency initiative, it is advantageous to first comprehend Estonia's historical trajectory leading up to this innovation, as e-Residency was not created from scratch, but rather as a means of extending the possibilities already available to Estonians to non-residents.

The table below, which maps out the various stages of Estonia's technological progress from the "Principles of the Estonian Information Policy" draft to the "Tiger Leap Initiative" and finally to the commencement of the e-Residency program, was created after examining the data provided on the e-Estonia website. The platform is managed by Enterprise Estonia, an Estonian governmental agency that promotes and supports innovation, export, tourism, foreign investments, and talent attraction (*E-Estonia Story*, n.d.).

Table 1
Key stages in the digital transformation of Estonia

Initiative	**Year**	**Effect**
First draft of the "Principles of Estonian Information Policy"	1994 (approved 1998)	1% of GDP earmarked as state funding for IT
Launch of the Tiger Leap Initiative	1996	99% of the population uses the internet regularly; Estonia ranked as #1 in the Digital Development Index
e-Tax Board	2000	To declare taxes now takes about 3 minutes online; 98% of people declare their income electronically
X-Road	2001	X-Road has become the backbone of e-Estonia
e-ID and digital signature	2002	98% of Estonians have an ID card
i-Voting	2005	One third of votes in elections are cast online
e-Health	2008	Electronic health records provide comprehensive profiles of each patient
e-Residency	2014	e-Residency is the first digital nation for global citizens

Note. Compiled by the author
Source: e-Estonia website.

The literature examined have documented the significant emphasis placed on digital transformation in Estonia over time. This commitment to technological growth can be traced back to the first post-independent government's recognition of the potential of ICT to confer a competitive advantage (Rainer Kattel & Ines Mergel, 2019, pp. 143–160). The adoption of the Estonian Information Policy and the subsequent launch of the Tiger Leap Initiative were instrumental in this regard. The Tiger Leap Program aimed to enhance technological and computer competency in society by equipping schools with information and communication technologies (ICT) systems and providing ICT training to teachers (Aru-Chabilan, 2020; Runnel et al., 2009; Tammpuu & Masso, 2018).

By 2001, Estonia had developed X-Road, the technological infrastructure that forms the "backbone of e-Estonia." This platform is a complex system that enables the integration of different state and private information systems and serves as the primary technology and base on which subsequent Estonian proprietary technologies, such as e-Residency, have been built (Tammpuu & Masso, 2018).

According to Kotka et al. (2016), the Estonian e-Residency program was among the priorities of the Digital Agenda for Estonia 2020, which aimed to enhance Estonia's international reputation in digital affairs. As stated in the document:

"Estonia will start offering its secure and convenient services to the citizens of other countries. Virtual residence or e-Residence will be launched, meaning that Estonia will issue non-residents with electronic identity in the form of digital ID cards. The aspiration for Estonia is to become as re-known [sic] for its e-services as Switzerland is in the field of banking."

The program was developed collaboratively by a range of stakeholders, including the authors of the Digital Agenda for Estonia 2020, the Estonian Development Fund, a 7-member team at Enterprise Estonia, the Board of e-Residency, the Cabinet, E-ID, X-Road, the Estonian Police and Border Guard, the Information System Authority (RIA), and several ministries (i.e., the Ministry of Interior, the Ministry of Economic Affairs and Communications, the Ministry of Justice, the Ministry of Finance, and the Ministry of Foreign Affairs). The e-Residency program thus relies on the cooperation of many government agencies and builds on several technologies that were initially created to serve Estonian residents (Kotka et al., 2016).

Tammpuu and Masso (2018) examine how the e-Residency program could impact Estonia's branding by asking what kind of national images and representations of national space are created around the concepts of "virtual state" and "virtual residency." To achieve this, the authors attempt to connect Estonia's "Tiger Leap" program with her "Digital Agenda 2020 for Estonia," as efforts in which nation branding and national reputation management have been closely integrated into the agenda and implementation of the national ICT policy.

Sullivan and Burger (2017) investigate the implications of Estonia's use of blockchain technologies in the e-Residency program. Their research also considers the security and data protection implications of blockchain in the context of the Estonia e-Residency program.

2.2. Entry barriers affecting company creation - A review of different countries.

To further contextualize the study, it's important to understand the factors that contribute to probability of firm formation and barriers to firm entry worldwide. To do this, we explored different literature around firm entry and factors affecting company creation.

A barrier to entry can be defined as anything that prevents an entrepreneur from instantaneously creating a new firm in a market (Fee et al., 2004). These barriers could include anything from government regulations (e.g. residency requirements), costs of entry, existence of incumbents in the industry, etc. In a paper on the impact of regulations and corruption on firm entry, Dreher and Gassebner (2013) investigate whether and to what extent regulation (and corruption) deter firm entry into markets. According to them, "the existence of a larger number of procedures required to start a business, as well as larger minimum capital requirements are detrimental to entrepreneurship" by reducing the number of entrepreneurs creating firms in different industries.

Generally, it is also expected that governments lowering the "barriers to entry" for companies would lead to a higher firm formation rate. This was confirmed in a study by Castellaneta et al. (2020) in their study on the lowering barriers to entrepreneurship on women. Interestingly, in a study of US-based firms, Kwapisz (2019) found that 1% of entrepreneurs list "regulations" as their major reason for discontinuing a start-up process, while 6% view "government" as a major barrier.

In a similar study for European firms, the authors examine entry costs or entry regulations, which they describe as the cost of meeting the regulatory requirements for

establishing a limited liability company. They find that “costly regulations hamper the creation of new firms, especially in industries that should naturally have high entry, and that these regulations also force new entrants to be larger” (Klapper et al., 2006).

In their 2002 paper, Djankov et al. (2002) go deeper to consider the time it takes to establish new firms across 85 different countries. According to their research, firm creation time varies from 2 business days in Australia and Canada to 152 business days in Madagascar, with an average time of 47 business days (for the 85 countries in study). To get a better and updated comparison, we use current World Bank data available on the Doing Business archive to compare company creation time in 7 countries and mean time to attain residency across these countries. We select 6 countries by picking the 3 countries with the shortest time (in days) to create a business - New Zealand (0.5), Georgia (1) and Canada (1.5), and the 3 countries with the longest time (in days) to create a business, for which we found official information on their visa/residency application process - Belize (48), Botswana (48) and Iran (72.5) (*Starting a Business - Doing Business - World Bank Group*, n.d.). The mean visa/residency processing time for these countries were obtained from their respective government pages (*Application Register*, n.d.; *Global Impact Work Visa*, n.d.; *Migration Commission :: Residence Permit and Residence Card*, n.d.; *Residence Permit Application | Government of Botswana*, n.d.; “Residence Process,” n.d.; Immigration, 2018),

We plot a comparison of these 6 countries with Estonia in figure 1:

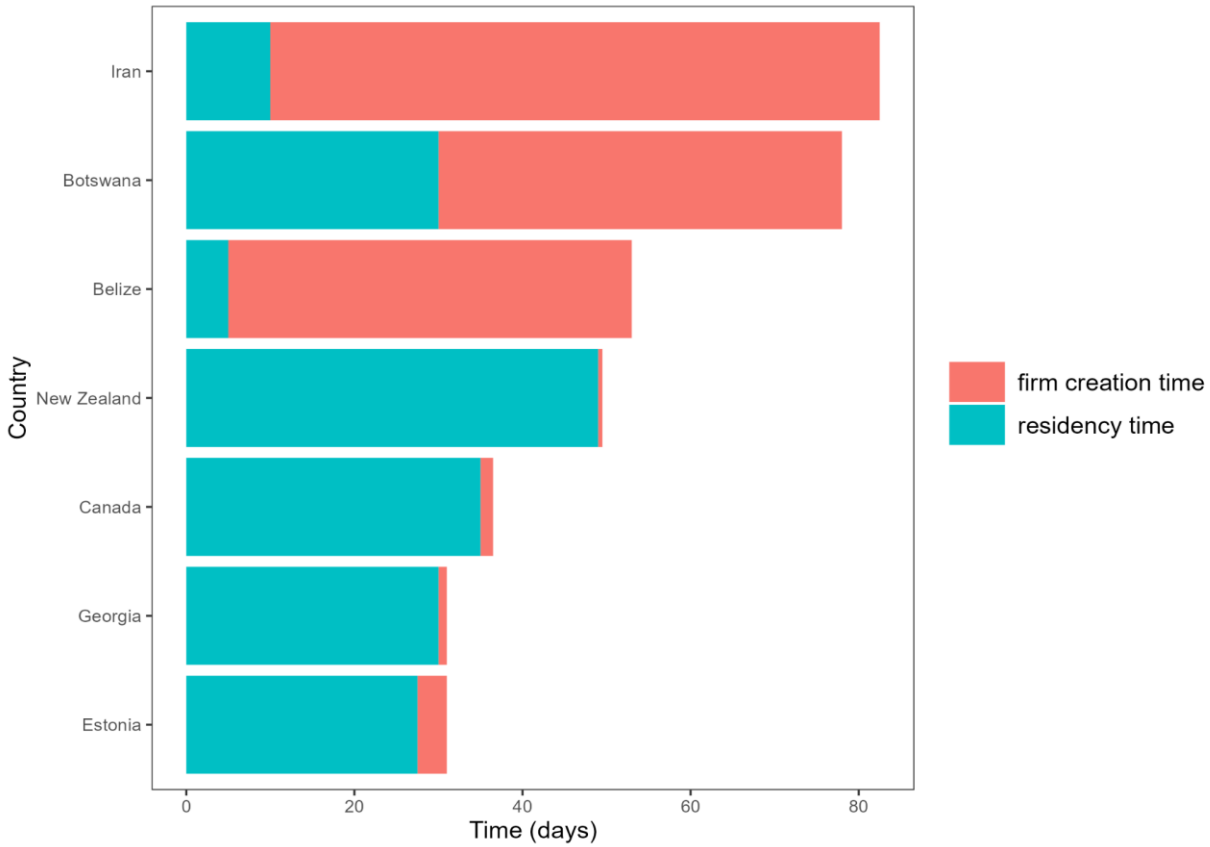

Figure 1: Time to obtain residency and create company in different countries.
Note. Total time to obtain residency and create a company in different countries. 3 each of the countries with least and highest firm creation time selected, plus Estonia. Sorted by total time (both residency and firm creation).
Source: Plotted by author from World Bank Group -Doing Business data, and official data from countries' immigration offices.

There is however a research gap regarding the main topic of this research – how much does ease of creating a company, and even more specifically – how much does the speed of processing the Estonian e-Residency card, affect the company creation. This paper studies exactly this niche area: trying to answer whether "processing time" is a significant factor affecting the creation of new "e-Resident" firms in Estonia.

We know from a small e-Residency internal study that there is a difference of propensity for forming a company between those who gather their e-residency card early and those who get their card late. Figure 2 shows that for those who pick up their e-Residency card in around 1.5 months or less after applying, create a company with higher than 40% probability; for those who pick up the card after more than three months the probability falls to less than 30%. But we do not know if this is affected by self-selection (people who want to

create a company will pick up the card quickly, people who do not want to create it will let the time pass and pick the card up later).

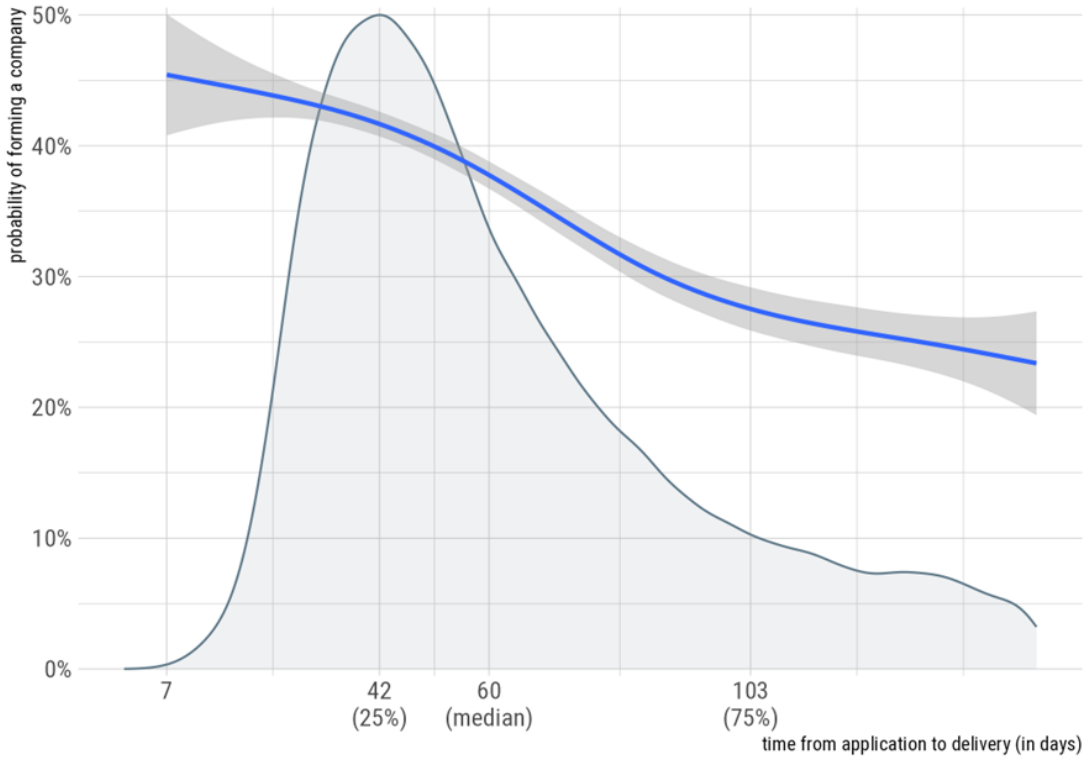

Figure 2: Probability of forming a company depending on the time of pick-up of the Estonian e-Residency card.
Source: In-house study by Estonian e-Residency program.

This paper will, using newly obtained data which tracks the time from application time to when the cards are available in pickup location ("processing time") which removes the effect of self-selection bias from the dataset, examine if there is a relationship between e-Residency card processing time and the probability of e-Resident firm creation.

3. Data and Methodology

3.1. Data

Data for this study was obtained from the Estonian e-Residency program, encompassing information on applicants from April 2021 to March 2022 and e-Residency cards available from October 2021 to June 2022. To ensure data privacy, de-identification techniques were employed to anonymize the dataset.

The dataset analyzed comprises 4,554 applications and includes variables such as application date (*whenapplied*), date of arrival at the foreign embassy pickup point or at the alternative pickup point[1] (BLS), gender, country of residency (*residency*), total time (from application date until when the person received the card), and a Boolean variable indicating whether the applicant established an e-resident company within 6 months (*entrepreneur*). The initial dataset contained 5470 individuals, and the author removed those observations where e-Residency cards were obtained in Estonia or those applying for renewal of e-Residency cards, as we do not have reliable measures of the arrival date for these observations.

Table 2
Descriptive statistics

Characteristic	**N = 4,554**[1]
whenapplied	2021-04-30 to 2022-03-21
gender	
M	3,899 (86%)
F	655 (14%)
when_arrived	2021-10-05 to 2022-06-29
entrepreneur	1,206 (26%)
processing_days	23 (20, 28)
is_eu	
EU	2,036 (45%)

[1] Alternative pickup points (BLS) refer to pickup points established in cooperation with an private company BLS.

Non-EU	2,518 (55%)

Note. Reported as descriptive statistics for available data.
[1]Range; n (%); Median (IQR)

At a high level, we noted that the dataset included applicants resident in 127 different countries with the most applications from Spain (421), Russia (340), Germany (331), China (271), Ukraine (235) and Turkey (234).

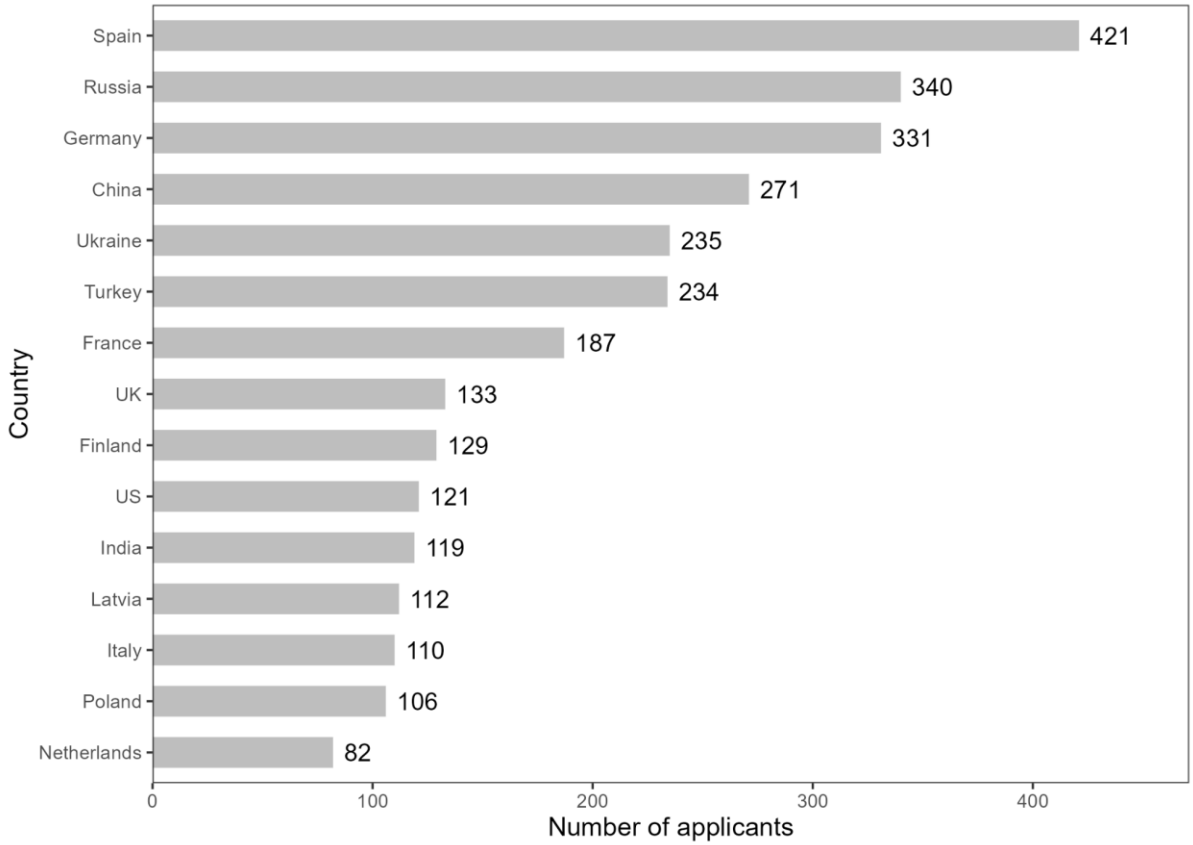

Figure 3: Countries with the most e-Resident applications
Source: Compiled by the author from available data.

Across all the countries the processing days had a mean value of 27.5 days and a median value of 23 days.

3.2. Methodology

The term "processing time", as used in this study, is defined as the duration between the application date and the availability of the card for collection. This approach mitigates potential self-selection bias that may arise if the completion of the process were considered as the date when the card was physically collected. Processing time in days can be calculated as:

$$Processing\ time\ (days) = date\ of\ arrival\ at\ collection\ centre - application\ date$$

This processing time consists of Estonian Police and Border Guard time to assess the application, then printing the card and delivering it to the pick-up point.

To understand the relationship between company formation and processing time, we will define a logit regression, which is the appropriate methodology for analysing dichotomous outcome variables (Lemeshow et al., 2013). The logit regressions representing out models are as follows:

$$logit(Entrepreneur_i) = \beta_o + \beta_1 processingtime_i + \varepsilon_i \ldots\ldots\ldots 1$$

Where *Entrepreneur*, the response variable, represents whether the e-resident i created a company (1) or not (0) within 6 months, *processing_time* is the time in days to process the e-residents e-Residency card and εi represents error term.

Subsequently, we examine the potential influence of the applicant's region of residency on the likelihood of establishing a company. The region of residency is categorised into EU and non-EU and the resulting model is:

$$logit(Entrepreneur_i) = \beta_o + \beta_1 processingtime_i + isEU_i + \varepsilon_i \ldots\ldots\ldots 2$$

Where *isEU* is 1 when applicant is resident in the EU and 0 when applicant is resident outside the EU. The third specification will control for country of residency by including *residency* as one of the regressors in the logit regression, taking out is_EU$_i$ to avoid multicollinearity:

$$logit(Entrepeneur_i) = \beta_o + \beta_1 processingtime_i + residency_i + \varepsilon_i \ldots\ldots\ldots 3$$

This is important as e-residents from different countries have very different propensity to create companies as shown in table 3.

Table 3
Probability of forming a company by e-residents from different countries

Country of residency	number of e-residents in our data	Percent of e-residents creating a company (%)
Belgium	51	41.00
Germany	331	38.00
Turkey	234	38.00
Portugal	70	37.00
Austria	53	36.00
Spain	421	36.00
Netherlands	82	35.00
Sweden	52	33.00
UK	133	30.00
Ukraine	235	29.00
France	187	28.00
Italy	110	28.00
Latvia	112	25.00
Poland	106	25.00
Russia	340	25.00
United Arab Emirates	66	20.00
Finland	129	18.00
Belarus	59	17.00
India	119	16.00
US	121	15.00
Brazil	72	14.00
China	271	6.00

Note. Only countries with more than 50 e-resident applications included in table. Table sorted by percentage of applicants creating a company (descending order).
Source: Compiled by the author from available data.

Analysis was conducted using R (*R: The R Project for Statistical Computing*, n.d.), the tidyverse package (Wickham et al., 2019), the margins package(*Marginal Effects for Model Objects*, n.d.) (Leeper 2021), gtsummary package (Sjoberg et al., 2021), jtools package (Long, 2022).

4. Results and Discussion

The results of the 3 models are summarized in the table below:

Table 4
Output of the 3 Logit models

	Model 1	Model 2	Model 3
processing_days	-0.01 ***	-0.01 ***	-0.01 ***
	[-0.02, -0.01]	[-0.02, -0.01]	[-0.02, -0.00]
is_euEU		0.54 ***	
		[0.41, 0.68]	
N	4554	4554	4554
AIC	5232.33	5171.73	5154.76
BIC	5245.17	5191.00	5977.00
Pseudo R2	0.01	0.03	0.11

Notes:Compiled by author from model data
*** p < 0.001; ** p < 0.01; * p < 0.05.

Table 4 gives an overview of the results of three logit models (the coefficients of countries of residence are omitted from the Model3). The response variable for all the models is entrepreneur (logit of it) – if the person created a company or not within 6 months. Confidence intervals are given below the point estimates.

Figure 4 visualizes the coefficients of the models as coefficient plot.

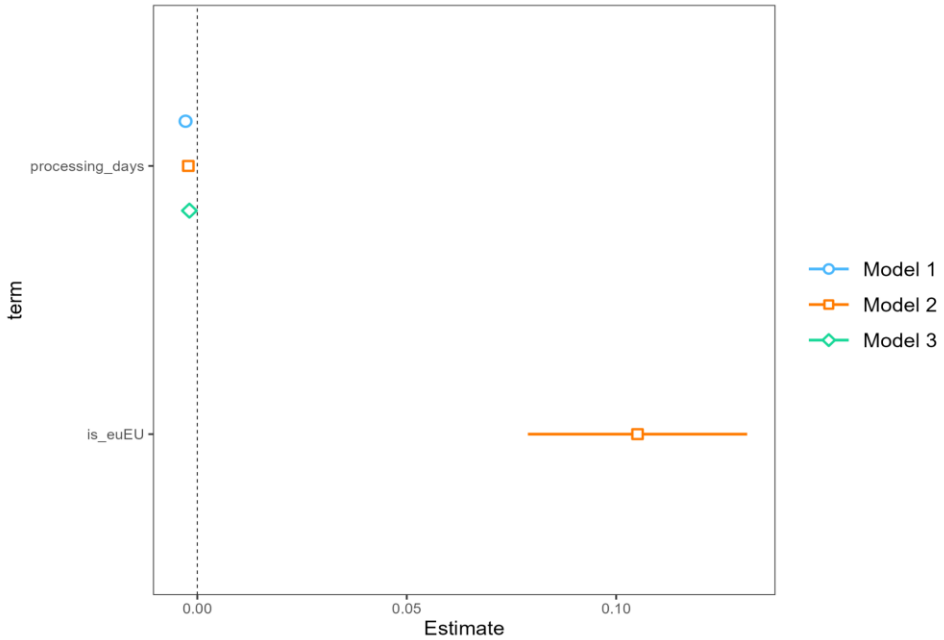

Figure 4: Coefficient plot of the models
Source: Plotted by author from model data.

Upon examining the results in figure 4 and table 4, the following observations can be made regarding the relationships between the regressors and the response variable:

- Statistical Significance: Across all models, processing_days demonstrates a statistically significant effect on the probability of establishing a company. This holds true when controlling for region (EU/Non-EU) or when controlling for country of residence. Moreover, the dummy variable for EU countries exhibits a statistically significant impact on entrepreneurship.
- Negative Estimate of Treatment Variable: The relationship between processing_days and entrepreneur is negative, implying that as processing_days increases, the likelihood of entrepreneurship decreases. Given the nature of the data, it can be inferred that an increase in the number of processing days corresponds to a reduced likelihood of e-Residency applicants establishing a company.

Marginal Effects

For easier interpretability we have calculated the marginal effects for models 2 and 3. The average marginal effects (AME) of processing_days on the probability of establishing a company can be ascertained, while controlling for country of residency (model3) or if they live in EU (model2). Additionally, the AME of residing in the EU on the probability of creating a company can be determined.

In particular, it is inferred that for each additional day spent processing the e-Residency card, the probability of creating a company decreases by 0.0022 [CI: -0.0031, -0.0012] or 0.31%…0.12%. Additionally, the average marginal effect of EU residency on the response variable amounts to 0.1051 [CI: 0.0789, 0.1313], signifying that, all else being equal, the likelihood of establishing a firm is 7.89%...13.13% higher for applicants residing within the EU.

The effect plot (Figures 5) illustrates the marginal impact of processing days on the probability of creating a company, by displaying the corresponding probabilities associated with various processing days (graphs are based on model 2).

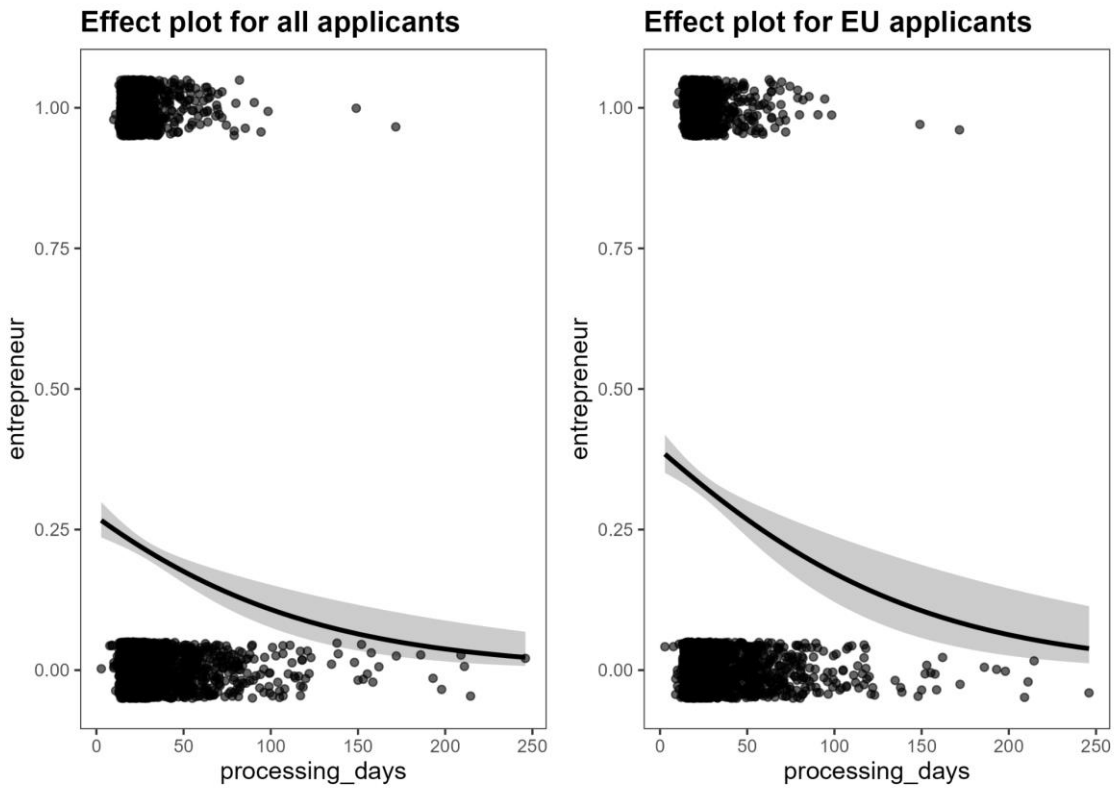

Figure 5: Effect Plots for EU and all applicants respectively
Note: Plotted by author using model 2

We can see, from comparing the effect plots for all applicants and that for only EU applicants, that there is a higher probability for applicants to create companies if they are resident in the EU.

In summary, we can deduce that there is a statistically significant relationship between processing time of the e-Residency program and the probability of company creation. Based on the data analysis, a one day increase in processing time would result in a 0.22% [CI: -0.31%, -0.12%] drop in probability of company creation.

The magnitude of the 0.22% decrease in probability per day warrants further consideration. Given that 26% of individuals in our sample established a company, reducing the e-Residency processing duration by an average of 5 days would result in an approximate 1% point increase, or approximately 27% of e-residents creating a company (translating to a 2% rise in companies created from 1,206 to 1,230). One could contend that the companies not formed may possess lower value (e.g., in future tax returns), as the entrepreneur may have had additional time to contemplate their idea, ultimately leading to the decision not to

establish the company. It is also possible that the venture was time-sensitive, and the entrepreneur found alternative methods for setting it up.

Nevertheless, the relationship has been shown to persist even after controlling for country fixed effects. Identifying an alternative explanation apart from causality proves to be challenging, though some possibilities exist - one such option is that individuals not intending to establish a company may undergo longer background checks for certain reasons compared to those who do wish to create one.

As a result, it is recommended that the Estonian e-Residency program consider implementing measures to decrease e-Residency application processing times. Although due diligence intrinsically requires time and near-zero processing times are infeasible, there is a cost associated with unduly lengthy processing periods.

5. Conclusions

This study addresses the research gap by examining the operational effectiveness of the Estonian e-Residency Program's application process. The focus is placed on exploring relationships between the application processing duration (in days) and the likelihood of applicants establishing an e-resident company in Estonia (in the first 6 months), by analysing data obtained from the Estonian e-Residency program. To achieve this, we first established a theoretical background through a review of different literature on the Estonian e-Residency program and entry barriers affecting company creation (a review of different countries). We then defined a logit regression with probability of creating a company as output variable and processing time, country of residency as the regressors.

The primary finding reveals a statistically significant relationship between the length of processing time of e-Residency cards and the probability of applicants forming a company (0.22% decrease of probability of creating a company for an additional day of processing). We also found that applicants resident in the EU are 10.51% more likely to create an e-resident company than those who are not. This finding is critical and can help the Estonian e-Residency program make data-backed decisions on how to increase e-resident company creation. Other countries working on their e-residency programs can also apply the output of this research. It is important for the relevant government agencies in these countries to prioritise prompt processing of applications as it increases probability of firm creation, which in turn has advantages like increased entrepreneurial activity, improved national economies and income or even greater tax collections.

The primary limitation in this study is the scope of information collected about the e-Residency applicants, which could have been incorporated into the analysis model. Due to privacy concerns, the author was only able to obtain applicant residency and gender as potential regressors.

Future research could collaborate with the Estonian e-Residency program to obtain more relevant data for use as regressors. To circumvent privacy restrictions, consent could be sought from applicants during the application process, allowing authorized analysts to utilize this information for meaningful research. An additional avenue for further investigation would involve examining the causality behind e-Residency applicants' decisions to establish companies or not. This would necessitate advanced research methods, including randomized controlled trials involving some participants undergoing an expedited or prioritized process while others experience the standard process. It may also be advantageous to determine if

residents of certain countries exhibit a higher tendency to lose interest in forming companies over time and whether prioritizing those countries would be beneficial.

References

Application Register. (n.d.). Retrieved May 17, 2023, from https://evisatraveller.mfa.ir/en/request/how_to_apply/

Aru-Chabilan, H. (2020). Tiger Leap for digital turn in the Estonian education. *Educational Media International*, *57*(1), 61–72. https://doi.org/10.1080/09523987.2020.1744858

Become an e-resident | Learn the Benefits & Apply. (n.d.). *E-Residency*. Retrieved November 27, 2022, from https://www.e-resident.gov.ee/become-an-e-resident/

Blue, A. (2021). Evaluating Estonian E-residency as a tool of soft power. *Place Branding and Public Diplomacy*, *17*(4), 359–367. Scopus. https://doi.org/10.1057/s41254-020-00182-3

Castellaneta, F., Conti, R., & Kacperczyk, A. (2020). The (Un) intended consequences of institutions lowering barriers to entrepreneurship: The impact on female workers. *Strategic Management Journal*, *41*(7), 1274–1304. https://doi.org/10.1002/smj.3133

E-Estonia Story. (n.d.). E-Estonia. Retrieved February 7, 2023, from https://e-estonia.com/story/

Fee, P. R., Mialon, H. M., & Williams, M. A. (2004). What Is a Barrier to Entry? *American Economic Review*, *94*(2), 461–465. https://doi.org/10.1257/0002828041302235

Global Impact Work Visa. (n.d.). Immigration New Zealand. Retrieved May 17, 2023, from https://www.immigration.govt.nz/new-zealand-visas/already-have-a-visa/managing-your-visa-and-passport/details-page-for-passport-sticker/visa/global-impact-work-visa

Immigration, R. and C. C. (2018, January 24). *Check processing times*. https://www.canada.ca/en/immigration-refugees-citizenship/services/application/check-processing-times.html

Klapper, L., Laeven, L., & Rajan, R. (2006). Entry regulation as a barrier to entrepreneurship. *Journal of Financial Economics*, *82*(3), 591–629. https://doi.org/10.1016/j.jfineco.2005.09.006

Kotka, T., Del Castillo, C. I. V. A., & Korjus, K. (2016). Estonian e-residency: Benefits, risk and lessons learned. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *9831 LNCS*, 3–15. Scopus. https://doi.org/10.1007/978-3-319-44159-7_1

Lemeshow, S., Sturdivant, R. X., & Jr, D. W. H. (2013). *Applied Logistic Regression*. John Wiley & Sons.

Long, J. A. (2022). *jtools: Analysis and Presentation of Social Scientific Data* (2.2.1). https://cran.r-project.org/web/packages/jtools/index.html

Marginal Effects for Model Objects. (n.d.). Retrieved April 29, 2023, from https://thomasleeper.com/margins/

Migration Commission: Residence permit and residence card. (n.d.). Retrieved May 17, 2023, from https://migration.commission.ge/index.php?article_id=161&clang=1

R: The R Project for Statistical Computing. (n.d.). Retrieved April 29, 2023, from https://www.r-project.org/

Rainer Kattel & Ines Mergel. (2019). *Great policy successes, or, A tale about why it's amazing that governments get so little credit for their many everday and extraordinary achievements as told by sympathetic observers who seek to create space for a less relentlessly negative view of our pivotal public institutions* (First edition). Oxford University Press.

Residence Permit Application | Government of Botswana. (n.d.). Retrieved May 17, 2023, from https://www.gov.bw/residency-and-work/residence-permit-application

Residence Process. (n.d.). *Belize*. Retrieved May 17, 2023, from https://immigration.gov.bz/residence/residence-process/

Runnel, P., Pruulmann-Vengerfeldt, P., & Reinsalu, K. (2009). The Estonian Tiger Leap from Post-Communism to the Information Society: From Policy to Practice. *Journal of Baltic Studies*, *40*(1), 29–51. https://doi.org/10.1080/01629770902722245

Sjoberg, D. D., Whiting, K., Curry, M., Lavery, J. A., & Larmarange, J. (2021). Reproducible Summary Tables with the gtsummary Package. *The R Journal*, *13*(1), 570–580.

Starting a Business—Doing Business—World Bank Group. (n.d.). Retrieved April 19, 2023, from https://archive.doingbusiness.org/en/data/exploretopics/starting-a-business

Sullivan, C., & Burger, E. (2017). E-residency and blockchain. *Computer Law & Security Review*, *33*(4), 470–481. https://doi.org/10.1016/j.clsr.2017.03.016

Tammpuu, P., & Masso, A. (2018). "Welcome to the virtual state': Estonian e-residency and the

digitalised state as a commodity. *European Journal of Cultural Studies*, *21*(5), 543–560. https://doi.org/10.1177/1367549417751148

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T. L., Miller, E., Bache, S. M., Müller, K., Ooms, J., Robinson, D., Seidel, D. P., Spinu, V., … Yutani, H. (2019). Welcome to the Tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Appendices

Appendix 1: Summary Output of Model 1

MODEL INFO:
Observations: 4554
Dependent Variable: entrepreneur
Type: Generalized linear model
  Family: binomial
  Link function: logit

MODEL FIT:
$\chi^2(1) = 36.466$, $p = 0.000$
Pseudo-R^2 (Cragg-Uhler) = 0.012
Pseudo-R^2 (McFadden) = 0.007
AIC = 5232.327, *BIC* = 5245.175

Standard errors: MLE

	Est.	2.5%	97.5%	z val.	p
(Intercept)	-0.636	-0.786	-0.485	-8.282	0.000
processing_days	-0.015	-0.020	-0.009	-5.406	0.000

Appendix 2: Summary Output of Model 2

MODEL INFO:
Observations: 4554
Dependent Variable: entrepreneur
Type: Generalized linear model
  Family: binomial
  Link function: logit

MODEL FIT:
$\chi^2(2) = 99.064$, $p = 0.000$
Pseudo-R^2 (Cragg-Uhler) = 0.031
Pseudo-R^2 (McFadden) = 0.019
AIC = 5171.729, *BIC* = 5191.001

Standard errors: MLE

	Est.	2.5%	97.5%	z val.	p
(Intercept)	-0.982	-1.156	-0.808	-11.066	0.000
processing_days	-0.011	-0.017	-0.006	-4.227	0.000
is_euEU	0.542	0.407	0.676	7.883	0.000

Appendix 3: Detailed Summary Statistics

Characteristic	**N = 4,554**[1]
name_of_PUP	
Abu Dhabi Araabia Ühendemiraadid	125 (2.7%)
Ankara Türgi	137 (3.0%)
Ateena Kreeka	61 (1.3%)
Bakuu Aserbaidzaan	16 (0.4%)
Bangkok Tai	76 (1.7%)
Berliin Saksamaa	296 (6.5%)
Brüssel Belgia	95 (2.1%)
Budapest Ungari	66 (1.4%)
Bukarest Rumeenia	53 (1.2%)
Canberra Austraalia	35 (0.8%)
Dublin Iirimaa	18 (0.4%)
Haag Holland	98 (2.2%)
Helsingi Soome	135 (3.0%)
Istanbul Türgi	191 (4.2%)
Kairo Egiptus	44 (1.0%)
Kiiev Ukraina	202 (4.4%)
Kopenhaagen Taani	25 (0.5%)
Lissabon Portugal	100 (2.2%)
London Suurbritannia	151 (3.3%)
Madrid Hispaania	463 (10%)

Minsk Valgevene	58 (1.3%)
Moskva Venemaa	241 (5.3%)
New Delhi India	124 (2.7%)
New York USA	88 (1.9%)
Nur-Sultan Kasahstan	15 (0.3%)
Oslo Norra	12 (0.3%)
Ottawa Kanada	36 (0.8%)
Pariis Prantsusmaa	216 (4.7%)
Peking Hiina	277 (6.1%)
Pihkva Venemaa	5 (0.1%)
Praha Tšehhi	42 (0.9%)
Pretoria LAV	32 (0.7%)
Riia Läti	109 (2.4%)
Rooma Itaalia	132 (2.9%)
San Francisco USA	56 (1.2%)
Sankt-Peterburg Venemaa	112 (2.5%)
Sao Paulo Brasiilia	100 (2.2%)
Singapur Singapur	64 (1.4%)
Soul Lõuna-Korea	44 (1.0%)
Stockholm Rootsi	53 (1.2%)
Tbilisi Gruusia	22 (0.5%)
Tel Aviv Iisrael	23 (0.5%)
Tokio Jaapan	43 (0.9%)
Varssavi Poola	120 (2.6%)

Viin Austria	99 (2.2%)
Vilnius Leedu	44 (1.0%)
whenapplied	2021-04-30 to 2022-03-21
gender	
M	3,899 (86%)
F	655 (14%)
residency	
Albania	3 (<0.1%)
Algeria	14 (0.3%)
Andorra	5 (0.1%)
Argentina	25 (0.5%)
Armenia	7 (0.2%)
Australia	39 (0.9%)
Austria	53 (1.2%)
Azerbaijan	14 (0.3%)
Bahamas	1 (<0.1%)
Bahrain	2 (<0.1%)
Bangladesh	13 (0.3%)
Barbados	1 (<0.1%)
Belarus	59 (1.3%)
Belgium	51 (1.1%)
Benin	2 (<0.1%)
Bolivia	1 (<0.1%)
Bosnia	10 (0.2%)

Brazil	72 (1.6%)
Brunei	1 (<0.1%)
Bulgaria	17 (0.4%)
Cambodia	4 (<0.1%)
Cameroon	4 (<0.1%)
Canada	44 (1.0%)
Chile	8 (0.2%)
China	271 (6.0%)
Colombia	21 (0.5%)
Costa Rica	2 (<0.1%)
Côte d'Ivoire	1 (<0.1%)
Croatia	24 (0.5%)
Cuba	7 (0.2%)
Curaçao	2 (<0.1%)
Cyprus	13 (0.3%)
Czechia	26 (0.6%)
Denmark	22 (0.5%)
Dominican Republic	1 (<0.1%)
Ecuador	4 (<0.1%)
Egypt	26 (0.6%)
Estonia	4 (<0.1%)
Ethiopia	3 (<0.1%)
Finland	129 (2.8%)
France	187 (4.1%)
Georgia	9 (0.2%)

Germany	331 (7.3%)
Ghana	1 (<0.1%)
Gibraltar	2 (<0.1%)
Greece	46 (1.0%)
Guadeloupe	1 (<0.1%)
Hong Kong	5 (0.1%)
Hungary	32 (0.7%)
Iceland	3 (<0.1%)
India	119 (2.6%)
Indonesia	8 (0.2%)
Iran	35 (0.8%)
Iraq	1 (<0.1%)
Ireland	18 (0.4%)
Israel	24 (0.5%)
Italy	110 (2.4%)
Jamaica	1 (<0.1%)
Japan	49 (1.1%)
Jordan	9 (0.2%)
Kazakhstan	12 (0.3%)
Kenya	7 (0.2%)
Kosovo	2 (<0.1%)
Kuwait	1 (<0.1%)
Kyrgyzstan	2 (<0.1%)
Latvia	112 (2.5%)
Lebanon	14 (0.3%)

Libya	3 (<0.1%)
Liechtenstein	1 (<0.1%)
Lithuania	40 (0.9%)
Luxembourg	8 (0.2%)
Madagascar	1 (<0.1%)
Malaysia	10 (0.2%)
Mali	1 (<0.1%)
Malta	23 (0.5%)
Mauritania	1 (<0.1%)
Mauritius	1 (<0.1%)
Mexico	13 (0.3%)
Moldova	8 (0.2%)
Monaco	1 (<0.1%)
Montenegro	2 (<0.1%)
Morocco	15 (0.3%)
Namibia	1 (<0.1%)
Netherlands	82 (1.8%)
New Zealand	4 (<0.1%)
Nigeria	6 (0.1%)
North Macedonia	4 (<0.1%)
Norway	14 (0.3%)
Occupied Palestinian Territories	1 (<0.1%)
Oman	1 (<0.1%)
Pakistan	37 (0.8%)
Panama	2 (<0.1%)

Peru	5 (0.1%)
Philippines	1 (<0.1%)
Poland	106 (2.3%)
Portugal	70 (1.5%)
Puerto Rico	1 (<0.1%)
Qatar	4 (<0.1%)
Romania	37 (0.8%)
Russia	340 (7.5%)
Saudi Arabia	20 (0.4%)
Senegal	1 (<0.1%)
Serbia	16 (0.4%)
Singapore	33 (0.7%)
Slovakia	11 (0.2%)
Slovenia	11 (0.2%)
South Africa	28 (0.6%)
South Korea	42 (0.9%)
Spain	421 (9.2%)
Sri Lanka	7 (0.2%)
Sweden	52 (1.1%)
Switzerland	41 (0.9%)
Syria	2 (<0.1%)
Taiwan	6 (0.1%)
Thailand	48 (1.1%)
Tunisia	13 (0.3%)
Turkey	234 (5.1%)

Turkmenistan	3 (<0.1%)
UK	133 (2.9%)
Ukraine	235 (5.2%)
United Arab Emirates	66 (1.4%)
Uruguay	1 (<0.1%)
US	121 (2.7%)
Uzbekistan	9 (0.2%)
Venezuela	3 (<0.1%)
Vietnam	5 (0.1%)
Zimbabwe	1 (<0.1%)
when_arrived	2021-10-05 to 2022-06-29
entrepreneur	1,206 (26%)
processing_days	23 (20, 28)
is_eu	
EU	2,036 (45%)
Non-EU	2,518 (55%)

[1] n (%); Range; Median (IQR)

Resümee

KAS E-RESIDENTSUSE KAARTIDE TÖÖTLEMISAEG MÕJUTAB ETTEVÕTETE LOOMISE TÕENÄOSUST? UURING EESTI E-RESIDENTSUSE PROGRAMMIST.

Okereke, Onyekachi Fortune

Eesti e-residentsuse programm võimaldab EL-i riigil laiendada oma rahvuslikku iduettevõtlusinfrastruktuuri teistest riikidest pärit isikutele, võimaldades neil (e-residentsuse kaardi kaudu) luua Eesti-põhiseid ettevõtteid ilma Eestis elamata. Käesolev uuring täiendab olemasolevat teadustööd Eesti e-residentsuse programmi kohta, kasutades äsja kättesaadavaks saanud andmeid, et uurida seost e-residentsuse töötlemisaja ja taotlejate ettevõtete loomise tõenäosuse vahel.

Selleks läbisime Eesti e-residentsuse programmi ja ettevõtte loomise takistusi käsitleva kirjanduse ülevaate, et luua teoreetiline taust. Seejärel kasutasime logit regressioonimudeleid, kus väljundmuutujana oli e-residentide ettevõtte loomise tõenäosus kuue kuu jooksul. Regressoriteks olid töötlemisaeg ja elukohariik, eesmärgiga kontrollida täiendavaid muutujaid, näiteks EL-i liikmelisuse staatust.

Meie regressioonianalüüs, mis põhines 4554 Eesti e-residentsuse programmi taotleja andmestikul ajavahemikus aprill 2021 kuni märts 2022 ning e-residentsuse kaartide kättesaadavusel oktoober 2021 kuni juuni 2022, näitas statistiliselt olulist seost töötlemisaja ja ettevõtte loomise tõenäosuse vahel. Iga täiendav töötlemispäev vähendas ettevõtte loomise tõenäosust umbes 0,22% võrra. Arvestades, et meie valimis lõi ettevõtte 26% isikutest, tooks e-residentsuse töötlemise kestuse keskmise vähenemine 5 päeva võrra kaasa umbes 1-protsendilise suurenemise, mis vastaks ligikaudu 27% e-residentidest, kes loovad ettevõtte (mis tähendab ettevõtete loomise 2% kasvu arvult 1 206-lt 1 230-le).

Lisaks avastasime, et EL-i elukohaga kaasnes oluline positiivne mõju ettevõtte loomise tõenäosusele. EL-i elukohaga seotud keskmine marginaalmõju väljundmuutujale oli 0,105, mis tähendas, et kõigi muude tegurite samaks jäädes oli EL-i elanikel 10,5% suurem tõenäosus ettevõtet luua.

Edasised uuringud, näiteks juhuslikud kontrollitud katsed, võiksid uurida e-residentsuse töötlemisaja ja ettevõtte loomise tõenäosuse vaatlusel ilmnenud seoste aluseid põhjuseid.

Eesti ja teised e-residentsuse programmi käitavad riigid saavad selle uuringu tulemusi kasutada andmepõhiste äriotsuste tegemiseks oma vastavates programmides.

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