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LEGAL BOUNDARIES AND SANCTIONS IN SUBCONTRACTING

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ABSTRACT

Purpose- The main purpose of this study is to scrutinize the problems caused by the subcontractor business model that has been spreading in our country and in the world since the beginning of 1980s and the legal regulations to overcome the said problems.
Methodology- The legal legislation regulating subcontracting and the related literature were scanned, and provisions that aim to prevent excessive contracting were examined.
Findings- It was found that subcontracting has a strong tendency to exceed its purpose and related legal regulation does not meet the expectations of either employees or employers.
Conclusion- Regulations that do not ignore obligations originating from global competition, aims to protect the most basic rights and values of the modern society and reinforces working peace will contribute greatly to solving this problem.

Keywords: Primary employer, subcontractor, over-subcontracting, auxiliary business
JEL Codes: L23, L24, L29

1. INTRODUCTION

The increase in production diversity and flexibility generating activities and the attempts of businesses to carry out these activities with high quality and the least cost resulted in giving jobs other than those that businesses focus on, invest in and employ to other employers specialized in them and the concept of subcontractor emerged. As in other countries, the practice of businesses to give some of their jobs to employers called subcontractor has spread in our country. Subcontracting practices have continued in traditional practice fields for a long time and stayed limited to construction, transportation and businesses that require less quality in general. Since the 1980s, the subcontracting practice has started to gain widespread popularity with municipalities giving cleaning jobs to subcontractor companies and rapidly spread to private sector workplaces. Today, the subcontracting practice has spread to all branches of business, and to all the manufacturing and service sector. This spread has also led to the practice of eliminating workers' rights. With this phenomenon called subcontracting, which is one of the most complained about issues by the workers and unions, work in a workplace is divided as much as it can be and given to the separate subcontractors; and subcontractors that employ non-union workers without any social security and even under the legal minimum wage decrease the labor cost and unionization and collective contract becomes almost impossible (Şakar, 2010). What is essential in Business Law is that the employer manufacture with his/her own employees. However, it can be seen that the businesses start to follow strategies coherent with the competition conditions in the global market and externalize production and employment as a flexibility tool as a result of the economic and technological developments that come with the globalization process. The subcontracting practice, in which employers realize their goods and/or services production through other employers and his/her employees they otherwise do with their own employers, is a typical example of externalizing goods or services production in a workplace (Güzel, 2010). In this context, as employer organizations incline towards a more flexible subcontracting system and legal regulations that will enable it, workers' organizations advocate for a more restricted subcontracting practice. Thus, intense differences of opinion and interest conflicts arise between workers' organizations and employers. In this study, legal boundaries towards preventing excessiveness in the subcontracting practice and enforcements to be imposed when the practice is abused.

3. CONCEPTS AND DEFINITIONS

The most debate-causing provisions of Labor Law No. 4857 are the sixth and seventh paragraphs of Article 2, in which primary employer-subcontractor relations and their limitations are regulated (Güzel, 2004). According to Article 2/VI of the law, "The relationship between the employer and the employer who receives a job from an employer, in auxiliary work related to the production of goods or services carried out in the workplace, or in some part of the actual work, in which the business and its workers employed for that job are employed only in the workplace is called primary employer-subcontractor relation." The type of employer called "sub-employer" in the law is called "subcontractor" in practice. The fact that employers give certain jobs to other employers were originally based on justifiable reasons. For example, employers' giving certain jobs such as that an employer that constructs buildings gives the tasks of installing electricity wiring or attaching woodwork to subcontractors, operating a dining hall in a factor, carrying workers by service vehicles was considered reasonable.

However, since the 1980s, subcontracting practice has started to gain widespread popularity with municipalities giving cleaning jobs to subcontractor companies and rapidly spread to private sector workplaces. This phenomenon called "subcontracting" causes unfair competition for workplaces that respect workers' rights, are unionized ad fulfill their social security obligations and employ workers with labor agreements and forces them towards subcontracting.

4. MEASURES AGAINST OVER-SUBCONTRACTING

The excesses seen in subcontracting since 1980s have reached alarming levels in terms of workers' rights. In order to eliminate these excesses, certain measures were tried to be taken with Labor Law No. 4857 (Şakar, 2008; Şen, 2006).

These measures may be listed as:

- Primary job-auxiliary job[1] difference was made, and while there are no restrictions on the use of subcontractor in auxiliary jobs, use of subcontractors in primary jobs is accepted to be possible only in jobs that require specialization for technological reasons necessitated by the business and the job.
- It was foreseen that the primary employer cannot restrict the rights of workers by getting them employed by a subcontractor.
- It was ensured in the Law that anyone that had worked in that business cannot establish a subcontractor relation.

Otherwise and generally, in situations where the primary employer-contractor relation is determined to be based on fictitious 2transaction, the employees of the subcontractor will be regarded as the employee of the primary employer since the beginning. Labor Law No. 4857 foresaw these measures but the measures in question were inadequate and ineffective thanks to the lack of penal sanction. This deficiency was tried to be filled with Law No. 5763 and Ministry of Labor, and Social Security was given an important task of inspection on this issue.

According to the Additional paragraph of the Article 3 of Labor Law No. 4857 with Law No. 5763: *".... subcontractor is obliged to make notification according to the first paragraph provision with a written subcontracting agreement and necessary documents obtained from the primary employer for the registration of his/her working place. These documents belonging to the said workplace that are registered by the regional manager are examined by labor inspectors when necessary. In the event that fictitious transaction is determined after the examination, justifiable inspector report will be communicated to the employers. Employers may object to the authorized labor court for this report within thirty working days from the date of notification. The case to be settled on objections is concluded within four months according to the petty court procedures. In the case of an appealing decision by the court, the Supreme Court will render a final verdict within six months. It is obligatory that Public Administrations will object to the authorized labor courts for these reports and apply to other legal remedies against court decisions. If the report is not objected to within thirty working days or the court approved of the determination of fictitious transaction, the registration process will be cancelled, and the employees of the subcontractor will be accepted as the employees of the primary employer.*

Subcontracting Regulation3 was published on the codes of practices of the regulation. In addition, administrative fine obligations have been imposed on employers or employer representatives who violate the obligation to make notifications. Separate administrative fine provisions have been introduced to the primary employer, subcontractor and their

[1] Primary Work refers to the work that constitutes the basis of goods and services production (Subcontracting Regulation, a.3/c). Auxiliary Business refers to businesses that are related to the goods or services production carried out in the workplace but not directly in the production organization and that is not a compulsory factor of production but continues as long as the primary business does... (Subcontracting Regulation, a.3/ğ).

[2] Simulation refers to giving primary jobs that do not require specialization in goods and services production to subcontractors (Subcontracting Regulation, a.3/g).

[3] RG. 27.09.2008-27010.

representatives who notify their workplace fictitiously. These legal measures were severely criticized by employers (Aktekin, 2008) and requests for changes were expressed4. The measures foreseen by the law were rendered de facto unenforceable due to the employer reactions. In the additional paragraph to the Article 3 of the Labor Law, it was mentioned that as the inspection should be done *"when necessary"*, it is not usually carried out in practice and inspection practices are subdued to the economic crisis and unemployment reasons (Şakar, 2010).

5. PROBLEMS CAUSED BY OVER-SUBCONTRACTING

Despite the views that place the start of the subcontracting practice in our country within the Code of Obligations no. 818 dated 1926, the most common view regarding the start of the practice is with the Labor Law no. 3008 dated 1936 (Narmanlıoğlu, 2008). The subcontracting venture is subject to intense and heated discussions for working relations and contains many complex factors within it. It also displays an extremely regular increase in practice as it reinforces the impression that it will be a constant and inseparable part of our legal system. Along with the unfair practices seen in subcontracting, the increase in the work-related accidents among subcontracting employees has caused the institution of subcontracting as an instrument for rasping workers' rights. Unfortunately, the need for legal regulations towards solving these problems has not been properly met (Koç, 2018). Especially the fact that the number of subcontracted workers is so much higher compared to other problematic employment models such as on-call working, part-time working, temporary working relationship, indentured working increases the intensity of the problems and significance of the issue. Looking at other atypical employment models, it can be said that the practice that pit the employers against employees the most is subcontracting, because situations such as the detection of fictitious transaction or the legal validity of the contract arise in subcontracting relationship the most (Durmaz and Özdemir, 2019). Over-subcontracting leads to important problems related to working life. Essential problems will be focused on below.

5.1. Subcontractor Employees' Establishing and Becoming a Member of Unions

Law of Trade Unions and Collective Bargaining Agreement No. 6356 does not either contain a regulation on subcontractors or bring a limitation to subcontractors or their employees on unionization or becoming a member of unions. As a natural result of this, the subcontractor has the right to establish an employer union or become a member of such union within the framework of the principles set out in the Law. The same is valid for the employees of the subcontractor. According to the views of subcontractor employers considering the workplace they work in completely different than their primary employer; the employers of subcontractors will have the right to be a member of a union for whichever profession they enter. If the workplace of the primary employer is in the same line of business as the subcontractor, the employees of the subcontractor will have the right to become a member of a union in that same line of business. If the lines of business are different, the employees of the subcontractor can only be a member of a union that is in the same line of business with their workplace (Canbolat, 1992; Tuncay, 1991; Ekonomi, 1991). However, according to the view that considers the workplace of the primary employer to be the same as the workplace of the subcontractor; subcontractor employees can be members of a union in the line of business of the primary employer (Kutal, 1990). Beyond these different views, when the divided and minimized organizational structures of subcontractor employees are taken into consideration, the fact that they are deprived of inner interaction and strength to be a member of unions is one of the most important obstacles to their unionization. Subcontracting practices lead to important problems in terms of union rights. It can even be said that fundamental principles on which these rights are based have disappeared. Because the existence and use of fundamental social rights recognized to employees depend on the existence of an employee community that works in a similar status at the workplace, business or even line of business. The establishment of unions to protect the joint interests of those who have solidarity requires the existence of a particular community of employees. However, subcontracting practices have lost these characteristics; they consist of employees in different statuses that have no joint interest or a particular solidarity. This sociological phenomenon makes unionization impossible or remains weak. In cases where the main purpose of subcontracting is de-unionization of workers, this phenomenon that we try to explain gains even more remarkable sense. For example, 98% of workers that work in petroleum, chemistry, plastic lines of business work without unions (Güzel, 1993).

5.2. Problems Reflected in the Individual Rights of Employees

It is unquestionably clear that the excessive spread of subcontracting lead to negative consequences of subcontractor employees. First of all, inequality arises among employees working in the same workplace. Employees in two different statuses are in the same economic body. One group (employees of the primary employer) forms a privileged group compared to the other group (subcontractor employees) due to the rights and assurances they have. The group's rights such as union membership, collective agreement and strikes deepen this inequality. Again, there is a major imbalance between employees

4 http://www.tusiad.org.tr/FileArchive/2009.07.23-Esneklik_TISKTOBBTUSIAD Ortak GorusRevizeMetin.pdf; TİSK, TOBB ve TÜSİAD'ın Esneklik Konusundaki Ortak Görüş ve Önerileri (Gözden Geçirilmiş Metin)

of subcontractors and primary employers in terms of wages and other social benefits. Subcontractor employees are often employed at very low wages. Their inability to benefit from collective bargaining increases the wage imbalance further. The same is true for rights in terms of the employee's seniority in the workplace. Subcontractor employees are generally employed for short periods of times, leading to their deprivation of rights such as annual paid leave and severance pay. There are also significant differences between the two groups of employees in terms of working conditions. It is observed that subcontractor employees are employed in heavier conditions and their resting periods also vary (Kutal, 1990). On the other hand, subcontractor employees are not exactly benefiting from the right to Social Security. The vast majority of them are employed uninsured-unregistered. In addition, the insured subcontractor employees are not fully entitled to Social Security rights. It should be noted that benefiting from these rights requires not paying a premium for a certain period of time; it can be clearly seen that many subcontractor employers are far from fulfilling this condition considering that they are employed for very short periods. In all these aspects, the problems of the workers employed by the subcontractors gain broad and complex dimensions, and there is a danger of labor becoming a commercial commodity again (Güzel, 1993).

5.3 Over Spread of Subcontracting Practices in terms of Employers

Subcontracting practices provide a wide range of economic opportunities for employers in the short term. Because they have the opportunity to reduce labor costs and put businesses in a more flexible and profitable position. Furthermore, subcontracting practice significantly removes employers from the obligations stipulated by individual and collective labor law. For example, issues such as dismissal and related severance pay, wage increases resulting from collective agreements, pressure of strike in collective labor disputes are just a few of the issues employers complain about. In spite of these advantages, it is also necessary to keep in mind the effects of excessive subcontracting on long-term working peace and social peace, and increasingly reducing productivity (Okcan and Bakır, 2010).

5.4. Inadequacy of the Current Legal System

As in other countries, Turkish Labor Law has been formed and developed according to a specific employment model. This model can be described in its simplest terms as follows: employer hires workers to employ them in their own workplace and with their own means of production. All staff employed within the same manufacturing unit (workplace) have the same and only employer. Certain rights (assurances against layoffs, notice periods, severance pay, annual paid leave etc.) and protective peremptory regulations (occupational health and safety, working times etc.) are generally provided for workers that work for an indefinite time according to their length of service in the workplace. All these are the mainstays of contemporary labor law. The concepts and institutions of this branch of law are shaped according to the employment model, which is reminiscent of the basic lines. Here, subcontractor practices and other new forms of employment have radically changed this model and have not been successful in comprehending the new model. The basic concepts of labor law, such as *workplace* and *employer*, are largely inadequate in giving what is expected. The fact that the primary employer and the subcontractor meet in the same unit of production leads to the emergence of two separate employers according to the current regulation. In these workplaces, there is a community of workers who are connected to more than one employer with different status. Two different employment models are together. One is the Employment Market, which Labor Law grasps and contains norms according to it; the other is the *Externalized* or *Fragmented* Employment Market. There is a legal loophole in terms of the latter. In other words, a Parallel employment market like "Parallel Economy", that is not fully comprehended by the legal order next to the Employment Market recognized by the legal order, therefore open to non-legal practices have emerged (Güzel, 1993; Güzel, 2010). Contrary to hopes and expectations that a new and contemporary Labor Law will minimize the debates, the most debate causing provisions of Labor Law No. 4857 are the sixth and seventh paragraphs of the article 2 in which primary employer and subcontractor relations and their limitations are regulated. Arguments witnessed during the legislative process also exist after the enactment of the law5 (Güzel, 2004). Unfortunately, neither the employers or the employees are satisfied with legal regulations. Turkish Confederation of Employer Associations (TİSK) expresses the following views in a publication on the subject (TİSK, 2012);

"Since 2003, when the Labor Law No. 4857 was published .... The amendments to the law and the subsequent secondary legislation have been amended by ignoring that primary employer-subcontractor relation is an indispensable mechanism of the economic and working life and prepared the deadlock experienced today."

Legal loopholes and inadequacies are sought to be partially remedied by provisions and judicial decisions laid down in collective bargaining agreements. The Supreme Court ruled in 2016 that the employer's authority to provide work to subcontractors could be limited by provisions set out in the collective bargaining agreement. According to the Supreme Court,

5 For an extensive literature review on this topic, see.: Güzel: 2004: 31.

"Some of the provisions on the mutual rights and debts of the parties are provisions for the parties to perform duties in good faith in collective bargaining agreements. The most important of them is "peace debt (protecting working peace)". Each collective bargaining agreement includes peace debt, even if it is not explicitly included among the provisions governing the mutual rights and debts of the parties (Sur, 2011). It has the protective feature of peace of work with this aspect. The records for the implementation and supervision of the collective bargaining agreement are in the category of debt relation provisions.

In the event that one of the parties of the Collective Agreement does not claim and prove that declaration of intention for the collective agreement enterprise if flawed, in other words, the declaration is made as a result of faults and tricks, collective agreement provisions are valid for the employer, the union and union member worker.6

In this case, with this provision of collective bargaining agreement, it is limited that the employer goes to the practice of subcontracting in continuous and certain term jobs.

The provision of the contract that the employer cannot apply to the practice of the subcontracting with the Collective Bargaining Agreement is a debt-bearing provision. This provision is valid because it provides that the employer does continuous work with his or her own workers and prohibits the application of the exception. It cannot be thought that this provision completely eliminates the employer's freedom of interference. As stated, the main thing in the workplace, whether it is the primary work or the auxiliary work, is that it performs these jobs with its own workers. The employer must comply with this debenture provision.

As a result, since the Collective Agreement between parties covers the subcontracting practice, it should be interpreted in this direction... in the event that defendant employer is confirmed to give jobs to the subcontractor all the time in contracts regarding the subcontractor, this discrepancy should be decided to be eliminated in the scope of livelihood debt, and keeping working peace.7

As can be seen, the Supreme Court accepted the collective bargaining agreement provision regarding not giving the principal work and auxiliary work to the subcontractor as the debt-bearing provision and found it to be in accordance with the law. According to the High Court, the provision also does not completely eliminate the employer's freedom of interference (Sümer, 2018). The right to regulate the conduct of work and worker behaviors with orders and instructions on condition that the employer complies with the law, collective agreement and labor contract is called the employer's right to govern (Süzek, 2017; Mollamahmutoğlu, et al. 2017). The employer may issue orders and instructions to the workers based on this right. The employer's right to management may be restricted by collective bargaining agreements. Collective bargaining is above the employer's management right in the ranking of resources. Therefore, the employer cannot exercise the right of management in violation of collective bargaining agreements (Süzek, 2017).

The employer may make various operational decisions based on the right to management. The subcontracting of a part of the auxiliary work or the primary work in the workplace is also among the operational decisions that the employer can take. A limit can also be imposed on the operational decisions taken by the employer by collective bargaining (Sümer, 2018).

5.5. Recent Legal Regulations Regarding the Subject

Labor Law no. 4857 has been amended many times since it came into force in 2003, but the articles that regulate the primary employer-subcontractor relationship in the law no. 4857 have been maintained despite the fact that the huge demand from employers and their demand for more flexibility have not been met in the legal regulation. This attitude of the legislator can be said to be caused by work-related accidents seen among subcontracted employers. In fact, Subcontractor Regulation that contains regulations in favor of workers came into force in 2008 and stayed in force without any amendments to this day. In other words, the public pressure caused by the constant death of workers has persuaded political authorities to make regulations in favor of employees (Odman, 2008). Similarly, after the mining accident in Soma in 2014 that resulted in the loss of 301 mining workers, law no. 6522 was made, and many amendments have been made to the Labor Law no. 4857. These amendments include three regulations that directly affect the subcontractor relationship. The fifth paragraph of the Article 36 of Labor Law no. 4857 has been amended to be, "In the event that employers give work to the subcontractor, they are obliged to control ex officio whether the payments of the employees are made on workers' demand or monthly and deposit the unpaid money into the workers' bank account by cutting from the deserved money," through law no. 6552. It is possible to assess this amendment as reinforcing the existing responsibility of the primary employer and thus as a regulation in favor of the worker. Again with the same law, a new paragraph was added to the article 56 of the Labor Law and in the event that the subcontractor is changed, in calculating the annual paid leave right of the subcontracted worker that continue

[6] Y9HD. T. 29.03.1991, E. 1991/6488, K. 1991/ 6704.

[7] Y9HD. T. 31.05.2016, E. 2016/16706 K. 2016/12873.

to work in the same workplace the total seniority of the worker will be taken as a basis. With law no. 6552, extensions were made to the article 112 of Labor Law no. 4857 and detailed regulations were made on the severance pay rights of subcontracted workers that are employed in public workplaces (Durmaz and Özdemir, 2019).

6. CONCLUSION

The subcontracting relation in Turkey has been observed to become widespread in practice since the 1980s (Şafak, 2004). Indeed, the high-speed change based on technology in the world economy and the Turkish economic structure has brought the subcontracting practice to a position where it is sought after persistently and made it an important part of the new business relations (Tozlu and Eraslan, 2012). As a result of the transformations in the dynamics of the economy, subcontracting continued its prevalence with reasons such as it contributes to decreasing production costs due to dividing the job and it is a flexible working form (Tozlu and Eraslan, 2012). It is possible to predict that this development will inevitably continue in the face of the international aspect and pace of the competition. Subcontracting is an important option for companies in that it enables them to increase their employment capacity by using the expert workforce flexibly, in other words, to provide businesses with the opportunity to *"focus on the job they are most successful in"*. It is also possible to meet sudden demand increases quickly by using subcontractor facilities. For SMEs, the opportunities offered by subcontractor practices are of greater importance and contribute to the retention of these businesses by sharing financial and organizational risks. However, the fact that the primary employer and the subcontractor share the same business environment and are part of the same supply chain leads to various problems. The problems encountered in the primary employer and subcontractor practices in our country are the source of serious disputes for public and private sector workplaces and constitute one of the main areas of discussion of working life. After subcontracting practices have gained a rapid currency, practices for restricting the worker rights in collective bargaining law and other observed troubles have led to continuous solution-seeking in the legal area, detailed regulations have been made, but misconduct methods against the changing legal norms achieved to change and continue with proficiency (Güller, 2015). When considering the practice examples especially in recent years, subcontracting practices have eluded from the qualification that jobs that require specialization other than the primary job should be given to the organization of another employer and turned into a common employment model that cause the labor market to break apart and even put unions out of action (Özveri, 2008). These problems also have disruptive effects on the fundamental balances of the Industrial Relations System. The problems caused by these disruptive effects actually affect employers as closely as they do workers. Deteriorating social balances can also lead to damage in working peace. The widespread use of subcontracting to enforce legal limits risks labor becoming a commercial commodity and exploitation again. The aim of protecting the most fundamental rights and values of the contemporary society, together with economic and technological imperatives, should be observed simultaneously.

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THE EFFECTS OF PERSONALITY TRAITS ON FINANCIAL BEHAVIOUR

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ABSTRACT

Purpose- The development of financial markets, the complexity of financial products and services, the differences in individual investor profile increase the importance of estimating the financial behaviour of individual investors. The aim of the study is to determine the effects of individual investor's personality traits on their financial behaviors.

Methodology- A questionnaire designed to evaluate the personality traits and financial behaviours of individual investors was used. The data set consisted of 1347 individual investors through survey method. We performed multiple linear regression to examine the hypothesized relationships.

Findings- According to the statistical results of the research, the dimensions of personality traits such as conscientiousness, agreeableness and openness to experience have positive and significant effects on financial behaviour. But extraversion and neuroticism have not significant effects on financial behaviour.

Conclusion- The results of the study emphasize the importance of personality characteristics in explaining financial behaviours. Personality traits are important factors that financial institutions should focus on when offering products and services related to individual investor portfolios.

Keywords: Behavioral finance, financial behaviour, personality traits, financial risk tolerance, financial literacy.
JEL Codes: G00, G40, G41

1. INTRODUCTION

Financial behaviour can be defined as the expenditure, saving, investment and planning actions of the individual in the financial fields. The development of financial markets, differences in investor profile and complexity of financial products increase the importance of estimating the financial behaviour of individual investors. Financial behavior, which is the focus of interest of researchers for the reasons stated, has attracted interest from both microeconomic and macroeconomic aspects by researchers and policy makers. Financial attitudes and behaviours have an effect on financial decisions on monetary issues such as expenditure, saving, budgeting and investment. Financial decisions of individuals are effective on financial welfare levels. In order to make the right decisions on the management of money, such as the evaluation of investments in the right investment tools, spending and savings, it is necessary for individuals to increase their financial literacy levels and evaluate their decisions in terms of risk, return and cost. Many studies based on classical finance theory have used demographic and socio-economic factors to explain financial behavior (e.g., Bajtelsmit and Bernasek, 1996; Powel and Ansic, 1997; Wang and Hanna, 1997; Grable and Lytton,1998; Dwyer et al., 2002; Hallahan et al., 2004; Grable and Joo, 2004; Roszkowski and Grable, 2005; Jianakoplos and Bernasek, 2006; Anbar and Eker, 2010; Gong and Yang, 2012; Larkin et al., 2013; Lan et al., 2018). The inadequacy of classical finance in explaining the financial problems and market anomalies faced by individuals caused new theories to emerge. Developed behavioural finance models against the effective market hypothesis argue that individuals are not fully rational and subject to some psychological tendencies while making decisions on financial matters. For this reason,

not only economic reasons but also psychological and sociological factors should be taken into consideration when examining individuals' financial attitudes and behaviours.

There are many internal and external factors affecting the financial behaviour of individuals. One of the internal factors that influence financial behaviour is personality. Personality is a relatively permanent form of individual thoughts, emotions, motives and behaviours (McCrae and John, 1992). Several dimensions related to personality have been revealed by the researchers. Goldberg (1990) stated that five strong factors emerged in his study based on adjectives in the dictionary and suggested that personality research could be organized within the framework of these five strong factors.

Personality traits are one of the important psychological factors affecting the financial behavior of individual investors. Individual investors may be considered as investors who are trading in financial areas on their own behalf. Unlike institutional investors, individual investors may be more affected by psychological and sociological factors. This research focuses on the effect of personality traits in determining investor behaviour that rational models do not provide sufficient explanations under the behavioural finance perspective. The paper contains sections suitable for scientific flow. The review of the relevant literature is provided in the second section. The third section includes data and methodology. In the fourth section, findings and discussions are given. The last section indicates the conclusion and recommendations.

2. LITERATURE REVIEW

2.1 Financial Behaviour

Financial behaviour, in the most basic sense, can be thought of as monitoring individuals' financial conditions, making careful purchases, managing their loans, savings and investments (Alkaya and Yagli, 2015). Hilgert, Hogarth, and Beverly (2006) divide financial behaviour into four basic sub-factors; cash management, credit management, savings and investment. The findings of the study characterize financial behaviors as hierarchical. The types of financial products owned by individuals can provide information on how well they manage their personal financial resources and how financially responsible and forward-looking. This conclusion is consistent with other studies show that budgeting, controlling expenditure and forward thinking are indicators of responsible financial behavior for specific actions (Perry and Morris, 2005). The effects of factors such as financial information, locus of control and income are examined on individual behavior. As a result, financial knowledge and locus of control have a significant effect on financial behavior, while income does not have the same effect (Arifin, 2017). There are studies suggesting that financial information acquired at an early age may affect subsequent financial behaviour. Kotlikoff and Bernheim (2001) investigated a sample of consumers in the highest earning periods (30-49 years) and showed that adults attending private financial education schools caused more financial behaviours towards non-educated adults. Kubilay et al.,(2016) examined the personality traits, psychological tendencies and financial risk tolerance of the individual investor. It was stated that there was a significant relationship between the personality traits and psychological tendencies of the investors and the personal characteristics affect the financial risk tolerance. Financial literacy is a concept beyond financial information, which is defined as the development of financial consciousness and understanding of financial concepts and procedures (Potrich et al., 2016). Lusardi's study (2008) examined the saving behaviour of American households and report that the effect of the low financial literacy and lack of education on savings behaviour. Financial education programs and financial advice are not only for individuals' savings for retirement but also suggests that children will be able to increase their special savings, which will help them against the suddenly loss of their education or income.

2.2. Personality Traits

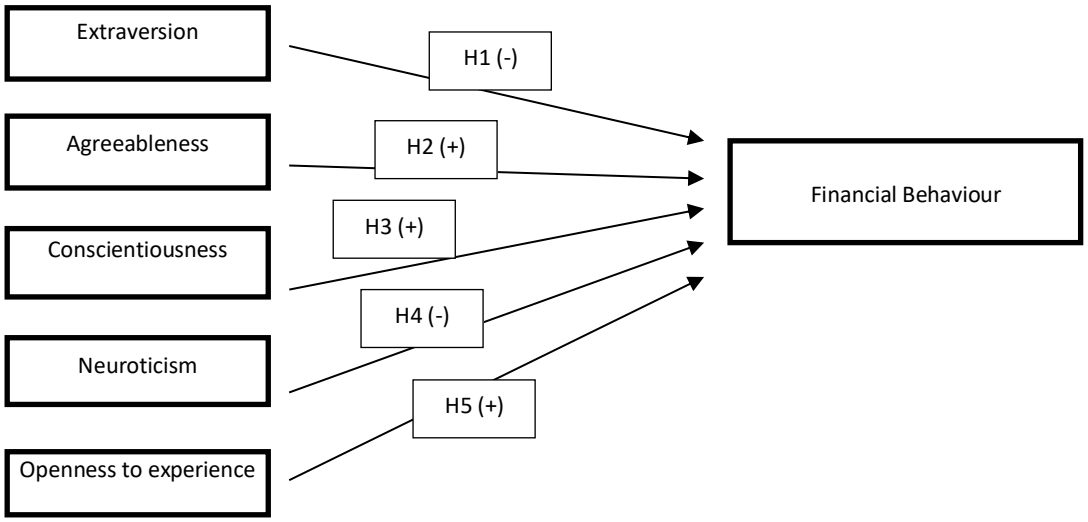
Personality can be defined as one of the fundamental psychological factors that shape human behaviour. Personality is taken partly genetically inherited from parents (Raheja and Dhiman, 2017). However, many factors such as social environment, family, geographical and physical conditions can be effective in personality development. For this reason, it can be said that individuals have different personality traits which are one of the main reasons for developing different perceptions or solutions against the same events (Erkuş and Tabak, 2009). Goldberg (1990) stated that five powerful personality traits called the"big five" emerged and personality researches could be organized within the framework of these five strong factors. Accordingly, the first dimension of the five personality model is extraversion. The extravert people are more social, more active and impulsive, less dysphoric, less introspective and self-preoccupied with ones compared to inward individuals (Watson and Clark, 1997). The second dimension of the model is agreeableness. Agreeableness includes many aspects such as socially preferred trust, forgiveness, helpfulness, and friendlyness. Disagreable individuals are more skeptical, self-centered and cruel (Costa and McCrae, 1992). Conscientiousness which is the third dimension of the five factor personality model, can be defined as diligent, responsible and careful, planned and organized. It is also associated with success, order and persistence as well as the degree of self-control (Costa, McCrae, and Dye, 1991). According to Costa and McCrae (1992b), the fourth dimension of neuroticism is examined in six sub-aspects: anxiety, hostility, depression, self-consciousness, vulnerability and impulsivity. Individuals with a high score of neuroticism probably have a variety of problems, including negative moods and

physical symptoms. The final dimension of the model is openness to experience. It is about creativity, imagination and innovation(Zhao and Seibert, 2006). Individuals who are not open to experience are generally more narrow-minded and traditional. Choosing a new experience can be seen as a cognitive stimulus as it involves taking risks(McCrae and Costa, 1997). Although personality is generally associated with attitudes and behaviours, a limited number of studies focus on the effect of personality on financial issues. Davey and George (2011) examined the effects of personality traits on financial attitudes and behaviours and it is stated that conscientiousness and extraversion affected their savings and borrowing behaviours more than others. In line with expectations, conscientiousness and locus of control is found to have a profound effect on both financial attitude and behaviour. Agreeableness, openness to experience and neuroticism were also important, while extroversion was shown to affect normal saving behaviours. Oehler et al. (2017) analyzed the effects of extraversion and neuroticism degrees on decision making processes in the experimental asset market. The authors found that extraversion and neuroticism significantly affected individuals' behaviours in the experimental entity market. Less extroverted individuals buy less assets and pay lower prices for financial assets. Less neurotic individuals have more risky assets in their financial portfolios than more neurotic individuals. According to Tauni et al.(2017), which examined whether the personality traits of the individual investor affect the relationship between knowledge acquisition and stock trading behaviour, it showed that personality traits direct the relationship between buying and selling behaviours of stocks. This research confirms that traders who obtain more information are more likely to trade in stocks. The acquisition of information tends to increase the trading frequency of investors who have conscientiousness, extraversion, and agreeableness personality traits. The individuals who have different personality characteristics also have different financial risk tolerance levels and these different personal properties ultimately affect the financial behaviour in the form of different savings and savings amounts. This key finding promotes the more study of psychological factors between financial risk tolerance and financial behaviour (Pinjisakikool, 2018). When the studies investigated the relationship between personality and financial risk tolerance, it was stated that there was significant relationship between personality traits such as extraversion and openness to experience, and other personality traits in which there is no positive relationship with financial risk tolerance (Pak and Mahmood, 2015). Soane et al. (2010) found that personality affects choice behavior both directly and through perceived costs and benefits.

2.3. Hypotesis Development and the Research Model

In general, researchers defined the significance of five dimensions to separate individuals into definite personality classifications (Digman, 1990). The five dimensions of the Big Five Model classify extraversion, agreeableness, conscientiousness, openness to experience and neuroticism. Different results have been obtained from the studies investigating the relationship between personality traits of the individual investor and its financial behaviour. As a result of the literature research and previous experimental researches, the research model developed to estimate the impacts of individual investors' personality traits on their financial behaviour as shown in figure 1.

Figure 1: Research Model



The hypothesis of the study was developed by taking into consideration the characteristics of the big five personality traits. The extraversion personality dimension represents the level of sociality and affinity of the individual. The basic characteristics of extraversion are more prone to experience warmth, initiative, aggressiveness, excitement and positive emotions. Extraverts tend to be risk averse and continue holding losing stocks with the hope of revival (Jamshidinavid et al.2012). Zaidi and Tauni (2012) studied the individual investors to detect the relation among overconfidence bias, demographics and personality traits. According to the results of the study, extraversion with overconfidence bias is positively related. On the other hand, Asebedo (2018), investigating the relationship between personality traits and financial behaviour, found the relationship between extraversion and financial behaviour negative. We anticipate that extraversion personality dimension affects the financial behavior of the individual investor negatively. Thus we hypothesize that;

H1: The extraversion negatively affects the financial behaviour of the individual investor.

The agreeableness personality dimension is more related to interpersonal relationships and it is close, social and trustworthy against other individuals. Nga and Yien (2013), found that conscientiousness, openness and agreeableness have a significant influence on risk aversion. According to Davey and George (2011), financial attitudes with agreeableness seems to have a significant relationship with financial behaviour. So the next hypothesis is;

H2: The agreeableness positively affects the financial behaviour of the individual investor.

The dimension of conscientiousness refers to individuals' planning, attention and degree of self-control exhibited. The study investigating the relationship between personality traits and financial behaviour, determined the relationship between conscientiousness and financial behaviour positive (Asebedo, 2018). According to Donnelly et al. (2012), conscientious individuals are successful in managing their money and financial attitudes and conscientious individuals have positive retirement planning and savings behaviour. (Hershey Openness to experience Mowen 2000), Hence the next hypothesis is;

H3: The conscientiousness positively affects the financial behaviour of the individual investor.

Neuroticism refers to whether the individual has an emotional balance. The neurotics tend to experience negative emotions such as emotional imbalance, anxiety, depression and anger. Mayfield et al. (2008) found that individuals with this personality trait had a propensity to avoid short term investing. Accordingly the next hypothesis is;

H4: The neuroticism negatively affects the financial behaviour of the individual investor.

Openness to experience represents the tendency to participate in intellectual activities and to be open to new feelings and thoughts. Mayfield et al. (2008) found that individuals with this personality trait had the propensity to engage in long term investing. Openness have a strong relationship with risk taking (Kowert and Hermann, 1997). In the view of these researches, we expect that openness personality dimension affects the financial behaviour of the individual investor positively. So we hypothesize that;

H5: The openness to experience positively affects the financial behaviour of the individual investor.

3. DATA AND METHODOLOGY

The focus of this study is to measure the effect of personality traits on the financial behaviour of individual investors. In this study, the scale of personality inventory developed by Goldberg (1990) was modified and then used to measure in order to measure five factor personality types. The personality traits scale was grouped under five factors and consisted of 35 items. Financial behaviour scale which developed by Potric, Ani, Caroline Grigion, Kelmara Mendes Vieira, and Weesley Mendes-Da-Silva (2016) was modified and consisted of 9 items. Because of these scale changes, we conducted an exploratory factor analysis to see to what extent these items would be accumulated in the same factors.

In this study, the research data were collected through a questionnaire and the financial behavior of individual investors was measured. The hand questionnaires were delivered to banks, government agencies, hospitals, schools and private or state universities. Two pilot studies were fulfilled. In the first one, consisting of 154 participants, was comprised on academicians and teachers in Kocaeli, İstanbul and Bursa in Turkey. The second pilot study was conducted with 52 officers and academicians from Istanbul and Kocaeli. These pilot studies aimed to examine the factor structures of the variables.

In the original study, sample consisted of 1347 individual investors over the age of 18 and selected according to the random sampling method. Sampling was constituted from certain major cities in Turkey, including Istanbul, Kocaeli, Ankara, Izmir, Bursa and Karabuk. Participants were chosen among academicians, businessmen, managers, university employees, teachers, officers, public–private sector employees and retired people. We did not include participants if they are under 18 ages and financially depend. Sampling descriptive statistics showed that 43,5 percent of the participants were female and (44 percent) were bachelor's degree and 25-50 age range. Nearly, 66 percent of the participants are married and 34 percent are single.

The income level of the participants is 4000 Turkish Liras (12,5 percent) and 5000 Turkish Liras(15 percent). The questionnaire consisted of 5-point Likert scale questions to measure the participants' personality traits and their thoughts on financial behaviour. Kaiser-Meyer-Olkin and Bartlett Tests were conducted to decide the suitableness of the scale for factor analysis before explanatory factor analysis. Before the explanatory factor analysis, tests were conducted to determine the suitability of the scale for factor analysis. Kaiser-Meyer-Olkin (KMO) value, which shows whether the factor analysis is adequate and whether the sample is sufficient for analysis, was obtained as 0.932. In this study, principal component analysis revealed no restriction on the number of factors and a total of 6 factors appeared. As a result of the analyzes made in this scope, the factor structure seen in appendix 1 has emerged. Factor loadings of the items formed using Promax rotation method and Cronbach's alpha values of factors in the analysis are shown in Appendix 1. The means, the standard deviations and the correlations of the variables can be seen in Table 1. As seen the the pearson correlation coefficients in Table 1, all variables except the neuroticism have significant relationships with each other at the level of p <0.05 and p <0.01. Considering these coefficients, the conscientiousness relationship with financial behaviour is higher than the relationship with other categories.

Table 1: Correlations

Variables	Mean	S.D.	1	2	3	4	5	6
1.Financial Behaviour	3,8490	,74294	1	,352**	,439**	,307**	,174**	,000
2.Agreeableness	3,8942	,66853	,352**	1	,654**	,430**	,276**	-,115**
3.Conscientiousness	4,0415	,72746	,439**	,654**	1	,547**	,232**	-,054*
4.Openness	3,7702	,78210	,307**	,430**	,547**	1	,384**	-,042
5.Extraversion	3,2750	,70992	,174**	,276**	,232**	,384**	1	-,143**
6.Neuroticism	2,8957	,85269	,000	-,115**	-,054*	-,042	-,143**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4. FINDINGS AND DISCUSSIONS

In order to test the hypotheses multiple linear regression analysis was used through IBM SPSS Statistics 21. The regression equation, in which the effect of individual investor's personality traits on financial behaviour, was found to be statistically significant (F=70,610; p<, 000). According to table 2, for the significance of the independent variable, it can be stated that the t-test is significant at level p <0.05 for the conscientiousness (β=, 328; p<, 000), agreeableness (β=, 099; p<, 003) and openness to experience (β=, 068; p<, 027). Neuroticism and extroversion were not significant at level p <0.05 significance level. These findings required acceptance of hypotesis 2 "The agreeableness positively affects the financial behaviour of the individual investor", hypotesis 3 "The conscientiousness positively affects the financial behaviour of the individual investor" and hypotesis 5 "The openness to experience positively affects the financial behaviour of the individual investor". These findings also require the rejection of hypotesis 1 "The extraversion positively affects the financial behaviour of the individual investor" and hypotesis 4 "The neuroticism positively affects the financial behaviour of the individual investor".

This means that the conscientiousness, agreeableness and, openness to experience personality traits have positive impact on the financial behaviour of the individual investor. According to the results of the analysis neuroticism and extraversion personality characteristics have no effect on financial behaviour. The beta coefficients of significant variables are 0.328 (conscientiousness), 0.099 (agreeableness) and 0.068 (openness to experience). The highest coefficient value is the conscientiousness which shows that it is one of the most crucial determinants of financial behaviour. The one-unit increase in conscientiousness leads to a positive change of 0.328 points against financial behaviour.

In this study, the effect of individual investor's personality traits on financial behaviour was analyzed by regression analysis of the data obtained from 1347 investors. According to the findings of the analysis; the personality dimensions of conscientiousness, agreeableness and openness to experience on the financial behaviour of the individual investor have a statistically significant effect. However, extraversion and neuroticism have no significant effect on the individual investor's financial behaviour. This result is consistent with the results of many studies (Donnely et al., 2012, Nga and Yien, 2013; Asebedo, 2018) in the literature. On the contrary, there are studies suggesting different results. For example, the studies on the effect of extraversion and neuroticism degrees on decision making processes in the experimental asset market and on financial risk tolerance, the authors found significant effects (Oehler et al., 2017); (Pak and Mahmood, 2015). Pinjisakikool (2018) stated that encourages further study of the psychological factors between financial risk tolerance and financial behaviour. The research are revealed that individuals with different personality traits have different levels of financial risk tolerance and these different personal characteristics ultimately affect financial behaviour in the form of different savings

and savings amounts (Pinjisakikool, 2018). Conscientiousness, agreeableness and openness to experience simultaneously affect the financial behaviour in a statistically significant and positive way, but the beta coefficients are different. Conscientiousness (β= ,328) has more effect than the other two dimensions. This finding supports many studies in the literature(Donnely et al., 2012; Asebedo,2018; Asebedo et al., 2019).

Table 2: Results of Regression

Financial Behaviour			
Independent Variables	**Beta**	**t**	**p**
Extraversion	,050	1,871	,062
Openness to experience	,068	2,210	,027
Conscientiousness	,328	9,393	,000
Agreeableness	,099	3,014	,003
Neuroticism	,039	1,596	,111
F	70,610		,000
R Square	,208		
Adjusted R Square	,205		

5. CONCLUSION

Attitudes and behaviours related to financial issues have a significant impact on the financial well-being of individuals. In order to make the right financial decisions, it is important that individual investors have all the information they may need in financial matters, and that financial institutions should guide to investors about correct financial behaviour. Individual investors often receive support from financial institutions in creating their investment portfolios. When conducting consultancy services for financial institutions, they should create a special portfolio for the investor in line with the expectations of the individual investor. In order to achieve this, financial institutions need to establish systems that will enable them to know their customers well. This study deduces that there is a direct relationship between the personality traits and financial behaviours of investors. Among the various elements of personality traits, conscientiousness, agreeableness and openness to experience were found to be related to financial behaviour. Individual investors with different personality characteristics make different kinds of investments in line with their needs and exhibit different financial behaviours. Personality traits are a factor that financial institutions should focus on to establish a relationship between investor and investment products. Financial institutions should take into account the psychological characteristics of individual investors when designing their financial products. Financial advisors should advise individual investors to avoid fear of investment results that may arise from lack of information or other reasons. Financial advisors also should provide information to investors for developing financial strategies that are appropriate to investor's personalities.

6.RECOMMENDATIONS

Future research should take into account models of financial risk tolerance and financial behaviour that simultaneously investigate psychological and attitudinal factors.

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Appendix 1: Results of Factor Analysis

Expressions	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness to Experience	Financial Behaviour
I'm a cheerful person	0.695					
I feel very comfortable myself in the community.	0.673					
I like to talk to strangers.	0.571					
I always start chats.	0.793					
I describe myself as extroverted.	0,532					
I like to be in the foreground.	0,709					
I make an effort to draw attention.	0,672					
It makes me happy to be the center of attention.	0,713					
I understand people's feelings and troubles.		0.680				
I take care of people.		0.876				
I take time for others		0.856				
I can feel others' feelings.		0,837				
I get along with people.		0,679				
I'il make people feel better.		0,683				
I make people relax		0,571				
I fulfill my responsibilities on time.			0.895			
I'm always ready to take responsibility.			0.798			
I'm careful about the details.			0.676			
I work programmed to fulfill my responsibilities.			0.850			
I'm meticulous about my work.			0.857			
I take responsibility in my job.			0,648			
I don't run out of my responsibilities.			0,772			
I enjoy fulfilling my responsibilities under all circumstances.			0,804			
I'm usually responsible.			0,853			
I'm easily stressed.				0.786		
My mood is very variable.				0.783		
I'm easily upset.				0.618		
I'm just angry.				0.804		
I often feel sad.				0.707		
I'm easily disturbed.				0.762		
I love trying new things.					0.727	
I'm interested in new ideas.					0.684	
I would like to be the first to try new products.					0.897	
I'm not afraid to try new things.					0.885	

I'm open to new ideas.					0,675	
I save money.						0.777
I know how I will pay when I use a credit card.						0.753
I set long-term financial goals that affect my spending.						0.689
I pay my credit cards on time to avoid paying extra fees.						0.677
I plan my financial future.						0.795
I keep my expenditures under control.						0.807
I check my credit card accountability for possible errors and debts.						0,740
I save money on a monthly basis.						0,763
Before big purchases, I analyze my financial situation.						0,725
Cronbach's Alphas	0,836	0,881	0,933	0,845	0,861	0,897

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IMPACT OF HIGH TECHNOLOGY EXPORT ON ECONOMIC GROWTH: AN ANALYSIS ON TURKEY

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ABSTRACT

Purpose- High-technology exports, with their high added value, are considered as one of the determinants of growth in recent years. The increasing competitiveness of developing countries in international markets depends on the country's capacity to produce and export high-tech products. Therefore, the export of high technology products is especially important for the economic growth and development of the countries. In this study, the effects of the causality analysis on the economic growth of high-technology exports in Turkey has been investigated.
Methodology- Granger Causality Analysis was used to determine the direction of the relationship and the results of the variance decomposition were evaluated. VAR model is primarily applied in the model in order to determine the short-term causality relationship between the variables while the analysis is performed with the Granger causality, impulse-response and variance decomposition methods.
Findings- After 1980, Turkey has transitioned from import substitution to export-oriented industrialization strategies and largely completed the liberalization process during 1990s. Important policies for industrialization have been implemented by improving the export structure within the scope of competitive advantages. When the impulse-response and variance decomposition results are evaluated together, the outcome is consistent with the Granger Causality Test results where high-technology export is effective on GDP.
Conclusion- In conclusion, it was found out that high technology exports affect economic growth. Therefore, Turkey has to put more emphasis to increase high technology shares in its exports and incentivize high technology production.

Keywords: Technology intense exports, economic growth, causality analysis, VAR analysis, Turkey
JEL Codes: E60, O11, O47

1. INTRODUCTION

The ability to transform the knowledge into innovation and to use it in today's world determines the international competitive power of countries. Therefore, many countries are in an effort to open their national economies to foreign countries and to integrate it with the world economy. Within such scope, economic growth and development of countries and creating employment opportunities are not only associated with their abilities to innovate, but also it is closely associated with their potential to export these innovations. The countries need to develop, make production for increasing their competitive power, and market the said production abroad (Avcı et. Al., 2016: 50-51).

Since high-technology production means the production of high value-added products at the same time, particularly the developed countries have the leading positions worldwide in terms of exports including high-technology products. Therefore, production and export of the products including high-technology products are important factors in terms of financing the growth and development of countries, which have adopted export-oriented growth, through increasing their export revenues (Yıldız, 2017: 27).

There are many factors that are effective on ensuring economic growth and its sustainability. Particularly, having high-technology sectors, manufacturing goods with high added value, and increasing exports have an important share amongst these factors. Specifically, high-technology efficiency is seen as the driving force behind economic development and growth for the countries implementing an export-oriented growth policy (Hobday et. al., 2001: 209). Therefore, increasing the share of high-technology products within the total exports takes part among the main objectives of countries in terms of international competition and economic growth.

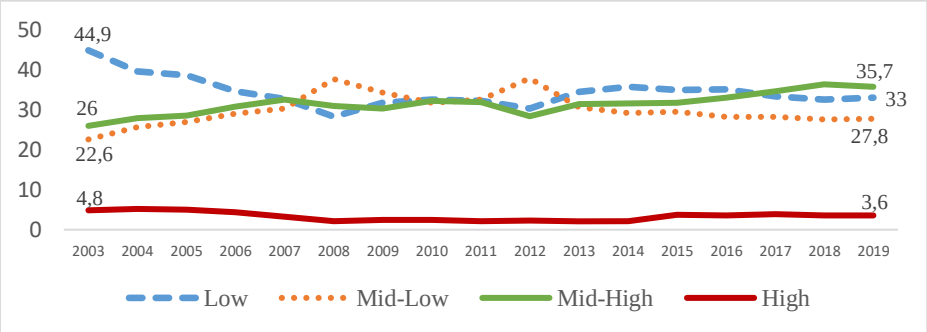
When differences between the countries' income per capita and economic growth levels are examined, it is understood that the technological infrastructure, natural resources, manpower, economic and political stability are the important determinants. Developing countries transfer technology into their own countries in order to reach to the level of developed countries; allocate a higher share of resources to education; and try to foster research and development activities (Göçer, 2013: 216).

Turkey has gone into the effort of opening its economy to foreign countries, and to integrate with the world countries especially after 1980. In this regard, the policies based on import substitution were replaced by export-oriented policies, and important steps were taken towards financial liberalization in 1989. The relationship between high-technology export and economic growth in Turkey is analyzed for the period of 1989-2017 in this study. Granger causality test is utilized to analyze this relationship, and results of the impulse and response and variance decomposition are evaluated.

According to the decisions taken on January 24th, 1980 in Turkey, export-oriented development policy was commenced to be implemented, and the export activities started to increase with membership to the Customs Union in 1996. A significant change occurred in the structure of export, which consisted of labor-intensive products such as agriculture and textile products, in 1980s when durable household goods such as major home appliances and automotive parts replaced labor-intensive products in export. However, export of Turkey featuring high-technology products hasn't reached to the desired level despite such change. Since imported input is predominantly utilized in the production process for Turkey, an increase in the industries' production, which is performed through employment of high-technology, also increases the demand for imported input. At the same time, a significant portion of the added value to be obtained thereof goes abroad because the local industries, which may provide input to high-technology industries in Turkey, are not sufficiently developed (Konak, 2018: 71-72).

Export shares of industries according to their technology levels is an important indicator demonstrating the technological production levels. Accordingly, industries are grouped as low-technology, medium low-technology, medium high-technology and high-technology. The shares of Turkey's export between the years 2003 and 2019, following Turkey's membership to the Customs Union, are given below according to levels of technology.

Graph 1: Distribution of Imports of Turkey According to Technological Status (%)



Source: TÜİK

Turkey's exports technological structure is undergoing a transformation according to the share of exports by technological level. In the beginning of 2000s, while almost half of its exports are produced with low technology, later this share has decreased over time, whereas the exports of products with low-medium and medium-high technologies have increased consistently. However, the exports of high-tech products remains at similar low levels.

According to first quarter data of 2019, Turkey's low technology share in total exports is 33%, low-medium technology is 27.8%, medium-high technology is 35.7% and high technology is 3.6%.

The main reasons for the low level of exports of Turkey can be associated with import high value-added products rather than produce locally, low level of shares allocated to research and development activities, lack of skilled labor, lack of direct foreign capital inflows and innovation policies. Developed countries have transformed their low and medium technology production capacities like textile, clothing, machinery, plastics, into advanced technology and high-value-added production like electronics, computers, software, pharmaceuticals, aircraft. Turkey has remained behind this technological development and competition (İlhan and Gelgeç, 2018: 35-54).

2. LITERATURE REVIEW

Capital movements between the countries have accelerated with the increase in international trade, and accordingly the pace of advancement in technology increased depending on this development. Within that context, the will to possession of high-technology has become one of the primary goals of both developed and developing countries because countries may manufacture products with high added value by this means, and export these products alongside gaining competitive power in international markets. One of the most important targets of countries in today's world is exporting products with high added values and high-technology (Saray and Hark, 2015: 348).

Furthermore, the studies which discuss the effects of export on economic growth, address various benefits such as increasing efficiency arising from exports; facilitation of capital goods imports through the revenues to be obtained from exports; utilization from scale economies depending on the increase in scales of relevant companies; and transfer of new information and methods into the country via the relations to be established with foreign markets through export operations (Gerni et. al., 2008: 5). The recently conducted studies particularly emphasize the importance of high-technology exports. Accordingly, empirical studies conducted with the objective of explaining the relationship between high-technology exports and economic growth are given place in this part.

Cuaresma and Wörz (2005) tested the hypothesis that exports in technology-intensive industries have a higher potential for positive externalities coupled with higher productivity levels using a data set, covering 45 industrialized and developing countries for time period 1981–1997. The estimation results, using a random effects model and employing an instrumental variables estimator, support the hypothesis of qualitative differences between high- and low-technology exports with respect to output growth.

In the study of Değer (2007), aimed to reveal the importance of the product composition of exports in the economic growth processes of the developing countries and concluded that technology-intensive product exports have positive effects on economic growth. The biggest and significant effect on economic growth is labor intensive manufacturing industry exports.

In the study of Falk (2009), new evidence on the impact of the change in the high-tech export share on economic growth in OECD countries was presented with a dynamic growth model on panel data for 22 OECD countries for 1980–2004, in which the data is measured as 5-year averages. It found out that both business R&D intensity and the share of high-tech exports are significantly positively related to the GDP per working age population.

Lee in the paper dated 2011, empirically investigated the extent to which technological characteristics in exports affect the patterns of trade-led economic growth across countries. The findings are robust to the presence of various control variables as well as the consideration of parameter heterogeneity and in the endogeneity of export structures.

In the study of Kılavuz and Topcu Altay (2012), the effect of different classifications of export and import on economic growth in 22 developing countries in the 1998–2006 period was tested. The findings revealed that only high-technology manufacturing industry export, investment and low-tech manufacturing industry import have a positive and significant effect on growth.

Göçer (2013) examined effects of R&D expenditures on high technology exports, information-communication technology exports, total exports and economic growth as well as the effects of high technology exports on the balance of foreign trade for 11 developing Asian countries by using data of 1996-2012 period. As a result of the analysis, it has been determined that an increase by 1% in R&D expenditures raised the high technology export by 6.5%, the information-communication technology exports by 0.6% and the economic growth by 0.43%.

In their 2013 study, Aditya and Acharya investigated the export-growth relationship at disaggregate levels – disaggregation both at the country level and at the level of exports – focusing on the diversification and the composition of exports of countries. In a sample of 65 countries for the period 1965–2005 the dynamic panel estimation reveals that both diversification and composition of exports are important determinants of economic growth after controlling for the impacts of other variables like lagged income, investment, and infrastructure.

Telatar, Değer and Doğanay (2016) investigated the effect of technology intensity product export on economic growth with time series analysis for Turkey. According to the findings obtained from co-integration testing results, low and medium technology intensive products have significant and positive effects on Turkey's economic growth. On the other hand, according to Granger causality results, there are unidirectional causal relationships from exports of medium and high technology intensive products to economic growth.

Yıldız (2017) investigated the effect of the high- technology export on the economic growth for BRICS countries and Turkey for the period 2005 – 2014 is analyzed by using panel data techniques. The results of show that high- technology export is significantly positive effect on the economic growth for BRICS countries and Turkey.

Özkan and Yılmaz (2017) examined the share of R&D expenditures in GDP, the share of high-technology exports in total exports and its relationship with GDP via data of 1996-2015 period for Turkey, and 12 member countries of the European Union. The results for the entire panel reveal that R&D expenditures positively affect high-technology exports and GDP.

In the study of Kızılkaya, Sofuoğlu and Ay in 2017, they examined the effect of foreign direct investment and openness on high technology product export with panel data analysis method in 12 developing countries over the period of 2000-2012. According to analysis results, foreign direct investment and openness have a positive impact on high technology product export. Within the framework of empirical findings, we presented some policy recommendations for developing countries.

In the study of Konak (2018) analyzed World Bank data of 1992-2016 period for selected OECD member countries and Turkey's high technology export and its impact on economic development. According to the analysis result, Turkey's exports mainly are based on "low", "medium-low" and "medium-advanced" technology.

3. DATA AND METHODOLOGY

The relationship between high-technology exports and economic growth in Turkey for the period 1989-2017 is tested by using the Granger causality test in this study. The Augmented Dickey-Fuller (ADF) tests are preferred for examining the stationarity of series in the analysis. VAR model is primarily applied in the model in order to determine the short-term causality relationship between the variables while the analysis is performed with the Granger causality, impulse-response and variance decomposition methods. Gross Domestic Product (GDP) and high-technology export amount (HTE) variables are used as economic growth indicators in the analysis where annual series from the 1980-2016 period are employed. The data set employed in the analysis has been obtained from the World Bank.

4. FINDINGS AND DISCUSSION

4.1. Stationarity Analysis

Fake regression problem may be encountered when worked with the non-stationary time series in the econometric analysis studies. Therefore, the stationarity of variables should be checked before analyzing the relationship between variables. Otherwise, using the non-stationary series in analysis may lead to obtaining unreliable results including spurious relationships (Sevüktekin and Nargeleçekenler, 2007: 312). Therefore, Augmented Dickey-Fuller (ADF) unit root test, in other words stationarity analysis, was performed in this study. If the variables are not stationary at the level value in the stationarity analysis, differences of the series are taken and they are made stationary. If the test statistics are smaller than the determined critical value in the analysis, the series is accepted as stationary (Kaya and Öz, 2016: 644).

Table 1: ADF Unit Root Test Results

Variables		ADF-t Statistics with Constant Term	ADF-t Statistics with Constant Term and Trend
HTE	**Level**	-2.845159 [0.0654]	-2.789584 [0.2127]
GDP		-5.720186 [0.0001]*	-5.726882 [0.0004]*
DHTE	**1st Difference**	-4.098447 [0.0039]*	-4.019207 [0.0203]*
DGDP		-	-

*In the model with constant term, MacKinnon critical values are -3.69, -2.97 and -2.62 for the significance levels of 1%, 5% and 10% respectively. In the model with constant term and trend, the values are -4.33, -3.58 and -3.22 respectively. The figures in between the square brackets correspond to probability values.

As may be seen in Table 1, since the absolute values of ADF-t statistics, which are obtained for the HTE variable at the level values, are smaller than the MacKinnon absolute values at significance levels of 1%, 5% and 10%, they are non-stationary. When the first differences of this variable are taken, it is determined to be stationary. GDP variable is determined to be stationary at the level.

The assumption that errors are independent from each other and have constant variance in the ADF test causes problems when both autoregressive and moving-average elements are involved. Philips (1987) and Philips and Perron (1988) developed a unit root test with the assumption that there may be autocorrelation and heteroscedasticity between the error terms. Due to both the autocorrelation and heteroscedasticity problem as well as the objective to obtain healthier information on stationarity of these variables, Philips-Perron (PP) test is also utilized in this study in addition to the ADF test. The results of the PP tests are listed in the below table.

Table 2: PP Unit Root Test Results

Variables		PP-t Statistics with Constant Term	PP-t Statistics with Constant Term and Trend
HTE	**Level**	-2.169456 [0.2211]	-2.231938 [0.4548]
GDP		-5.840569 [0.0000]*	-7.205557 [0.0000]*
DHTE	**1st Difference**	-4.098447 [0.0039]*	-4.019207 [0.0203]*
DGDP		-	**-**

*In the model with constant term, MacKinnon critical values are -3.69, -2.97 and -2.62 for the significance levels of 1%, 5% and 10% respectively. In the model with constant term and trend, the values are -4.33, -3.58 and -3.22 respectively. The figures in between the square brackets correspond to probability values.

When results of the stationarity test are considered in the Philips-Perron test method, it is seen that the GDP variable is stationary at the level while the HTE variable becomes stationary when its first difference is taken just as in the ADF test.

4.2 Granger Causality Test

Granger causality test is applied in order to determine direction of the relationship between the high-technology export and economic growth variables. Granger causality test is conducted with the help of below-given equations (Granger, 1969: 424-438).

$$Y_t = \sum_{i=1}^{m} \alpha_i \; Y_{t-i} + \sum_{j=1}^{m} B_j \, X_{t-j} + \; u_{1t} \qquad (1)$$

$$X_t = \sum_{i=1}^{m} \lambda_i \; X_{t-i} + \sum_{j=1}^{m} \delta_j \, Y_{t-j} + \; u_{2t} \qquad (2)$$

Here m expresses the lag length and the error terms of u_{1t} and u_{2t} are assumed to be independent from each other (Granger, 1969: 431). In Granger causality can be both from X to Y and from Y to X. The dependent variable is first added to the model with an appropriate lag count, and then the other variable is added to the model. The error sum of squares pertaining to these models are figured, and then the F statistics, which is developed by Wald, is calculated (Yılmaz, 2005: 70).

$$F\ (m; n-2m) = \frac{(ESS_r \; - ESS_{ur})/\, m}{(ESS_{ur}\,)/\, n \; - 2m} \qquad (3)$$

ESS: Error Sum of Squares, ur: Unlimited Model, r: Limited Model

If the calculated F statistics is bigger than the table value in the α significance level and (m; n-2m) degree of freedom, null hypothesis is rejected. Rejection of this hypothesis shows that the coefficients in this model are significant. For instance, in case

there is causality from the Xt variable to the Yt variable, the coefficients of variables included in the equation numbered (1) become statistically significant (Granger, 1969: 431).

The second step required for determination of lag count of the model to be established is creating the VAR model, and setting the appropriate lag count. The appropriate VAR model lag length is determined as 2 according to the LR, FPE, AIC and HQ criteria.

Table 3: Granger Causality Test Results

Ho Hypothesis	X2 Statistics	Prob. Value
HTE is not the cause of GDP.	7.793882	0.0203
GDP is not the cause of HTE.	0.972283	0.6150

According to the short-term Granger causality test results, the null hypothesis "HTE is not the cause of GDP" is rejected. Similarly, the null hypothesis "GDP is not the cause of HTE" is accepted. In line with these findings, it is accepted that there is a one-way causality relationship between high-technology export and economic growth in the short term.

4.3. Variance Decomposition and Impulse-Response Analysis

The dynamic relations between the variables are examined with the variance decomposition and impulse-response analysis in the VAR model. It is examined in variance decomposition what percent of the change in variance of a variable results from itself, and what percent thereof results from other variables. Variance decomposition may be also used as an auxiliary assessment about whether the variables are internal or external. Accordingly, if almost one hundred percent of a change in a variable's variance is explained by its own value, this variance is characterized as an external variable. Impulse-Response Analysis is a method employed for determining the effect of one-unit standard deviation shock, which is delivered from one variable to another, on the dependent variable, and the length of this effect (Tarı, 2006: 452-453).

This part features variance decomposition and impulse-response analysis for the purpose of determining the dynamic relations between variables within the framework of causality test results.

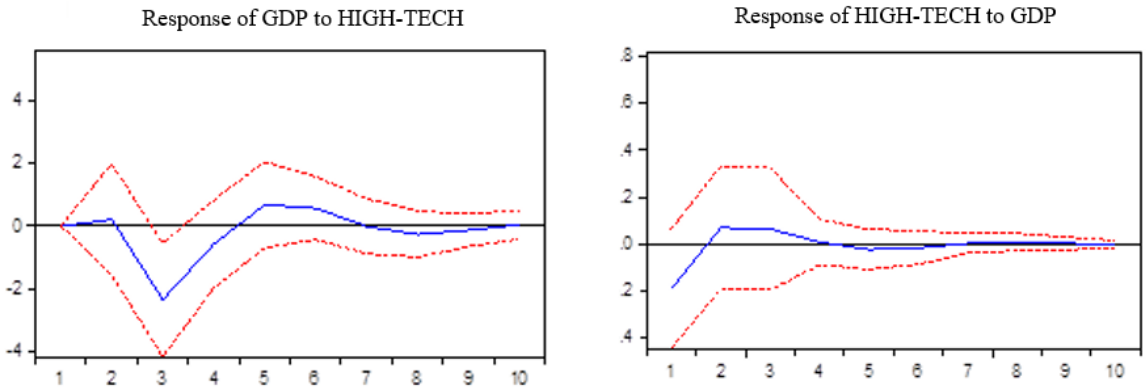
Table 4: Variance Decomposition Results

GDP			
Period	**Standard Error**	**GDP**	**HTE**
1	4.360069	100.0000	0.000000
2	4.379315	99.75651	0.243490
3	4.978535	77.73090	22.26910
4	5.016217	76.77783	23.22217
5	5.069174	75.44024	24.55976
6	5.101110	74.49860	25.50140
7	5.102170	74.50914	25.49086
8	5.108787	74.32718	25.67282
9	5.110384	74.28205	25.71795
10	5.110721	74.27642	25.72358
HTE			
Period	**Standard Error**	**GDP**	**HTE**
1	0.666120	8.234795	91.76521
2	0.692456	8.626787	91.37321
3	0.707590	9.100023	90.89998
4	0.723876	8.707398	91.29260
5	0.724524	8.792722	91.20728
6	0.726997	8.780730	91.21927
7	0.727980	8.758007	91.24199
8	0.728054	8.768740	91.23126

9	0.728331	8.763862	91.23614
10	0.728369	8.763729	91.23627

When we examine the exposition of high-technology export on GDP, it is seen that the changes occurring in GDP mostly results from itself, but this weight starts to decrease after the second period. While the exposition of share of high-technology export is approximately 22 in the third period, it rises to 25.72 in the tenth period. When the variance decomposition results of high-technology export are evaluated, it is seen that the rate of GDP explaining the change in high-technology export is around 8.7 through several periods, and that it doesn't demonstrate any major changes.

Graph 2: Impulse - Response Results



It is seen in Graph 2 that the effect of a shock occurring in high-technology export on GDP starts to response positively after the second month, then the degree of response increases following which the effect diminishes until it gets closer to zero. However, the effect of a one-unit shock occurring in GDP first reacts negatively, but a positive increase is experienced after the fifth month, and eventually the effect is observed to diminish.

When the impulse-response and variance decomposition results are evaluated together, the outcome is consistent with the Granger Causality Test results where high-technology export is effective on GDP.

5. CONCLUSION

Competitiveness in international markets is increasingly dependent on the capacity to produce and export technology. The development of trade relations between countries increases the economic growth by providing consumers with higher quality and cheaper consumption, while increasing the country's competitiveness. Countries that want to get more share of this competitive environment need to allocate more shares to high technology product exports.

Turkey, after the 1980, has started to implement export oriented and externally open industrialization policies in order to increase the share in the global competition. However, although there has been a transformation and change in the industry, it is observed that in terms of production and added value, low and medium-low technology products still have the highest shares. The share of high-technology products in exports is very low. The fact that domestic demand for high and medium high technology products is imported from abroad, this leads to the country imports being higher than exports.

In this study, the impact of economic growth of high-technology exports in Turkey was examined by Granger causality analysis, variance decomposition and impulse-response analysis. The results reveal the importance of high technology exports in terms of ensuring high and sustainable economic growth. As a result of the causality analysis, it has been determined that there is a causal relationship between high technology product exports and economic growth. In addition, the results of variance decomposition and impulse-response analyzes also support this relationship. Therefore, Turkey has to put more emphasis to increase high technology shares in its exports and incentivize high technology production.

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THE RELATIONSHIP BETWEEN HIGH-TECHNOLOGY EXPORTS, PATENT AND ECONOMIC GROWTH IN TURKEY (1990-2015)

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ABSTRACT

Purpose- Today technology ise one of the main driving force of economic growth. Indicators as high-technology exports and patent show the progress of technological development of economies. In this study evaluation of the relationship between high-technology exports, patent and economic growth in Turkey was aimed.
Methodology- The relationship between high-technology exports, patent and economic growth in Turkey have been investigated for 1990-2015 period. The stationary of variables have been tested by Augmented Dickey-Fuller (ADF) test, the causality relationship between variables have been investigated by Vector Autoregressive (VAR)Granger Causality test. For long term relationship Johansen Cointegration test and Vector Error Correction (VEC) Granger Causality test have been conducted respectively.
Findings- Study results showed a causality relationship from both high-technology exports and patent to economic growth. A long term relationship has been identified by Johansen Cointegration test and one way causality relationship has been also found from both high-technology exports and patent to economic growth in long term.
Conclusion- The study results showed that both high-technology exports and patent accelerate economic growth in short and long term. In Turkey policies should be establish in order to support the production and exportation of high-technology products and to increase patent applications.

Keywords: High-technology exports, patent, economic growth, causality, co-integration.
JEL Codes: E60, O11, O47

1. INTRODUCTION

In economics, two approaches come to the forefront in explaining how economic growth occurs in a country. The Neo-Classic Growth Model proposed by Solow (1956), Swan (1956), assumes technology as an external component and the Endogenous Growth Models developed by Arrow (1962), Romer (1986, 1990), Lucas (1988), Grossman and Helpman (1991a, 1991b) and Aghion ve Howit (1992) assume the technology endogenous. Although both growth models argue that technological development is the source of economic growth, endogenous growth models explain how technological development occurs in countries and how it promotes the economic growth (Özçelik et al., 2018).

Today, it is emphasized that the growth phenomenon is related to the level of technology that countries have. According to an economist, technology is a measurement technique that is wedged between input and output and a tool which increases the welfare and living standards of nations. In engineering it is defined as series of methods for production. In general, technology is also defined as a source of knowledge that is used to improve the efficiency of production, marketing of the existing goods and

services and to produce new goods and services. With its dynamic structure, technology is a criterion used in the classification of countries and developed countries determine their industrialization and economy policies according to technology. It is generally accepted in the world that there is a significant positive relationship between the countries' high technology production and economic growth and development. On the basis of this view, it can be clearly stated that economic growth policies that are evaluated independently from technological developments will be deficient (Algan et al., 2017).

As advanced technology production means producing both high value-added and high yielding products at the same time, especially developed countries are the leading countries in the world in terms of high-tech product exports. In this context, the production and export of high-technology products is an extremely important source of financing for the growth and development of the countries that have adopted the export-oriented growth strategy by increasing their export revenues. In this respect, it is possible to say that exports are one of the most important economic activities that cause the growth of the economy and development of the countries by providing foreign currency inflow to the country (Konak, 2018).

Owning high-technology elements provides many important advantages to countries, the most important of which is the economic growth. Especially in developed countries, infrastructure investments for technological development have emerged as one of the most important factors of economic growth over time and have constituted the basis of technological developments. Technological developments and innovations contribute to increase the production potential and productivity directly. The positive developments in technology enable more effective use of factors of production by increasing efficiency in the production process, which, in return, accelerates economic growth and development and consequently, improves the life quality and life standards of individuals (Konak, 2018). And by patenting new ideas and inventions as a result of R & D activities, countries gain competitiveness in international markets and export high technology goods based on new ideas and inventions (Özçelik et al., 2018).

In Turkey, Science & Technology policies were introduced at the end of the 1970s and has been given priority in the 7th Five-Year Development Plan. In 1980, priority was given to incentive measures to increase export revenues but adverse effect was experienced on technological development because the expected income did not turn into R&D investments. In 2001, with a new legislation on creation of technology development regions, academicians and researchers were more easily involved and engaged in the processes of technology production. Through initiative of KOSGEB, two technology development centers as the centers of innovation were founded at METU and ITU. By 2008, the number of the similar centers were increased to 30. However, only few of them were successful. Another important development in the recent history of Turkey is the establishment of the Scientific and Technological Research Council of Turkey (TÜBİTAK) in 1963. It is the leading agency for management, funding and conduct of research in Turkey. It was established in 1963 with a mission to advance science and technology, conduct research and support Turkish researchers. Additionally, in 1983, the “Supreme Council for Science and Technology” and “Council of Science, Technology and Innovation Policies" have been established. TUBITAK and Supreme Council for Science and Technology aim to create an "affluent society" which is competent in science and technology; uses technology consciously and capable of developing new technologies; and possess the skill of converting technological developments into social and economic benefits (TÜBİTAK, 2004).

Since technological innovation is one of the most important factors determining the competitiveness of a country on a global basis, it directly affects both the foreign trade volume and growth rates of the country. The countries that have achieved competitive advantage in science and technology are generally ranked in the category of industrialized country while the countries producing labor intensive goods and services are ranked in the status of developing countries. At the first stage of development, developing countries specialize in labour intense industries since they have abundant and cheap labour force. However, they can not compete with developed countries in time (Alper, 2017).

Export-driven growth strategy, which emerged as an alternative to import substitution policies in the late 1970s, is expressed as a development strategy aimed at increasing production capacity through foreign trade. Since then, export-based growth strategies have been adopted and implemented by many countries. However, significant part of the countries adopting this strategy couldn’t achieved the their targets because of the differences between the export patterns of the countries and the change in the locomotive sectors in exports. In the end, some of these countries achieved their goals in a short period of time, while others were far behind the race. This situation is explained directly in relation to the value added in exports. The added value in exports is closely related to the quality of the products subject to export. The production of advanced technology also means the production of high value-added products. The fact that these goods are subject to exports provides a significant source of financing growth and development by increasing export revenues especially for countries following export-based growth strategies (Yıldız, 2017).

In this study, firtsly selected empirical studies conducted in the literature have been shared. After the methodology has been explained the analyses have been carried out. The causality relationship between high-technology exports, patent and economic growth have been examined by VAR (Vector Autoregressive) Granger Causality test and long term relationship has been investigated by Johansen Cointegration test and Vector Error Correction (VEC) Granger causality test. The aim of this study is to determine the relationship between high-technology exports, patent and economic growth and evaluate the policies needed related with the findings.

2. LITERATURE REVIEW

Different studies exist which examines the relationship between high-technology export, patent and economic growth in different countires/country groups for different terms. Selected studies and their results have been shared which conducted various methods:

Konak (2018) examined the impact of high technology on economic growth in Turkey for 1992-2016 period. According to the study results the share of export products with high technology in Turkey's total exports, the tapering period in 1999-2001, except to be as occurs at lower level than 2%, 1999-2001 sub-period, the rates in question but can rise up to 4%, Turkey's exports mainly "low", “low-medium” and “medium-high" technology has been found to be based on.

Kabaklarlı et al (2018) investigated the long term relationship between high-technology exports and economic growth in selected OECD countries for 1989-2015 period. A long-term relationship between high-technology exports and economic growth is found. While patent applications and foreign direct investment play a decisive role on high-technology exports, growth rate and investment effect high-technology exports negatively.

Özkan and Yılmaz (2017) examined the relationships between the share of R&D expenditures in GDP, the share of high-technology exports in total exports and GDP in Turkey and 12 EU members by panel data analysis for 1996-2015 period. As a result for R&D expenditures have positive effect on high-technology exports and GDP.

Algan et al. (2017), investigated the relationship between the share of R & D expenditure in GDP, the number of patent applications and GDP per capita by Granger causality test for 1996-2015 period and found one-way causality from high-tech product exports and R & D spending to GDP per capita, and one-way causality relationship from GDP per capita to patent application numbers in short term. In long-term R & D expenditures and patent applications have resulted in a positive GDP per capita, while high-technology exports negatively affected.

In his study Yıldız (2017) exmained the effect of the high- technology export on the economic growth for BRICS countries and Turkey by Panel Data Analysis for 2005-2014 period. As a result of the study significant and positive effect of high- technology export on economic growth was found in both Panel Fix Effect and Panel Random Effect models.

Aali Bujari and Venegas Martínez (2016) analyzed the impact of technological innovation on economic growth for 12 representative countries in Latin America for 1996-2008 period with dynamic panel data model and estimated with Generalized Method of Moments (GMM) system. As a result of study it is found that technological innovation have a positive impact on economic growth in the region, suggesting that Latin American countries might achieve economic growth in a context of incentives for technological innovation and investment in research, patents and exports of high-tech products are relevant to raise the total factor productivity and increase per capita GDP in most Latin American countries.

Ustabaş ve Ersin (2016) investigated the relationship between high-technology exports and economic growth by conducting causality and cointegration tests in South Africa and Turkey for 1989-2014 period. They found that high-technology exports effect economic growth positively in Turkey in short term. In South Africa positive effect of he high-technology exports on economic growth occurs in both short and long term.

Telatar, Değer and Doğanay (2016) conducted time series analysis for Turkey by using the data between 1996:1-2015:3 period an investigated the the effect of technology intensity product export on economic growth By Engle-Granger(1987) co-integration test and Granger causality test the relationship between variables were examined. A significant and positive effect of low and medium technology intensive products on economic growth was determined. Additionally unidirectional causality relationship from exports of medium and high technology intensive products to economic growth was found.

Işık (2014) analyzed the importance of patent rights for the economic growth in Turkey in order to establish economy policies. Patent expenses and economic growth are analyzed for1990:1-2010:4 period by Granger cointegration models and a uni-directional relationship between patent expenses and economic growth is found.

Song and Nan (2014) examined the relationship between economic growth and technologic innovations by Vector Autoregressive (VAR) model and a long term relationship between variables is found.

Weng et al. (2012), with the help of VAR analysis, tried to analyze the relationship between foreign direct investments, patent application, technology-based trade share and economic growth for Shanghai between 1991 and 2009. As a result of study, a positive correlation between economic growth and other technological indicators is reached.

Kılavuz and Topçu Altay (2012) examined the correlation between growth in export and economic growth in 22 developing countires for 1998-2006 period by establishing 2 models. In the first model including variables such as high and low-tech manufacturing industry exports, investment and population, they found that only high-tech manufacturing industry export and investment, have a positive and significant effect on growth. In the second model the effect of high and low-techology manufacturing industry imports on growth is investigated and it is found that only high-technology manufacturing industry export, investment and low-technology manufacturing industry import have a positive and significant effect on growth.

Zhang et al. (2012) investigated the dynamic relationship between scientific innovation and economic growth in Beijing for 1991-2010 period with VAR model and reached a long-term equilibrium relationship between scientific innovation and economic growth.

Erdil et al. (2009) investigated the impact of Informatin and Communication Technologies (ICT) on economic growth for 131 underdeveloped and developing countries. Panel data analysis is carried out for 1995-2005 period and the results of the analysis showed that ICT has positive and significant effect on economic growth.

Sinha (2008) analyzed the relationship between patents and economic growth in Japan and South Korea using both individual country and panel data for 1963-2005 period. A cointegration and a two-way causality between the growth of real GDP and the growth of the number of patents is reached for Japan. And a cointegration is also found for South Korea. For panel data growth of real GDP Granger causes the growth of the number of patents.

3. DATA AND METHODOLOGY

In this study the relationship between high-technology exports, patent and economic growth have been investigated for 1990-2015 period in Turkey. All variables has been expressed in logarithmic form. The data have been provided from Organization for Economic Co-operation and Development (OECD). Stationarity of series have been investigated by Augmented Dickey-Fuller (ADF) test, the causality relationship between variables has been examined by VAR Granger Causality test. For long term relationship, Johansen Cointegration test has been carried out and lastly the long term causality has been investigated by VEC) Granger causality test. All analysis have been carried out by Eviews 10.0. GDP, HTEC, PTNT represent gross domestic product, high-technology exports and patent applications respectively.

Non-stationary time series can lead false regression issue, therefore the series should be stationary before establishing VAR Model. Dickey and Fuller (1979) designed three different models by including the lagged values of independent variables to the analysis. When the null hypothesis is rejected it is decided that the series do not contain unit root. By Granger causality test, the causality relationship between series are investigated by using equation (1) and (2). When the calculated statistic is bigger than the table value at α significance level and (m; n-2m) degree of freedom, the null hypothesis is rejected. If a causality found from Xt to Yt variable, the coefficients of equation (1) become statistically significant (Granger, 1969).

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \emptyset_i Y_{t-i} + \sum_{i=1}^{q} \delta_i X_{t-i} + \varepsilon_t \qquad (1)$$

$$X_t = \beta_0 + \sum_{i=1}^{p} \pi_i X_{t-i} + \sum_{i=1}^{q} \boldsymbol{\lambda}_i Y_{t-i} + \mu_t \qquad (2)$$

Long term relationship is investigated by Johansen cointegration test developed by Johansen (1991) since the series are equally integrated and is conduted by the help of equation (3).The number of cointegration vectors are shown by the matrix π rank. When there is no cointegration the rank of π equals to zero. If long term relationship exist between the series, to determine the direction of the long-term relationship VEC is use which was developed by Engle-Granger (1987).

$$\Delta yt = \sum_{i=1}^{k-1} \pi_i \Delta y_{t-1} + \pi y_{t-k} + \varepsilon_t \qquad (3)$$

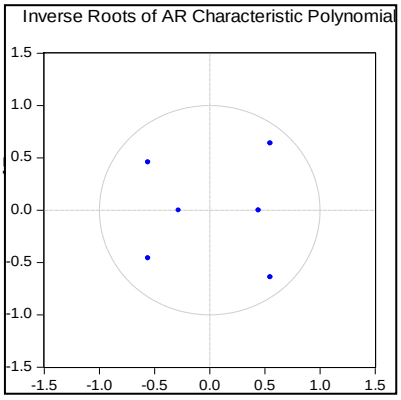
4. FINDINGS AND DISCUSSIONS

It has been determined that series are non-stationary at level form and first differences of series are used which are stable by ADF. As presented in Table 1, the ADF test results showed that calculated t-statistic values are bigger than McKinnon critical values at first differences of series. The characteristic roots of the model are contained within the unit circle which also confirms the stability of the VAR model (Figure 1).

Table 1: ADF Test

Variable	Constant, Linear Trend			
	Level		First Difference	
	t-statistics	McKinnon Critical Value (%5)	t-statistics	McKinnon Critical Value (%5)
GDP	-2.225696	-3.603202	-8.954988	-3.622033
HTEC	-1.860968	-3.603202	-4.678110	-3.690814
PTNT	-2.569282	-3.658446	-6.977945	-3.632896

Figure 1: Characteristic Roots



Before establishing VAR model for causality test, the appropriate lag length should be determined. In this study the appropriate lag length for VAR model has been selected as 2 at final predicting error (FPE), Akaike (AIC), Schwarz (SC) and Hannan-Quinn (HQ) values. According to VAR Granger Causality test, a causality relationship exists from high-technology exports to economic growth and also a causality relationship is found from patent to economic growth (Table 2).

Table 2: VAR Granger Causality Test

Dependent Variable: DGDP		
Independent Variable	Chi-sq	Probability
DHTEC	9.454907	0.0088
DPTNT	10.73066	0.0047
Dependent Variable: DHTEC		
Independent Variable	Chi-sq	Probability
DGDP	3.378708	0.1846
DPTNT	0.220599	0.8956
Dependent Variable: DPTNT		
Independent Variable	Chi-sq	Probability
DGDP	0.136351	0.9341
DHTEC	1.017140	0.6014

Long term relationship has been investigated by Johansen Cointegration test. It has seen that the trace statistic is bigger than critical value and the null hyphotesis has been rejected. According to test results 2 cointegating vectors have been determined and the existance of long term relationship between variables has been accepted. Table 3 shows the number of cointegrating vectors.

Table 3: Johansen Cointegration Test

Hypothesized No.of CE(s)	**Eigenvalue**	**Trace Statistic**	**Critical Value (%5)**	**Probability**
r=0	0.511149	28.45084	24.27596	0.0140
r≤1	0.427963	12.70551	12.32090	0.0431
r≤2	0.018793	0.417389	4.129906	0.5817

To determine the causality relationship between variables in long term, VEC Granger Causality test has been carried out which is developed by Engle-Granger (1987) and causality relationships have been found from both high-technology exports and patent to economic growth (Table 4).

Table 4: VEC Granger Causality Test

Dependent Variable: DGDP		
Independent Variable	Chi-sq	Probability
DHTEC	7.979688	0.0185
DPTNT	10.04952	0.0066
Dependent Variable: DHTEC		
Independent Variable	Chi-sq	Probability
DGDP	0.249799	0.8826
DPTNT	0.102074	0.9502
Dependent Variable: DPTNT		
Independent Variable	Chi-sq	Probability

DGDP	1.081716	0.5822
DHTEC	0.395359	0.8206

4. CONCLUSION

The production and export of high-technology products accelerate growth due to the high added value of these products. Developing innovative approaches, intensification of R & D activities and increases in patent applications are important for achieving economic growth and achieving competitive advantage. In this study, the causality and long term relationship between high-technology exports, patent and economic growth have been examined for Turkish economy for 1990-2015 period. According to study Granger causality test result causality relationships have been found from high-technology exports and patent to economic growth. Long term relationship between variables has been determined by Johansen Cointegration test and lastly by VEC Granger causality test, a causality relationship from high-technology exports to economic growh and also a one way causality relationship from patent to economic growth have been found. It is necessary to establish science and technology policies in Turkey to support the adoption of innovation-oriented strategy, the dissemination of patent applications and the production and export of high-technology products. By harmonized science and technology policies it will be possible to provide funds to the researchers and to realize investments required for advanced technology production.

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MODELLING AN EARLY WARNING SYSTEM FOR CURRENCY CRISES: A DYNAMIC PANEL PROBIT MODEL

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ABSTRACT

Purpose- The probability of currency crisis is attempted to be predicted by analysing the lagged binary crisis variable and some macroeconomic indicators.
Methodology- A new generation of early warning system model is developed in order to determine the leading indicators of the financial crises of 17 developing countries and the dynamic structure of the crises are examined by using the dynamic random effects probit model.
Findings- The results show that the 12th ($C1_{t-12}$), 3rd($C1_{t-3}$), 2nd($C1_{t-2}$) and 1st ($C1_{t-1}$) lags of the dependent variable have a statistically significant effect in explaining the probability of the currency crisis.
Conclusion- The results of the model show that *true* state dependence has a significant effect on the probability of currency crises in the short term. This clearly indicates that sources of endogenous persistence of crises should be taken into account in order to improve a new generation of EWS on the predictability of currency crisis.

Keywords: Currency crises, dynamic panel probit models, early warning systems (EWS), developing countries, state dependence.
JEL Codes: E44, C25, C23

1. INTRODUCTION

Despite noticeable progress in the literature on early warning system (EWS) in past years, the recent financial crisis has revived the interest in the EWS literature among researchers and politicians. An EWS consists of the quantitative definition of crisis and a set of variables that may help predict crises and an econometric method to obtain an early warning signal from those variables. Different models have followed different approaches to address a number of conceptual and practical issues that arise concerning both the quantitative definition of crisis and the modelling of the method to predict a crisis. The most important issues in the design of an early warning system are the quantitative definition of the crisis, the methodology to be applied, the scope of the country, the time dimension and the choice of explanatory variables (Berg et.al., 1999, p. 10). The model of an EWS defines a link function relating leading indicators to the occurrence of currency crises. One of the first EWS is proposed by Kaminsky et. al. (1998) and relies on a signalling approach. This is a pioneering paper both for the study of the determinants of banking and currency crises and for the literature on EWS for financial crises. In the EWS literature, another most preferred approach to empirical studies on currency crises are the discrete-choice EWS models (logit/probit). Most previous empirical studies using discrete choice models (see, Eichengreen, Rose and Wyplosz 1996, Frankel and Rose 1996) have used probit models. Later, Berg and Pattillo (1999) compared the forecast performance of the probit model with the signals approach and found that the probit model has exhibited superior performance in that forecasting the currency crisis. These studies paved the way for a large number of papers examining the determinants of currency crises. Kumar et.al. (2003) propose logit models instead of the probit model. Bussiere and Fratzscher (2006) propose a multinomial logit model to account for post-crisis bias. In spite of important differences between each other, most existing models share a noticeable characteristic. They are static models, *i.e.* these models assume that the crisis probability depends on a set of macroeconomic and financial variables representing the applied economic policies. Contrary to previous

studies that have used static logit/probit models, this study examined the dynamic structure of currency crises *i.e*. the intertemporal linkages between crises. For this purpose, it is used a new generation of EWS that combines the discrete-choice character of the crisis indicator and the dynamic dimension of this phenomenon. More precisely, in the study, examined not only the exogenous source of crisis persistence, *i.e.* explanatory variables but also sources of endogenous persistence of crises. Candelon et.al. (2014) and Dumitrescu (2012) indicate that endogenous dynamic of crises can be captured in three different ways. The first dynamic model includes the only lagged dependent variable (y_{it-1}). The second dynamic model includes the only lagged index ($EMPI_{it-1}$). Finally, the dynamic model includes both the lagged dependent variable (y_{it-1}) and the lagged index ($EMPI_{it-1}$). They estimate three models that address the endogenous dynamics of crises. As a result, they indicate that the dynamic model including the lagged dependent variable outperforms the other specifications. Hence in the study, following Candelon et.al. (2014) and Dumitrescu (2012), is used as a dynamic model including the lagged dependent variable. By inclusion of the lagged dependent variable on the model, assess the impact of the regime prevailing in the previous period on the crisis probability. The study is also investigated whether the endogenous dynamics of currency crises, (unobserved) country-specific factors or true state dependence. The results of the model show that *true* state dependence has a significant effect on the probability of currency crises in the short term.

The rest of the paper is organized as follows: section 2 describe the dataset, the definition of currency crises and the methodology, while the findings and discussions are presented in section 3, and finally conclusion on final part.

2. DATA AND METHODOLOGY

2.1. The Data

The first issue in the modelling of an EWS relates to defining the scope of the model and time dimensions. The study covers the period 1991- 2017 for 17 developing countries.[1] The countries included in the study consist of 5 different regions: Latin America, Asia, Eastern Europe, Middle East, and Africa. The explanatory variables which constitute another issue of the EWS, are selected from 4 economic sectors.

1.External Sector: Real effective rate overvaluation, import growth, export growth, current account balance as a percentage of nominal GDP, the growth rate of international reserves.

2.Financial Sector: M1 growth rate, the growth rate of domestic credit to GDP, the ratio of M2 to international reserves (level), the growth rate of M2 to international reserves.

3.Real Sector: Industrial production index

4.Global Sector: US interest rate and US inflation rate

Except for real effective rate overvaluation, US interest rate, current account balance as a percentage of nominal GDP and the ratio of M2 to international reserves (level), all other variables are defined as the annual percentage change.

While annual and quarterly data can give access to a larger set of variables, countries and time periods, monthly data is preferred to be able to capture the sudden nature of the money market. The data of these variables are obtained from the database Datastream, BIS and IMF-IFS. These variables are transformed into a monthly frequency by using the Chow and Lin interpolation method since the variables of GDP and current account balance are observed at a quarterly frequency. REER overvaluation is defined as a deviation of the real effective exchange rate from a linear trend. The measure of overvaluation of REER is calculated using the Hodrick-Prescott filter method.

2.2. Currency Crisis Definition

The most common method of identifying currency crisis periods implies the computation of an exchange market pressure index (EMPI). A modified version of the EMP index as suggested by Kaminsky et. al. (1998) and Kaminsky and Reinhart (1999), which

[1]Argentina, Brazil, Chile, Colombia, Czech Republic, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, South Africa, South Korea, Israel, Turkey, Thailand and Venezuela.

captures both successful and unsuccessful speculative attacks on the domestic currency is used in this chapter. Accordingly, the pressure on the domestic currency of country *i* at time period *t* is measured as:

$$EMP_t^i = \omega_e \left(\frac{e_t^i - e_{t-1}^i}{e_{t-1}^i}\right) + \omega_r \left(r_t^i - r_{t-1}^i\right) - \omega_{res}\left(\frac{res_t^i - res_{t-1}^i}{res_{t-1}^i}\right) \quad (1)$$

The EMP_t^i index is defined as the weighted average of the relative changes in the real exchange rate (e_t^i), domestic interest rate (r_t^i), and international reserves (res_t^i). The weights assigned to three component, denoted by ω are calculated as the inverse of their standard deviations over the in sample period, in a manner that gives a larger weight to the variable with lower volatility. In this paper, nominal interest rates are used instead of real interest rates, following Hagen and Ho (2003), because nominal interest rates are those the monetary authorities can directly control in order to prevent speculative attacks (Hagen and Ho, 2003). In addition, real exchange rate is used instead of the nominal exchange rate, so that nominal depreciation resulting from inflation differentials should not be considered as currency crises.

Next step, the specific crisis events in the country *i* at time *t* ($C1_{i,t}$) are identified when its EMP index crosses a certain threshold level. This threshold is calculated as the sum between the mean of the EMP index ($\mu EMPI_{i,t}$) and the product between a coefficient 2 and the standard deviation of the EMP index ($\sigma EMPI_{i,t}$). The threshold equals two standard deviations above the mean. Accordingly, $C1_{i,t}$ can be defined as:

$$C1_{i,t} = \begin{cases} 1, & If\ \ EMPI_{i,t} > 2\sigma EMPI_{i,t} + \mu EMPI_{i,t} \\ 0, & Otherwise \end{cases} \quad (2)$$

2.3. METHODOLOGY

A dynamic probit unobserved-effects model for the dependent variable y_{it} for individual *i* (i = 1,...,N) at time period *t* can be written as:

$$y_{it}^* = \gamma Z_{it} + \rho y_{it-1} + c_i + u_{it}, \qquad u_{it} \sim N(0,1). \quad (3)$$

$$y_{it} = 1(y_{it}^* > 0) \quad (4)$$

The latent outcome variable y_{it}^* in equation (3) expresses the chances of experiencing a particular status for unit i (i = 1, … , N) at time t as a function of a set of time-varying explanatory variables Z_{it} that are considered strictly exogenous, conditional on the unit-specific unobserved effect c_i. y_{it-1} captures (*true*) state dependence, while u_{it} is an error term. In the model, it is assumed that c_i is normally distributed and sometimes that is independent of all Z_{it} . Based on Rabe-Hesketh and Skrondal (2013), the unit-specific unobserved effect c_i can be written as follows:

$$c_i = \alpha_0 + \alpha_1 y_{i0} + \alpha_2 \bar{Z}_i + \alpha_3 Z_{i0} + \alpha_i \quad (5)$$

In this equation, y_{i0} and Z_{i0} represent the initial value of the dependent variable and of the time-varying explanatory variables respectively. $\bar{Z}_i = \frac{1}{T}\sum_{i=0}^{T} Z_{it}$, stands for the within-unit averages of the explanatory variables where the averages are based on all periods $t = 0, \ldots . T$. Finally, ai is a unit specific time-constant error term, normally distributed with mean 0 and variance σ_α^2. Holding the assumption that unobserved heterogeneity is captured by c_i, the lagged dependent variable can be interpreted as *true* state dependence. In terms of this study, *true* state dependence can be interpreted as the probability that a crisis occurred in period *t* affecting the emergence of another crisis in period *t+1*. The dynamic model in Equation (3) is estimated as a standard Random Effects (RE) probit.

3. FINDINGS AND DISCUSSIONS

In this section reports the results of the estimation by dynamic probit model binary dependent variable specified in equation (2) and a set of exogenous macroeconomic variables. Since a nonlinear method is used in this paper, it is difficult to interpret the coefficients. Although the respective sign shows the direction of the impact exerted by the independent variable on the dependent variable, the parameter values themselves do not allow a conclusion to be made regarding the strength of the relationship.

According to the model I estimation results, the growth of international reserves is affected the probability of occurrence of currency crises. The estimated coefficient is statistically significant at the 1% level and has a negative sign. This confirms the economic theory, which indicates that the growth of international reserves is decreased in the probability of the occurrence of currency crises. Similarly, the probability of occurrence of currency crisis is supposed to escalate if an expansion of the ratio of M2 to reserves is noticed in the previous period. In other words, if the growth of the amount of money in circulation overruns the growth of international reserves, the currency is perceived as unstable and therefore, a speculative attack is predictable. Thus, a positive coefficient of the ratio of M2 to reserves is expected. In accordance with these expectations, the estimated coefficient is significant at the 5% level and has a positive sign. However, the M2/reserves growth rate and the M1 growth emerge a result that does not coincide with the economic theory. In addition to this, they have a significant effect on the probability of currency crises at 5% and 10% respectively. Both real effective exchange rate overvaluation and domestic credit /GDP growth rate are significant at the 1% and have a positive sign. The current account balance as a percentage of nominal GDP has the correct sign – a higher current account balance is associated with a decline in crisis incidence – but the coefficient estimates are not significant. Export and import growth, which are the sub-items of the current account, has not an important role in explaining the possibility of currency crises. In particular, this result of the export growth is not consistent with the findings of the study by Kaminsky et. al. (1998), Berg and Pattillo (1999). It is observed that the real GDP growth, which is an indicator of real economic activity, has a significant effect on the probability of currency crisis at a level of 10% and the sign of its coefficient is consistent with expectations. A negative coefficient is considered to be a signal that growth in real GDP decreases the probability of currency crises. In this study, the industrial production index, which is compiled at a monthly frequency, is used to represent the real GDP growth. In the model used two indicators representing the global economy. Developing countries are affected by changes in global macroeconomic conditions. An increase in the level of international interest rates or in the level of deflation across the globe significantly increases the probability of currency crises. US inflation has no significant effect on the probability of currency crises in developing countries. This result does not support the predictions of Moreno and Trehan (2000) and Falcetti and Tudela (2006) who argue that a deflationary shock in the US can have a direct effect on economies that are exporters to the US market. International interest rates reflect the impact on the debt repayment capacity of a country. In the study, US 3 months treasury bill interest rate which serves as the representative international interest rate is used. The estimated coefficient has a significant effect at the 5% level on the probability of currency crises and has a positive sign.

Table 1: The Results for Dynamic Panel Probit Model - Model I

Dependent Variable: C1	Coef.	Std. Err.	z	P>|z|
The Lagged dependent variable ($C1_{t-1}$)	0.931	0.143	6.49	0.000
M2 / reserves (level) (x2)	0.242	0.107	2.27	0.023
M2 / reserves growth rate(x3)	-0.005	0.002	-2.35	0.019
Real GDP growth rate (x4)	-0.011	0.006	-1.71	0.088
Domestic credit / GDP growth rate (x5)	0.252	0.056	4.47	0.000
M1 growth rate (x6)	-0.111	0.057	-1.93	0.054
REER overvaluation (x7)	0.013	0.005	2.57	0.010
Export growth rate (x8)	0.002	0.002	0.75	0.453
Import growth rate (x9)	0.002	0.002	0.94	0.349
Current account / GDP (x10)	-0.008	0.012	-0.69	0.490
International reserves growth rate (x11)	-0.010	0.002	-3.71	0.000
International interest rate (x12)	0.106	0.044	2.40	0.016
US CPI inflation (x13)	0.025	0.051	0.49	0.624
Constant	-5.057	3.59	-1.41	0.159
Log-likelihood	-453.384			

LR test statistic	73.36
p-value (LR test statistic)	0.0000
Wald chi2 (40)	134.08

Note: Model outputs including the set of unobserved heterogeneity coefficients can be obtained from the author on request. All explanatory variables are lagged by one period unless otherwise specified.

The inclusion of the lagged value of the dependent variable in the model provides to test for the presence of state dependence. The state dependence has obvious policy implications: if a country experienced a crisis in the past, the probability of observing another crisis may likely depend on that previous crisis event. This is due to the fact that, as a result of the crisis experienced in the past, the restrictions or conditions regarding the emergence of another crisis may be changed in the future (Falcetti and Tudela, 2006, p. 446). In this case, past experience has a true behavioral effect, in that an otherwise similar country that did not experience the event would behave differently from the country that experienced the event (*true* state dependence) (Falcetti and Tudela, 2006, p. 454). The state dependence can be explained in an example: The country which X has often experienced crisis and the country that Y which does not experience crises have similar fundamentals. In this example, it is hard to know whether the difference between X and Y is due to unobserved effects that make X more vulnerable than Y, or whether X' s repeated crises are due to the fact that the first crisis rendered this country more vulnerable to future shock. The presence of unobserved effects suggests that results in state dependence should be interpreted with caution (Bussiere, 2007, p. 6). According to Heckman (1981) a *spurious* state dependence may emerge from the fact that in the idiosyncratic effects which may in fact reflect the unobserved individual effects such as country-specific characteristics. Therefore, it is not possible to assess the presence of the true state dependence by including solely the lagged dependent variable ($y$it-1) in the model. State dependence is based on the assumption of no correlation between unobserved heterogeneity and the dependent variable (y_{it}) (Heckman, 1981). In a dynamic model, may also occur an issue which called to an initial condition problem in case of which there is a correlation between the initial observation of dependent variable (y_{i0}) and unobserved heterogeneity (Grotti and Cutuli, 2018, p. 1). For all the countries which are included in the study, the initial values of the binary dependent variable are (t = 0). Therefore, the initial conditions problem for the estimation of a dynamic discrete choice model including the lagged dependent variable does not arise. By conditioning on the initial observation of dependent variable (y_{i0}), Wooldridge (2005) models unobserved heterogeneity by including in the model the values of the time-varying explanatory variables at each period excluding the initial period. Other authors such as Stewart (2007) and Biewen (2009) models unobserved heterogeneity through the inclusion of within-unit averages computed on the time-varying explanatory variables. Even if the use of the within-unit averages does not require a balanced panel, such a model specification tend to provide biased estimates (Grotti and Cutuli, 2018). Rabe-Hesketh and Skrondal (2013) are showed that this problem can be solved by including in the model the initial period of the explanatory variables (Z_{i0}). Based on the assumption that unobserved heterogeneity is captured by the initial period value of the dependent variable and the initial period and within-unit averages of time-varying explanatory variables, lagged dependent variable can be interpreted as true state dependence. In this context, when the unobserved heterogeneity is corrected by the method proposed by Rabe-Hesketh and Skrondal (2013), the coefficient associated with the lagged dependent variable is statistically significant at the 1 % level and has a positive coefficient. A positive coefficient indicates that when a speculative attack or currency crisis occurs, the probability of observing another speculative attack or currency crisis one month ahead increases. This result can be interpreted as an indicator that prudence must not be weakened after a first crisis has happened. When examined the set of coefficients of the variables capturing unobserved heterogeneity, it is seen that the coefficients do not have a significant effect on the probability of currency crises. To see the effects of working with a dynamic model, Table 2 shows the results performed with the same variables as in Table 1 and including up to 12 lags of the dependent variable (more lags were not significant). The results show that the 12th ($C1_{t-12}$), 3rd($C1_{t-3}$), 2nd($C1_{t-2}$) and 1st ($C1_{t-1}$) lags of the dependent variable have a statistically significant effect in explaining the probability of the currency crisis. The lagged dependent variable enter the specification with a significant and positive sign, especially in the very short term (one and three months). The 12th lag of the dependent variable ($C1_{t-12}$) has a significant impact on the probability of a currency crisis at the %10 level and has a negative sign.[2] A negative coefficient implies that once a crisis has occurred, the probability of observing another crisis 12 months ahead decreases. This can be interpreted as a sign that policymakers are taking action to prevent the crisis from occurring or at least mitigate its impact. To sum up, *true* state dependence has a significant impact on the

[2] In this model estimated by using the lags of the dependent variable from 1 month to 12 months, there is a weak evidence of unobserved heterogeneity. The initial value of the M2/reserves growth rate (x3) has a significant impact on the probability of a currency crisis at the 10 % level and has a positive sign. In the study, while 12 months period is short-term, 6 months period is very short-term.

probability of a currency crisis in the short-term. This clearly indicates that sources of endogenous persistence of crises should be taken into account in order to improve a new generation of EWS on the predictability of currency crisis. A similar result is reported by Falcetti and Tudela (2006), Dumitrescu (2012) and Candelon et. al. (2014). When the results are evaluated in term of explanatory variables, it is seen that the growth of M1 has lost its significance in model II where 12 months lag value of the dependent variable is used. While real GDP growth is significant at the 10% level in Model I, it is significant at the 5% level in Model II and has a negative sign. Similarly, the international reserves are significant at the 1% level in Model I, significant at the 5% level in Model II and have a negative sign. Other explanatory variables remain significant on the possibility of a currency crisis.

Table 2: The Results for Dynamic Panel Probit Model - Model II

Dependent Variable: C1	Coef.	Std. Err.	z	P>|z|
$C1_{t-1}$	0.746	0.151	4.91	0.000
$C1_{t-2}$	0.693	0.162	4.27	0.000
$C1_{t-3}$	0.363	0.178	2.04	0.042
$C1_{t-4}$	0.268	0.187	1.43	0.152
$C1_{t-5}$	0.281	0.196	1.43	0.151
$C1_{t-6}$	-0.185	0.240	-0.77	0.441
$C1_{t-7}$	-0.203	0.254	-0.80	0.425
$C1_{t-8}$	0.156	0.235	0.67	0.505
$C1_{t-9}$	-0.060	0.266	-0.23	0.821
$C1_{t-10}$	-0.400	0.326	-1.23	0.220
$C1_{t-11}$	-0.116	0.284	-0.41	0.683
$C1_{t-12}$	-0.763	0.431	-1.77	0.077
M2 / Reserves (level) (x2)	0.264	0.111	2.36	0.018
M2 / Reserves growth rate(x3)	-0.005	0.002	-1.99	0.046
Real GDP growth rate (x4)	-0.014	0.007	-2.03	0.043
Domestic credit / GDP growth rate (x5)	0.203	0.060	3.36	0.001
M1 growth rate (x6)	-0.073	0.061	-1.21	0.228
REER overvaluation (x7)	0.016	0.005	2.77	0.006
Export growth rate (x8)	0.002	0.002	0.81	0.418
Import growth rate (x9)	0.003	0.003	1.04	0.299
Current account / GDP (x10)	-0.017	0.013	-1.32	0.186
International reserves growth rate (x11)	-0.007	0.002	-2.53	0.011
International interest rate (x12)	0.104	0.046	2.27	0.023
US CPI inflation (x13)	0.065	0.055	1.19	0.235
Constant	-3.352	3.405	-0.98	0.325
Log-likelihood	-419.258			
LR test statistic	74.22			
p-value (LR test statistic)	0.0000			
Wald chi2 (40)	167.58			

Note: Model outputs including the set of unobserved heterogeneity coefficients can be obtained from the author on request. All explanatory variables are lagged by one period, unless otherwise specified.

4. CONCLUSION

There are significant differences between the existing models in the literature. In spite of this, most of these models are based on a static specification that does not allow the intertemporal links between crises. In this context, contrary to existing literature that are used static models, currency crises are considered in a dynamic structure. In an econometric model, the dynamic structure of the crisis is captured by including the lagged dependent variable in the model. The inclusion of the lagged value of the dependent variable in the model allows the analysis of the presence of the state dependence. However, the estimation of state dependence is complicated in the presence of unobservable heterogeneity (country-specific factors). Therefore, the role of state dependence and unobserved heterogeneity in the study investigated and it is concluded that the lagged dependent variable ($C1_{t-1}$) can be

interpreted as *true* state dependence. Several lags of the dependent variable are also included in the model to see the effects of working with a dynamic model. In this direction 12th, 3rd and 2nd lags of the dependent variable are found to have a statistically significant effect in explaining the probability of the currency crisis. This result clearly indicates that sources of endogenous persistence of crises should be accounted for in order to improve a new generation for currency crises EWS.

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