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Brief Notes on Central Indicative Planning in Turkey, 1960-2011: Its Rise, Fall and Dissolution[1]

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Abstract

The initiation and the rise of central indicative planning (CIP) in Turkey in the 1960s and the 1970s signified a late orientation of Turkish government to international Keynesianism dominating post - II. World War economic vision and the ideas put forward by emerging development economics. When the world capitalist economy started to exhibit signs of a structural crisis in the late 1960s and the implicit post-war social contract between capital and labour became unsustainable, the class compromises in Turkey which were conducive to a "planned" model of accumulation also weakened; and CIP gradually became ineffective not formally but *de facto* after 1980. In the 1980s and the 1990s, the State Planning Organization (SPO) which formerly had been entrusted with administering CIP was directed towards other tasks such as "structural adjustment" under a neoliberal economic regime. Eventually, a dysfunctional SPO was dissolved into a newly established Ministry of Development in 2011. However, the world economy has been passing from a period of restructuring after the global financial crisis of 2007-09; and the Turkish government may explore new and specific domains of planning under these circumstances.

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1. Introduction

In this paper, we shall briefly review the Turkish central indicative planning (CIP) experience of about half-a-century from 1960 to 2011. When we qualify a somewhat ambiguous term "planning" by adjectives "central" and "indicative", this implies that (i) we shall be interested in planning at national level, not at regional / corporate / individual levels; (ii) Turkish national planning (in contrast with the socialist one) had never been imperative, even for the public sector. Since students of the Turkish economy may benefit from good and extensive accounts of national planning in Turkey (e.g. Sezen 1999, Kansu 2004, Akçay 2007, Türkcan 2010), observations and remarks in our review will focus on a few critical issues.

The paper is composed of five sections. Following the first and introductory section, we examine the initiation and the rise of CIP in Turkey in the 1960s and the 1970s (Section 2). We then continue to Section 3, describing the gradual descent of CIP in the 1980s and the 1990s, when its protagonist, i.e. the State Planning Organization (SPO), was entrusted with other tasks irrelevant to its original mission. Section 4 is about the dissolution of a dysfunctional SPO within the Ministry of Development established in 2011. However, the demise of SPO does not mean that the neoliberal vision which dominated economic policy in Turkey since 1980 and its probable successors in the third decade of the 2000s will be devoid of

[1] Thanks are due to Prof. Cem Somel (Abant İzzet Baysal U., E.) for his helpful comments and to Mrs. Fatma Havsut (METU/FEAS) who typed the manuscript.

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specific planning domains of their own. Section 5 which concludes the paper explores these prospects

2. The Rise

2.1 The 1960s

Although Turkey had taken its place in the institutions of the post-II. World War international order after 1946 and benefited from the global economic boom starting in the early 1950s, its governments in the 1946-60 period had been reluctant to fully subscribe either to the visions of international Keynesianism, or the ideas put forward by the emerging development economics at that time. The establishment of the SPO by Law Nr. 91 (1960) signified a rather late orientation to these perspectives. [2] Their intellectual premises which (i) underline the importance of market failure; (ii) redefine the rules of the public sector in demand management, capital accumulation and equitable distribution of income; and (iii) advocate some kind of CIP in developing countries (DCs) helped Turkish governments in the early 1960s to formulate a new model of accumulation.

This model which is sometimes called "inward-looking" by some writers (*inter alia*, Akçay 2007: Section 3.2) was based on import-substituting industrialization (ISI). It was built on a consensus between large-scale commercial & industrial capital and newly organized & unionized labour. However, it also envisaged some protection for rural population *via* internal terms of trade manipulation and agricultural support schemes (Keyder 1987: Parts VII & VIII).[3] Turkish historical statistics confirm that until its breakdown in the late 1970s, this model of accumulation was successful in putting the Turkish economy onto a faster and more stable growth path and in providing a remarkable increase in the share of industry as a proportion to GDP (Akçay and Türel, forthcoming). [4]

For the implementation of that model, some definite steps were taken towards the organization and conduct of CIP in Turkey in the 1960-66 period. These were the following:

(1) In 1960-62, planners of SPO were highly sensitive on two issues: (i) reorganization of the state economic enterprise (SEE) system and increasing SPO's surveillance over its management; (ii) a tax reform, which also envisaged taxation of agricultural incomes (Akçay and Türel, forthcoming). Their policy proposals on these issues did not obtain sufficient political support from the governments of that period and were side-stepped. However, political supporters of planning succeeded in (i) making the state responsible for the preparation and realization of development plans and naming SPO as the agent to prepare them (Arts. 41 and 134, respectively, of the Constitution of 1961); (ii) setting-up definite bureaucratic / legal procedures by Laws Nr. 91 (1960) and Nr. 77 (1961), through which development plans and programmes would be ratified and put into effect.

(2) In the 1963-65 period (which coincided with the first two years of the First Five Year Development Plan (1963-67)), it became clear what kind of CIP was *politically feasible* in Turkey; and the organizational units of SPO as envisaged in Law Nr. 91 became fully staffed and operational. Thus the functional position of SPO *vis-a-vis* the central bureaucracy was settled.

(3) The Justice Party (AP in Turkish acronym) which came to power in October 1965 initially had an anti-planning posture, but its leader(ship) gradually perceived that SPO might be a very effective agent in the design and execution of economic policies (provided that it could be placed under the AP government's control, which was accomplished in 1966). The Second Five Year Plan (1968-72), bearing the imprint of AP's developmental aspirations was the product of this perception.

These steps brought SPO to the focal point of two concentric policy-making fields. The SPO, the Treasury and the Central Bank were placed in the inner field and they assumed responsibilities for short-term macroeconomic management. The outer field contained the SPO, ministries related to various productive activities, SEEs and Union of Chambers of Trade and Industry (TOBB in Turkish acronym); and these institutions formulated long-term development policies in collaboration with each other so as to realize the targeted resource allocation and trade patterns. [5] The platform where their "technical" blueprints were transformed into political decisions was the High Planning Council (HPC) composed of an inner cabinet of Council of Ministers plus top-level SPO executives (for a graphical description, see Türel 1996).

Under such an institutional format, Turkey became one of the few DCs which successfully carried out CIP in the 1960s and the 1970s, by embedding CIP into their political decision-making processes. One may cite Korea and India among other successful cases (Türel 2017: II. 3. 6). In many DCs (especially those in Latin America and Africa), the so-called "national" plans were nothing but technical exercises devised for the purpose of attracting capital from abroad (Agarwala 1983).

However, the institutionalization of CIP in Turkey in the 1960-80 period did not prove to be stable and consistent so far as public interventions at micro-level were concerned. [6] This defect was clearly observed during the implementation of Law Nr. 933 (1967) on encouragement of investments and exports. While AP governments (majority or coalition) made the SPO responsible for the operations related to Law Nr. 933, other governments in the 1967-80 period tended to delegate them to Ministries of Industry and Trade.

[2] For the country-specific reasons of this delay, see Kepenek (forthcoming).

[3] "Populist" features of this model is well expounded by Boratav (1983).

[4] In our opinion, a fair and in-depth assessment of accomplishments and failures of Turkish ISI in the period 1960-80 is still missing.

[5] To this set-up, we may add special commissions of experts, which were assigned temporary tasks by the SPO.

[6] Public interventions in the micro sphere is justified under Tinbergen-style planning in stages; since macro/sectoral/project planning are intimately related and they fed into each other.

In a developing capitalist economy where rapid industrialization is a prominent objective, some activities which were not performed earlier have to be undertaken partly by a rising new generation of entrepreneurs, and partly by an existing but rather risk-averse business class. These are led to new activities preferably by pecuniary incentives or by coercion of public authorities. Undoubtedly, micro-level interventions of above kind are prone to corruption or abuse of power, as the past Turkish experience demonstrates; even a relatively more accountable Korean public agents of a "developmental state" were criticized because of their toleration to crony capitalism in the 1960s and after. It must be admitted that problems of technological and coordination externalities in new industrial ventures defy easy and ready-made solutions (see, *inter alia*, Rodrik 2004).

2.2 The 1970s

After the global boom of 1951-68 ended and the world capitalist economy started to exhibit signs of a structural crisis, the appeal of international Keynesianism gradually waned (Armstrong *et al*. 1991; Glyn *et al*. 1991). Governments in advanced countries (ACs) came closer to the views that (i) the implicit post-war social contract between capital and labour was not sustainable; (ii) economic recovery had to be based upon greater reliance on market forces; (iii) profit rates falling in the long-run had to be restored to higher levels (Streeck 2014: Chs. 1-2).

In the 1970s, public opinion in the most of the ACs were very far from responding to aspirations of DCs for a just and equitable world order. Capital at the "centre" no longer advised CIP to "peripheral" countries; instead, it advocated reducing government interventions in the economy. Besides, the negotiating capabilities of DC governments in international platforms were eroding, basically because of (i) growing differentiation across these countries; (ii) increasing political power of peripheral capitalists who favoured a stronger articulation with the capital at the centre; and (iii) their failure to properly navigate through the external shocks of the 1970s.

In the Turkish case, it must also be noted that the class compromises which were conducive to the establishment of a "planned" model of accumulation weakened in the 1970s; political instabilities intensified and the Third Five Year Plan (1973-77) which was produced under an "interim" regime of 1971-73 did not enjoy sufficient political backing later. Towards the end of 1977, the Turkish economy faced three major problems, i.e.(i) restructuring foreign debt under conditions of near-insolvency; (ii) stabilization; and (iii) reviewing industrialization strategy.

On this last issue, three "pure" strategies were conceivable: (i) export-led industrialization (ELI); (ii) deepening ISI towards more sophisticated intermediate and capital goods industries; and (iii) "reconstructing populism", by putting greater emphasis on the production of wage goods and basic necessities (Türel 2010: 412-415). Although the Fourth Five Year Plan (1979-83) which was announced in 1978 emphasized the second of these strategies, it also incorporated some elements of the other two.[7] This plan was not formally, but *de facto* suspended by the January 24 Decisions (1980) which marked the end of former model of accumulation and the CIP apparatus administering it became virtually defunct.

3. The Fall

3.1 The 1980-94 Period

In the 1980s, the technical expertise of the SPO staff (which rapidly increased in numbers basically due to political motives) was used to design and oversee "structural adjustment" policies, i.e. export promotion and liberalization of trade and finance as stipulated by IMF and World Bank's conditionalities.[8]Apart from changes of secondary importance summarized in Akçay (2007: 5.1.1), the SPO's former organizational set-up was preserved till 1994.

However, there were signs that over these years SPO started to lose its privileged position in the central bureaucracy. In the Constitution of 1982, Art. 166 concerning the preparation of national plans was placed not into "Basic Rights and Duties" section, but carried into "Economic and Social Rules", and an explicit reference to SPO was omitted. On the other hand, the Motherland Party (ANAP) governments of the 1980s extended the authorities of some institutions in the central bureaucracy affiliated directly to Prime Ministry (e.g. Undersecretariats of Treasury and Foreign Trade, the Central Bank, Mass Housing Organization (TOKİ) and Ministries of State to which many SEEs were affiliated), hence reducing SPO's area of responsibilities. The two undersecretariats mentioned above and the central bank turned into new and stronger foci of economic policy-making.

Notwithstanding SPO's institutional commitment to greater reliance on market forces and lesser government intervention, its planners were still inclined to emphasize sectoral development priorities in the Fifth (1985-89) and Sixth (1990-94) Five Year Plans.

[7] Specifically, the export target of the Fourth Plan for the year 1983 ($ 5.4 billion) does not differ much from the actual export revenue of the same year ($ 5.7 billion) which was realized under an entirely different economic policy orientation. The same is also true for the revenue share of manufactured exports in total (approximately 61% in the plan, against the actual outturn of 64%) for the year 1983.

[8] According to the Fourth Plan, combined net capital inflow for the years 1979-83 was estimated to be $ 1.430 billion, which was supposed to finance current account deficits (CADs) summing up to $ 1.350 billion *plus* a modest increase in reserves ($ 80 million). Taking net errors and omissions as incorrectly recorded capital transactions, actual figures were as follows: Net capital inflows of $ 10.535 billion (which partly includes repatriation of capital illegally taken out earlier), combined CADs of $ 9.632 billion and increase in foreign exchange reserves by $ 0.903 billion (Ministry of Development 2012: 88). In short, Turkey's creditors chose an option which seems more costly for themselves; because they were categorically against the strategy of the Fourth Plan based on deepening ISI coupled with trade and foreign exchange controls.

3.2 The 1994-2000 Period

A major overhaul in SPO's structure and its planning practices took place after the economic crisis in May 1994. In line with the dominant vision of neoliberalism, one could expect that the SPO would then be transformed into a small and highly influential core, focusing upon "strategic" issues (see Dr. Ege's comments in Uygur (1991: 306-310). [9] Just the opposite occurred: Statutory Decree Nr. 540 (dated June 1994) established a far larger SPO made up of eight general directorates (in comparison to four in the earlier set-up), inclined to intervene into all major economic and social problem areas in Turkey (see Türel 1996). Such a contradiction may be explained by (i) the tendency of bureaucracies to reproduce themselves and assume new responsibilities; (ii) the government's decision to assign new tasks to SPO, the competence of which had been tested in the past. One of these tasks was probably the "indoctrination" of a large public sector bureaucracy in accordance with neoliberal tenets. Major international institutions would continue to get along with the enlarged SPO as their interlocutor; since SPO had been keeping its tradition of focusing on macroeconomic essentials rather than on factional details (Türel 2014: 173-176).

The Seventh Five Year Plan (1996-2000) which was put into effect after the transition programme of 1995 also represented a major breaking point and a precursor of what would the Turkish CIP be in the 2000s. Rather than describing the socioeconomic development perspectives in their entirety, it referred to various projects on diverse issues like international competition, disembodied technological change, flexibilization of labour markets and a regulatory state. It did not underline either sectoral development priorities or macroeconomic targets.

The restructuring and reorientation of SPO in mid-1990s did not stimulate much interest in CIP among academic economists in Turkey. [10] As we shall note below, the scholars who started to reconsider Turkish CIP in the late 1990s and the early 2000s were mostly those working in the field of public administration.

4. The Dissolution

The intellectual tradition which defines planning as "determination of instruments which can be used for the attainment of desired objectives" suggest that if objectives and/or policy instruments change, or the social conditions under which policy instruments will be applied change, planning is still needed (Sezen 1996: 290). Thus, the neoliberal age may have a specific planning domain of its own. In Turkey, such a domain was found in the 2000s, after many years of search around the concept of "strategic planning". However, the term "strategic" here has a different connotation from its earlier use: Strategic planning in the 2000s is transmitted to micro/corporate/regional levels and the planning process at the macro level is expected to work *via* information flows from the bottom to the top (Övgün 2010; 2011, Ekiz and Somel 2007). As the four national development plans prepared in the 2000s would suggest, the integration of lower level planning activities at the national level may be carried out by *ad hoc* methods, or may be partly left to the operation of market mechanism and/or budgetary practices.

Obviously, for such a national planning vision, a CIP apparatus envisaged by Statutory Decree Nr. 540 was irrelevant, and hence had to be discarded. The major steps in this direction were the following: (i) establishment of the Coordination Committee for the Amelioration of Investment Climate (YOİKK, 2001); (ii) Law Nr. 4815 on Foreign Direct Investment (2003); (iii) establishment of regional development agencies (Law Nr. 5449, 2006) and (iv) establishment of the Ministry of Development (Statutory Decree Nr. 641, 2011) into which departments of SPO were dissolved, as the umbrella of regional development agencies.

5. Conclusions: Prospects for the Future

It is clear that the world economy has been passing through a period of restructuring after the global financial crisis of 2007-09, and the governments of DCs with considerable experience in industrialization have been striving for more advantageous positions in the emerging world order. These efforts will necessitate a well-designed economic policy repertoire which has to include two basic components:

(1) At the macro level, policy planning will be of paramount importance, in view of probable trends in international trade and capital movements. It would not be inappropriate to name this task as some sort of indicative central planning under new circumstances.

(2) At the micro level, a country-specific industrial policy must be formulated, taking clues from but not imitating successful East Asian cases.

As Bürken *et al*. (2021) point out, these two tasks are interrelated, each one having positive feedbacks on the other.

Although the Tenth Development Plan (2014-18) expressed many aspirations to move Turkey into a more effective position in the emerging world economy, it was essentially built on the perspective of an articulation with the prevailing world order, assuming it more beneficial for the country. In our opinion, the intensification of the economic crisis in 2018-21 has been leading the AKP government to a reconsideration of this perspective: In July 2018, departments of the Ministry of Development at the central level and the Directorate of Budget and Financial Control of the Ministry of Finance were brought under a newly established Strategy and Budget Office of the Presidency (SBB in Turkish acronym); and regional

[9] We shall note below that the term "strategic" was used in an entirely different context in the 2000s.

[10] This corresponds to the reduced international academic interest in CIP (see Türel 1997).

development agencies were affiliated to Ministry of Industry & Technology by the Presidential Decree Nr.13. Later in October 2020, an Executive Committee of Industrialization (SAİK in Turkish acronym) was formed under the presidency, including the President, one of the vice-presidents, three ministers (i.e. Ministers of Industry &Technology, Treasury & Finance and Trade), and the head of SBB by the Presidential Decree Nr. 68, which was granted extensive executive powers.[11]

It remains to be seen whether SBB and SAİK will properly assume the two major tasks noted above, i.e. policy planning and the conduct of industrial policy.

According to the Eleventh Development Plan (2019-23) prepared by the SBB and published in July 2019, the objective is defined as a "productivity-focused, export-led and stable economic growth, assigning a dominant role to industry" (SBB 2019:27,29). [12]The policy instruments proposed for such an objective are essentially "horizontal" (i.e. improving the quality of basic inputs like human capital and physical infrastructure, provision of pre-competitive R&D support, etc.), while "selective" interventions were not clearly specified across industries. Two months after the announcement of the Eleventh Plan, the Ministry of Industry & Technology produced a document titled *Industry and Technology Strategy 2023*, following a similar approach.

Unfortunately, the internal consistency between these two policy documents and those prepared by the government for providing information to domestic and foreign actors (e.g. medium-term programmes (OVPs) and a series of announcements made by the Ministry of Treasury & Finance from April 2019 to October 2019) are rather weak. Further, from its establishment in October 2020 to the present, SAİK's interventions in industrial sectors have not been much effective.

These observations suggest that preparation of sound policy proposals are necessary, but not sufficient. Proper working relationships between institutions entrusted with policy planning & implementation and other bodies in the central administration must be established and this task may take a longer time than expected in crisis years, when the government's attention is focused on overcoming short-term difficulties.

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[11] These administrative reshuffles were, in part, due to the establishment of a "presidential government system" in Turkey, a review of which is outside the scope of this paper.

[12] The Eleventh Plan also emphasizes competitiveness, integration with the world economy and protection of domestic producers "within the framework of (our) international commitments" (SBB 2019:36), reiterating the major themes in the Tenth Plan.

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N.B.: References marked with an asterisk (*) are in Turkish.

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Foreign Investment Flows and Evidence of Market-Wide Herding in the Turkish Capital Markets

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Abstract

This study examines market-wide herding in Borsa Istanbul (BIST) during 2005-2014 period using a state-space model employing cross-section standard deviations of systematic risk (beta). We document that sentimental herding in BIST100 is statistically significant. More importantly, the results reveal that increase in foreign investment flows into the Turkish capital markets also cause increase in market-wide herding, which may lead to mispricing of stock prices and contribute to inefficiencies in the market. Herding trends over the sample period indicate that the financial crises, Lehman Brothers of 2008-09 and Euro Debt Crisis of 2011-2012, appeared to reduce sentimental herding in Borsa Istanbul. During the crisis period investors do seem to revert back to market fundamentals.

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1. Introduction

Foreign investment into capital markets in developing countries provides much-needed liquidity. It has also led to a rise in negative perceptions about the impact of foreign investors on the stability in these markets (Lakshman et. al, 2013). Some studies argue that foreign institutional investors follow short-term strategies that are not based on "market fundamentals." It may make stock prices overreact to changes in fundamentals (de Long et. al., 1990; Dornbusch and Park, 1995; Sias and Whidbee, 2006). Several theories explain the herd behaviour of foreign investors. Scharstein and Stein (1990) discovered that money managers herd since they consider moving against the crowd detrimental for their reputation. Studies also argue that money managers retrieve private information from better-informed managers and follow the same directions (Banerjee, 1992; Bikchandani et. al., 1992).

In this study we examine if foreign institutional investors have any impact on the market-wide herding behavior in BIST100 between 2005 and 2014. This work is also an extension of our previous work (Demir et al., 2014) in which Hwang and Solomon (2004) approach had been employed to study market-wide herd behavior in BIST100. The paper reported significant evidence of herding in BIST100. The paper also examined the investors behavior during the financial crisis of 2000-2002 Demir et al. 2014), it has been found that the crisis period is followed by an interval in which investors resort back to fundamentals. In this paper the work has been extended to link the herd behavior to the dynamics of foreign investment flows into BIST100. To the best of our knowledge such study has not been conducted for Turkish Stock Market.Istanbul Stock Exchange that was founded in 1986, renamed Borsa Istanbul (BIST) in 2013, brings together all exchanges operating in Turkish capital markets. From its inception, with only about 657 million USD market capitalization and 80 listed companies, by May 2014 the market capitalization had increased to 235 billion USD with

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223 listed companies in the national market. The process of the financial liberalization of Turkish capital markets that begun in early 1990's has been further accelerated during the last decade or so. Turkey has also been able to attract flows from abroad into its capital market. According to the Turkish capital market Association the foreign investment in Borsa Istanbul constituted 63% of total market capitalization in May, 2014. Furthermore, Foreign funds by institutions contributed 45% of the total capitalization while only 18% by the foreign individual investors. Sevil et al. (2012) also reported significant increase in foreign investment flows into BIST100 during last decade. To that extent, foreign investors are an important player in BIST, especially for the period that we study. The sample period selection has been based on the developments in the global financial markets after the implementation of quantitative easing polices advanced economies in 2010. The period after 2014 is marked with the tapering of Fed Rate that led to significant reversals in capital flows to Turkey. Furthermore, the currency crisis in 2018 also added some anomalies in the data. We continue to work on these anomalies and extend the present work to include the post-Pandemic period as well.

The study is organized as follows: In the second part a short review of literature related to empirical modeling of herd behavior has been provided. Part three outlines the empirical model employed in this study. In part four data and results of the model have been discussed.

2. Review of Literature

Herding in financial markets arises when investors start imitating the observed decision of others or movements in market rather than taking decisions on the basis of their own beliefs and information. Theoretical and empirical research in explaining such behavior has been diverse and several approaches/models have been proposed in the literature. These approaches can be classified broadly into two groups. The studies in the first group have focused in explaining the behavior of investors, either institutional or private, who mimic and/or follow the actions of others. Such behavior is further classified as rational and irrational (see Lakonishok et al. (1992), Banerjee (1992), Oehler et al. (2000), Gompers et al. (2001), Voronkova, et al. (2005), Kim et al. (2005), Frey et al. (2007) and Puckett et al. (2007), among several others). The second group of studies employs a "market wide" approach, which focuses on the cross-sectional dispersion of returns and/or betas. Christie and Hwang (1995) used cross-sectional deviations of returns (CSSD) to test the presence of herding in the market. Hwang and Solomon (2004) extended the work by focusing on the cross-sectional variability in factor sensitivities (betas) instead of looking at the variability of returns[1].

In this paper we focus on market-wide herding and utilize the framework of Hwang and Salmon (2004). This method uses information held in the cross-sectional movements in factor sensitivities (betas). Believing that herding is an outcome of investors' unobserved sentiments, Hwang and Salmon (2004) developed a state-space model to reveal empirically herd behavior towards the market. When investors herd towards market consensus, it is possible that the CAPM-betas will deviate from their respective equilibrium values. As a result, the beta of a stock may vary with the sentiments of the investors and herding may cause decrease in the cross-sectional dispersion of betas. The model also allows examining the impact of other factors on herding behavior, by incorporating them into the model explicitly. However, it is important to distinguish herding based on the unobserved sentiments (sentimental herding) of investors independent of particular state of the market and herding that directly relates to various states of markets, such as market returns, volatility of returns, other macroeconomic factors and investment behavior of foreign investors.

Lakshman et al. (2013) document that foreign institutional investors in Indian stock exchange does not contribute to market-wide herd behavior In a different context and motivation, Sevil et al. (2012) have investigated whether foreign investors make their decisions about portfolio investment, in Turkey, that are based on BIST market index, ignoring private information related to individual stocks. In this study Vector Error Correction Granger Causality test have been used to test the direction of causality between the buying of foreign investors and market return index. They found evidence of causality from buying of foreign investors to market return index in their sample period and concluded that the foreign investors may create noise trading. Alemanni (2006), analyzed the herd behavior of foreign investors of 9 emerging markets including Turkish capital market. They employed Lakonishok et al. (1992) approach (referred as LSV approach in literature), which examines the particular behavior of group of investors to follow other investors, different from our concept of market-wide herding in this study. Çelik (2013) examined herd behavior in both developed and emerging markets including Turkey. She employed Christie and Huang (1995) methodology and found no evidence of herding.[2]

3. Methodology

The hypothesis of Hwang and Salmon (2004) emphasizes sentiment behavior of investors which is unobservable and moves in association with the systematic risk indicator beta. They also use the cross-sectional behavior of assets similar to that of Christie and Huang (1995). Their model is different,

[1] Lakshman et al (2013) provide a good summary of both theoretical and empirical papers on herding.

[2] Solakoglu and Demir (2014) also examined herd behavior in Turkish stock market in two distinct types of investors in the market informed vs uninformed. The paper found no evidence of herding in BIST30 but significant evidence of herd behavior in less informed group of investors.

however, in that it is based on the notion of market-wide herding using betas rather than returns. In market-wide herding, investors may decide to follow market trends, and this may cause the individual asset returns to move in tandem with the market returns. As the sentiments of the investors vary, the beta values of the stocks will also change to previous equilibrium values, confining themselves to the market beta of unity. In short, the theoretical and empirical modeling of herd behavior used by Hwang and Salmon differs fundamentally from Christie and Huang and Chang Cheng and Khorana (2000) in that they make a clear distinction between unobserved sentimental herding and herding associated with market fundamentals, and they provide a framework in which to estimate it. The other models rely on observed dispersions of returns brought about by a combination of sentimental and fundamental movements[3].

The Capital Asset Pricing Model (CAPM) models the expected excess returns of a risky asset to the contemporaneous expected excess returns on market portfolio. Hwang and Salmon (2004) made the argument the existence of herding based on CAPM can be biased and introduced herding towards the market portfolio parameter, h_{mt} at time t (see eq. 1)

The model is based on a relationship between observed biased beta (β^b_{imt}) and unobserved true beta *(β_{imt})* as follows:

$$\frac{E^b_t(r_{it})}{E_t(r_{mt})} = \beta^b_{imt} = \beta_{imt} - h_{mt}(\beta_{imt} - 1) \quad [1],$$

where $E^b_t(r_{it})$ is the biased short run conditional expectation on the excess return of asset i at time t, and $E_t(r_{mt})$ is the conditional expectation of the market excess return at time t. The relation in [1] would imply that there is no herding towards the market when h_{mt} is zero and perfect herding when it is one. So the interval, $0 < h_{mt} < 1$would suggest degree of herding, depending on the value of h_{mt}. The unobserved herd behavior indicator h_{mt} is the parameter assumed proportional to the deviation of the individual true beta from market beta unity. The cross sectional variation of β^b_{imt} becomes:

$$Std_c(\beta^b_{imt}) = Std_c(\beta_{imt})(1 - h_{mt}) \quad [2].$$

Taking logarithms of both sides of [2], we get,

$$\ln[Std_c(\beta^b_{imt})] = \ln[Std_c(\beta_{imt})] + \ln(1 - h_{mt}) \quad [3].$$

We may now re-write equation [3] as:

$$\ln[Std_c(\beta^b_{imt})] = \mu_m + H_{mt} \quad [4],$$

where $\mu_m = \ln[Std_c(\beta_{imt})]$ is an assumed constant in the short term *and* $H_{mt} = \ln(1-h_{mt})$. Hwang and Salmon (2004) now allow herding, H_{mt}, to follow a dynamic process AR(1), such that the system becomes :

$$\ln[Std_c(\beta^b_{imt})] = \mu_t + H_{mt} + v_{mt} \quad [5]$$

$$H_{mt} = \varphi_m H_{mt-1} + \eta_{mt}$$

where the two error terms are v_{mt}~iid(0,σ^2_{mv}) and η_{mt}~iid(0,$\sigma^2_{m\eta}$), respectively.

The two equations in [5] constitute the standard state-space model. One of the key parameters of interest in equation [5] is the variance of the error term of the state equation $\sigma^2_{m\eta}$. When $\sigma^2_{m\eta}$ is zero, it would imply that there is no herding, since $H_{mt} = 0$ for all t. A statistically significant value of $\sigma^2_{m\eta}$, however, would indicate the presence of herding in the market. Furthermore, a significant φ_m, provided that $|\varphi_m| \leq 1$, would support the autoregressive process. Hwang and Salmon (2004) further tested the robustness of their model by including both market volatility and market returns in the first equation of the model. They argued that if H_{mt} becomes insignificant after the inclusion of these market fundamentals in the model, then changes in $Std_c(\beta^b_{imt})$ can be explained by market fundamentals. The standard model can therefore be modified to include these fundamentals as control variables to test for robustness as follows:

$$\ln[Std_c(\beta^b_{imt})] = \mu_m + H_{mt} + \theta_{c1} ln\, \sigma_{mt} + \theta_{c2} r_{mt} + v_{mt} \quad [6]$$

$$H_{mt} = \varphi_m H_{mt-1} + \eta_{mt} \quad ,$$

where $ln\, \sigma_{mt}$ and r_{mt}represent market volatility and log return in time period t. The two equations in [6] constitute our Model 2.

Finally, in Model3, foreign investment (FII) has been added to evaluate the impact of FII on herding, Model 3:

$$\ln[Std_c(\beta^b_{imt})] = \mu_m + H_{mt} + \theta_{c1} ln\, \sigma_{mt} + \theta_{c2} r_{mt} + \theta_{c3} FII + v_{mt} \quad [7]$$

$$H_{mt} = \varphi_m H_{mt-1} + \eta_{mt}$$

The paper employs the model in [7] to examine two distinct hypotheses in this paper. First, it reexamines the behavior of unobserved sentimental herding as proposed by Hwang and Salmon (2004). Second, to determine whether FII causes herding in BIST100 or not? The paper also aims to analyze the herd behavior during extreme market stress due to global financial crises.

5. Data and Results

The daily share prices for the firms in the BIST100 index as well as their index levels were obtained from the Bloomberg Terminal. The data cover the dates between February 28, 2005 and May, 23, 2014 providing us with 2370 usable observations. Each month, Borsa Istanbul also publishes the nominal value of transactions carried out by foreigners[4]. We subtracted nominal buy from the nominal sell value and aggregate the net difference across each month in order to capture the behavior of the overall cumulative changes in the foreign holdings in BIST. In calculating the monthly beta of a stock, we utilized the the market model and regressed log returns of firm i on the log returns of the market

[3] Discussion of methodology in this section, with some modifications, has been taken from our previous paper, Demir et al. (2014).

[4] The justification of the sample size selection has been provided in the introduction in detail.

index, usingdaily data for each month. Hence, we have one beta estimate for each firm for each month, giving us 100 beta estimates per month (unless there are missing data in the sample).

Once we have the individual betas, we calculate the cross-section standard deviations of betas for each month based on the following formula:

$$Std(beta)_t = \sqrt{\frac{\sum_{i=1}^{n}(beta_{it}-\overline{beta_t})^2}{n-1}},$$

where t represents the month, i represents the firm i, and $\overline{beta_t}$ represents the cross-sectional average of all betas in month t.

Table 1 reports some of the statistical properties of the estimated cross-sectional standard deviations of the betas covered by the BIST-100 market portfolio.

Table 1. Properties of Cross-sectional Standard Deviations of BETAS.

	Cross-sectional Standard Deviation OLS Betas	Log cross-sectional Standard Deviation OLS Betas
Mean	0.478954	-0.751147
Standard Deviation	0.085040	0.085040
Skewness	0.806154	0.188154
Kurtosis	4.371876	3.285191
Jarque-Bera	20.91403	1.040395

The results indicate that the $Std_c(\beta^b_{imt})$ is significantly different from zero. The Jarque-Bera statistics for normality clearly suggest that the distribution of the $std_c(\beta^b_{imt})$ is not Gaussian. However, estimated log cross-sectional standard deviations do not seem to deviate from Gaussianity.

In the first stage base model (Model 1) has been estimated, the maximum likelihood estimates of the parameters are also reported in Tables 2.

Table 2. Estimates of State-Space Standard Model.

Kalman Filter State-Space Model
Maximum Likelihood Model
Number of Observations:112

	Coefficent	Std. Err.	Z-Stat.	Prob.	Variable	
C(1)	-0.750537	0.024476	-30.66458	0.0000	μ_m	-0.750537
C(2)	0.550748	0.336439	1.636990	0.1016	φ_m	0.550748
C(3)	4.197638	0.658854	-6.371117	0.0000	$\sigma_{m\eta}$	0.100726
C(4)	-4.590589	1.097558	-4.182548	0.0000	$\sigma_{m\nu}$	0.122603
			Signal to Noise Ratio		$\sigma_{m\nu}$ / Log Std β	0.582356
			Log-Likelihood		42.84866	
			Akaike Criterion		-0.693726	
			Schwarz criterion		-0.596637	

It is immediately clear that H_{mt} is fairly persistent as the estimated value of φ_m is statistically significant with a signal to noise ratio of about 0.5823%. That is 58% of the total variability in $\ln[Std_c(\beta^b_{imt})]$ is being explained by sentimental herding. Similarly, the estimated $\sigma_{m\eta}$, which is the standard deviation of the error term η_{mt} in the state equation, is also highly significant. If $\sigma_{m\eta}$ were equal to zero, it would have indicated that there is no herding. We may therefore conclude, on the basis of the base model specification, that there is strong evidence of market-wide herding towards the market portfolio for the BIST-100. Furthermore, a fairly high value of 'signal to noise ratio' implies that the process of herding has not been very smooth. The results of H_{mt} in Model 2, which also takes into account the market volatility of returns and the levels of returns in order to test for the robustness of the model, also suggest fairly persistent and statistically significant presence of sentimental herding towards the market portfolio for the Turkish stock market. However, a significant coefficient of volatility seems to impact the herding patterns as well. So when market becomes riskier, that is volatility of return increases it causes betas to herd towards the market, i.e., $\ln[Std_c(\beta^b_{imt})]$ decreases and vice a versa. The coefficient of returns in the model turned out to be statistically insignificant. The signal to noise ratio drops to 0.1840% in model 2. These results further support the earlier results reported in Demir et. al. (2014).

Table 3. Estimates of State-Space Model with Market Volatility and Market Returns.

Kalman Filter State-Space Model
Maximum Likelihood Model
Number of Observations:112

	Coefficent	Std. Err.	Z-Stat.	Prob.	Variable	
C(1)	-2.218076	0.170223	-13.03037	0.0000	μ_m	-2.218076
C(2)	0.813686	0.207804	3.915651	0.0001	φ_m	0.813686
C(3)	-4.448278	0.223812	-19.87505	0.0000	$\sigma_{m\eta}$	0.0031833
C(4)	-6.894528	1.572514	-4.384399	0.0000	$\sigma_{m\nu}$	0.111726
C(5)	-0.351374	0.040758	-8.621086	0.0000	θ_{c1}	0.838881
C(6)	0.182448	2.804980	0.065044	0.9481	θ_{c2}	1.095514
			Signal to Noise Ratio		$\sigma_{m\nu}$ / Log Std β	0.184045
			Log-Likelihood		80.18901	
			Akaike Criterion		-1.324804	
			Schwarz criterion		-1.179170	

Finally, in Model 3, foreign inflows have also been included in the model in order to test the second hypothesis of this paper. Both the coefficients of volatility and foreign inflows, θ_{c1} and θ_{c3}, turned out to be highly significant. The coefficient of foreign investment flows is found to be significantly negative. This indicates that $\ln[Std_c(\beta^b_{imt})]$ increases /decreases when these flows falls/rises[5]. In other words, increase in foreign investment flow causes herding in BIST100. This is an important result, it suggests that as cumulative foreign capital flows into BIST increases, the market participants tends to herd towards market. Furthermore, we also found that $\sigma_{m\eta}$ is significantly different from non-zero and we may conclude that besides herding caused by foreign flows, there is still some evidence of

[5] Other variables related to foreign investent such as buying/selling of stocks, net of buying/selling have also been employed, however, they were found statistically insignificant.

presence of sentimental herding in the market[6]. In Figure 1, we have shown the patterns of the sentimental herding computed from three specifications of the model and results are fairly comparable with each other. And in particular, the patterns of sentimental herding of model 2 and model 3 follow almost similar paths. However, these results need to be interpreted with some care. First, we have only been able to incorporate overall net flows of foreign funds into the model due to the fact that further disaggregated sources of these funds were not available for the sample period of this study. For example, Lakshman et al (2013) found no evidence of herding caused by overall foreign funds into the Indian Capital Market. However, they did find that foreign mutual funds do significantly cause herding in the market. So upon availability of the sources of these funds into the Turkish market, it will be interesting to see if particular types of foreign funds cause more herding or not in future work. Ekinci and Sakarya (2020) have examined, for example, how Exchange-Traded Funds (ETFs) may contribute to exchange rate volatility. The results have shown that large inflows ETFs do contribute positively to exchange rate volatility. ETFs are basket of securities and can be included in the model framework of this paper to examine their impact on herd behavior in our future research. Second, Hwang and Salmon (2004) considered volatility and market returns as fundamental(s) of market and herding caused by these fundamentals were not interpreted as sentimental herding by them, which is otherwise unobservable. It is, however, not obvious whether foreign inflows and outflows constitutes one of the fundamentals of capital market. Therefore, in our interpretations of these results, we think that injections/withdrawals of foreign funds into BIST100, is one the important determinants of the herd behavior of agents in this market. And this is an important result of this study as this behavior of agents may lead to inefficiencies and mispricing of assets.

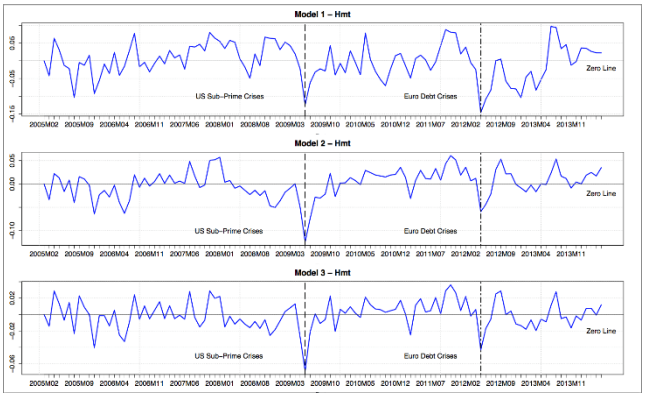
Table 4. Estimates of State-Space Model with Foreign Institutional Investment (FII)

Kalman Filter State-Space Model
Maximum Likelihood Model
Number of Observations:112

	Coefficent	Std. Err.	Z-Stat.	Prob.	Variable	
C(1)	-2.135562	0.156020	-13.68774	0.0000	μ_m	-2.135562
C(2)	0.270804	0.799034	0.338914	0.7347	φ_m	0.270804
C(3)	-5.035536	3.349037	-1.503577	0.1327	σ_{mn}	0.082504
C(4)	-4.989813	3.321876	-1.502107	0.1331	$\sigma_{m\nu}$	0.080639
C(5)	-0.348150	0.037963	-9.170787	0.0000	θ_{c1}	0.810234
C(6)	0.714398	2.689047	0.265670	0.7905	θ_{c2}	1.42932
C(7)	-0.050334	0.027605	-1.823353	0.0682	θ_{c3}	0.975147
			Signal to Noise Ratio		$\sigma_{m\nu}$ / Log Std β	0.477004
			Log-Likelihood	81.99640		
			Akaike Criterion	-1.339221		
			Schwarz criterion	-1.169315		

Three herding measures of h_{mt}, based on three different specifications of the model have also been plotted (see Figure 1). The time series also reveal different phases of market-wide herding and reverse herding during the sample period. It is also very evident that during the global financial crisis 2008-09, there had been sharp decrease in sentimental herding, indicating that market reverts back to fundamentals under severe crisis. Similarly during 2011-12, during Euro Debt Crisis, similar pattern has been observed. Interestingly few months prior to Sub-Prime crisis in 2008-09 and Euro-Debt crisis in 2011-12, herding starts to fall. However, continued increase in the equity prices after the crises, again led investors to herd. This further supports Hwang and Solmon (2004) argument that when market(s) are under extreme stress, investors tend to stop herding and try to follow the market fundamentals.

Figure 1. Sentimental Herding Patterns[7].

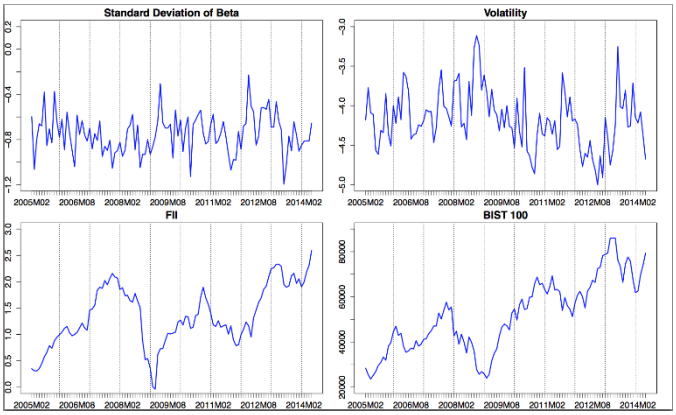


In Fig 2 beta herding measure, $\ln\left[Std_c\left(\beta_{imt}^b\right)\right]$ has been plotted together with cumulative foreign investment FII, Volatility and BIST100 market index. It further confirms the results reported earlier, based on the estimated model. Both higher volatility and cumulative foreign investment cause betas to herd towards the market. It also confirms the results of Sevil (2012), in which they had shown that foreign investment also causes some noise in BIST100 by impacting the market index. However, in this paper our focus has been to examine the herd behavior based on the movements in the standard deviations of betas.

[6] Both Akaike and Schwarz criteria and the values of log-likelihood function show significant improvement in overall fit of Model 2 and Model 3 over Model 1.

[7] Herding measure hmt (=1-exp(Hmt))

Figure 2. Herding Patterns, Volatility, Foreign Investment and BIST-100 index.



6. Conclusions

In this study herding behavior in the Borsa Istanbul has been analyzed, employing monthly data between 2005 and 2014. Several variations of State-Space Model, as proposed by Hwang and Salmon (2004) have been estimated and the Kalman filter is used to make herding observable.

The study is an extension of our previous work (Demir et al.,2014) by incorporating foreign investment flows in the model explicitly. It has been found that herding towards the market in the BIST-100 is both significant and persistent independently from other variables such as the volatility of returns, levels of market returns and foreign investment flows. It is concluded that not only the investors' sentiments cause market-wide herding but increase in foreign investment flows and volatility of returns also significantly impact the herd behavior in the market. One of the important contributions of the paper is that, foreign investment into BIST100 significantly reduces the standard deviations of observed betas of individual stock and therefore causes market-wide herding. The path of herding during the sample period also reveals that during severe financial crises, such as Lehman Brothers crisis in 2008-09 and Euro Debt crisis in 2011-12, also negatively impact the herd behavior. During these crises, market participants seem to return to the market fundamentals, this further supports the conclusions of Hwang and Salmon (2004) results. The results also suggest that this decline in herding starts few months prior the peak period of crises. Furthermore, the sentimental herding in the Turkish market has not been very extreme, fluctuating between +0.09 and -0.07. There is a need to further examine this channel of herding caused by foreign investment in more detail in future. For example, herding patterns of subset of stocks with more foreign investment as compared to the other stocks may further foster our understanding of these results. And use of more disaggregated data on the sources of foreign investment may also be another direction for future work.

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Real Exchange Rate Volatility on Economic Growth under Intermediate and Flexible Exchange Rate Regimes: Empirical Evidence from Turkey

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Abstract

The aim of this paper is to analyze empirically the effects of real exchange rate volatility on economic growth under intermediate and flexible exchange rate regimes in Turkey. The cointegration analysis and error correction models are used to test the long-run relationship and short-run effects respectively. The cointegration analysis shows that there is a long-run relationship between all the variables. The estimation results show that real exchange rate volatility has depressing effects on economic growth in both intermediate and flexible exchange rate regimes. The real exchange rate has positive effects on economic growth in the intermediate exchange rate regime and negative effects on economic growth in the flexible exchange rate regime. The inflation rate and financial deepening have positive effects on economic growth in both of the exchange rate regimes. While interest rate has negative effects on economic growth in the intermediate exchange rate regimes, it has positive effects on economic growth in the flexible exchange rate regime. The error correction models support the long-run relationship between the variables and the variables return to their long-run values in a high speed of adjustment.

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1. Introduction

After the collapse of the Bretton Woods fixed exchange rate system in 1973, many of the developed, developing and emerging market economies adopted the flexible exchange rate regime. In the flexible exchange rate regime, exchange rates are determined freely by demand and supply in the foreign exchange market. The main advantages of flexible exchange rate regime are to pursue an independent monetary policy, its invulnerability to currency crisis and its ability to absorb country-specific real asymmetric shocks. However, the adoption of flexible exchange rate regime by many countries brought into question the exchange rate volatility or uncertainty and its effects on macroeconomic variables, i.e., economic growth, investment, international trade, international capital flows, productivity and financial market development. It is argued that exchange rate volatility creates an uncertain environment for economic growth, investment, international trade, capital flows, productivity and financial markets and this uncertainty may lead to decrease of these macroeconomic variables.

The origin of the economic growth theory goes back to the Neoclassical growth theory that started with Robert M. Solow in 1957 (Solow, 1957). According to the Neoclassical growth theory, major determinants of long-run economic growth are capital stock, labor supply and technology. In the Neoclassical growth model, the real exchange rate was not one of the major factors that affect the economic growth. The reasons may be the economies were closed and there was no role for exchange rates.

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What could be relationship between exchange rate regimes and economic growth? This linkage comes from investment, international trade and productivity. Eichengreen (2008) states that

"*This is not the same as saying that real exchange rate policy can substitute for the presence of a disciplined labor force, high savings, or a foreign investment-friendly climate. But it can help to jump-start growth by encouraging the redeployment of resources into manufacturing and reaping immediate productivity gains. This way of thinking about the issue has the merit, as noted, of explaining why the simple correlation between growth and the level and volatility of the real on the presence or absence of other fundamentals."*

In Turkey, the implemented exchange rate regimes from 1990 to 2001 can be described as intermediate exchange rate regimes (more details are given in Section 3). After the financial crisis on 21 February 2001, flexible exchange rate regime was adopted.

Some of the macroeconomic indicators related with the Turkish economic growth rates in the intermediate and flexible exchange rate regimes are summarised as follows[1]: While average growth rate of real Gross Domestic Product (GDP) was 4 percent in the flexible exchange rate regime period it was 6 percent in the intermediate exchange rate regime period. The ratio of investment expenditures to GDP was 24 percent in the intermediate exchange regime and 25 percent in the flexible exchange rate regime. While inflation rate was 75 percent in the intermediate exchange rate regime period, it was 13 percent in the flexible exchange rate regime period. While openness of the economy to international markets was 40 percent in the intermediate exchange rate regime period, it increased to 48 percent in the flexible exchange rate regime period.

These macroeconomic indicators support Ghosh, Guide, Ostry and Wolf (1996) conclusion. The authors state that while investment is higher under the fixed exchange rate regimes for industrial and upper middle income countries, there is no difference in regarding investment between different exchange rate regimes for lower income countries.

The aim of this study is to analyze empirically the effects of real exchange rate volatility on economic growth under intermediate and flexible exchange rate regimes in Turkey. Since intermediate exchange rate regimes have lower uncertainty about real exchange rates, it is expected that real exchange rate volatility should not have depressing effects on economic growth in the intermediate exchange rate regimes. On the other hand, it is expected that real exchange rate volatility should have depressing effects on economic growth in the flexible exchange rate regime. To the best of my knowledge there is no empirical study that examines the effects of real exchange rate volatility on economic growth under intermediate and flexible exchange rate regimes in Turkey. This study may also helpful to show the relationship between the exchange rate regimes and economic growth.

2. Literature Review

Why do some countries grow faster than other countries? Barro and Sala-i-Martin (2004) gives detailed information about growth theories and empirical analysis of countries' growth experiences. According to the Neoclassical growth theory, the major determinants of long-run economic growth are capital stock, labor supply and technology. The real exchange rate was not at the centre of analyses of economic growth in the first generation of Neoclassical growth models (Eichengreen 2008). The reason for this may be that these were closed economies and there was no role for real exchange rates.

However, with the liberalization of international trade and capital flows, the real exchange rate became one of the most important factors that affect economic growth. Eichengreen (2008) states that keeping real exchange rate at competitive levels and avoiding excessive real exchange rate volatility enable a country to use its resources efficiently for economic growth. Some of the empirical studies that examine the relationship between exchange rate regimes and economic growth can be summarised as follows:

Bayraktutan and Özkaya (2009) examined the relationship between exchange rate regimes and economic growth for 97 countries over the period from 1975 to 2004. The authors found that as compared to flexible exchange rate regime, fixed and intermediate exchange rate regimes have better performance on economic growth, but their effects on economic growth are minimal.

Bleaney and Francisco (2007) examined the relationship between exchange rate regimes and growth rate of per capita GDP for 91 developing countries over the period from 1984 to 2001. The authors find that in the developing countries hard pegs are associated with significantly slower growth rates than flexible and soft pegs exchange rate regimes.

Levy-Yeyati and Sturzenegger (2003) examined the relationship between exchange rate regimes and economic growth for 183 countries over the period from 1974 to 2000. The authors find that exchange rate regimes have significant effects on economic growth of developing countries and have

[1] The variables are calculated using the IFS of the IMF data. The inflation rate data is taken from the Turkish Statistical Institute.

weaker effects on economic growth of industrialised countries. The aouthors also show that less flexible exchange rate regimes are associated with slower economic growth in developing countries.

Chirwa and Odhiambo (2016) give a review of international literature on macroeocomic determinants of economic growth. The authors find that the determinants of economic growth show differences depending on whether the country is developed or developing country. The authors reveal that for developing countries the key macroeconomic determinants of economic growth are based on the order of their importance include exogenous factors (foreign aid, foreign direct investment), fiscal policy, trade, physical capital, human capital, demographics, monetary policy, natural resources and geographic, regional, political and financial factors. For developed countries, the key macroeoconomic determinants associated significantly with economic growth are physical capital, fiscal policy, human capital, trade, demographics, monetary policy as well as financial and technological factors.

Most of the empirical studies find depressing effects of exchange rate volatility on economic growth. Some of the empirical studies can be summarized as follows: Barguellil, Ben-Salha and Zmami (2018) examined the effects of exchange rate volatility on economic growth in 45 developing and emerging market economies for the period from 1985 to 2015. The authors find that both nominal and real exchange rate volatilities have negative effects on economic growth in the countries with flexible exchange rate regime and they have no significant effects in the countries with fixed exchange rate regime. Besides, the impact of exchange rate volatility on economic growth is negative and more pronounced in financially open economies.

Sabina, Manyo and Ugochukwu (2017) finds negative effects of exchange rate volatility on economic growth in Nigeria for the period from 1981 to 2015.

Janus and Riera-Crichton (2015) finds negative effects of real exchange rate volatility on economic growth in a panel of OECD countries for the period from 1980 to 2011.

Onwuka and Obi (2015) examines the relationship between real exchange rate volatility of the country and of the G-3 countries (United States, Japan, Germany/or Euro zone) and the economic growth of developing African countries, namely; Nigeria, Kenya, Ghana, Malawi, Zambia and Mali for the period from 1980 to 2001 and from 2002 to 2013. The authors find that G-3 real exchange rate volatility improves economic growth of developing African countries in the period from 1980 to 2001 and depresses in the period from 2002 to 2013. The developing African country's own real exchange rate volatility has depressing effects on economic growth in both two periods.

Sanginabadi and Heidari (2012) find negative effects of exchange rate volatility on economic growth in İran in the flexible exchange rate regime for the period from 1988 to 2007.

Ndambendia and AL-Hayky (2011) find negative effects of real exchange rate volatility on economic growth in 15 Sub-Saharan African (SSA) countries over the period from 1980 to 2004.

Schnabl (2009) finds negative effects of exchange rate volatility on growth in both Emerging Europe and East Asia. The author states that part of this negative effect can be associated with exchange rate volatility caused by macroeconomic instability.

Schnabl (2007) examines the effects of exchange rate volatility on economic growth for a sample of 41 mostly small open economies at the EMU (European Monetary Union) periphery. The author shows that exchange rate stability leads to more growth and this evidence is especially strong for Emerging Europe which moved from high macroeconomic instability to macroeconomic stability during the observation period. The author also shows that the benefits of exchange rate stability is weaker for the group of industrialized non-EMU European countries where capital markets are more developed.

Regarding Turkey, Ünlü (2015) finds negative effects of exchange rate volatility on economic growth in Turkey for the period from 1998 to 2014.

The exchange rate volatility may have negative effects on key determinants of economic growth, namely, investment, international trade, foreign direct investment and international capital flows. Erdal (2001) shows theoretically that real exchange rate uncertainty decreases real investment spending in either export-oriented or import-competing firms using option pricing techniques. When the opportunity to undertake irreversible investment (such as financial call option) is exercised, it kills the option of investing and the possibility of waiting for new information. Therefore, investment decisions of firms are sensitive to uncertainties over economic environment. Assuming present real exchange rate volatility is a proxy for real exchange rate uncertainty, and investment spending is like a call option, Erdal (2001) shows that real exchange rate volatility causes optimal real exchange rate level to undertake investment to be higher for export-oriented sectors and lower for import-oriented sectors. Thus, the zone of "*inaction*" increases, and real investment spending falls as volatility increases regardless of whether the sector is an export-oriented or import-oriented sector.

Erdal (2017) examines the effects of real exchange rate volatility on investment in the manufacturing sectors of the countries in the quasi-fixed exchange rate regime, i.e., Exchange Rate Mechanism (ERM) of the European Monetary System (EMS), as well as of the countries in the flexible exchange regime. One of the main reasons for the establishment of the ERM was to create a stable exchange rate environment, and thereby induce investment and trade in Europe. The author finds that real exchange rate volatility has depressing effects on sectoral investment of the countries in the flexible exchange rate regime and has no depressing effects on sectoral investment of the countries ERM of the EMS.

Some of the empirical studies that examine the effects of exchange rate volatility on investment, capital flows and foreign direct investment in Turkey can be summarised as follows: Erdal and Pınar (2019) examine the major determinants of economic growth under intermediate and flexible exchange rate regimes in Turkey. The authors show that the determinants of the growth of real GDP show differences depending on the type of exchange rate regimes. While the ratios of investment and government expenditures to GDP, openness of the economy and employment rate have positively significant effects on the growth rate of real GDP in the intermediate exchange rate regime, they have negative or insignificant effects on the growth rate of real GDP in the flexible exchange rate regime. On the other hand, the central bank policy rate has negative effects and inflation rate has positive effects on economic growth in both of the exchange rate regimes.

Pınar and Erdal (2018) examine the effects of real exchange rate volatility on foreign direct investment (FDI) in the flexible exchange rate regime (i.e., the period from 2005 to 2016). The sectors are separated as primary (agriculture, mining & quarrying), secondary (manufacturing) and tertiary (services) sectors by taking their interactions with real exchange rate volatility and macroeconomic variables into consideration. The authors find that real exchange rate volatility has positive effects on total FDI inflows and FDI inflows to the manufacturing sector and it has insignificant effects on FDI inflows to agriculture, mining & quarrying and services sectors in Turkey.

Erdal and Pınar (2017) analyze the effects of real exchange rate volatility on sectoral export flows in Turkey under intermediate and flexible exchange rate regimes. The authors use sectoral level export data and it is expected that the using of sectoral level rather than aggregate data may disentangle the relationship between real exchange rate volatility and export flows. The authors show that real exchange rate volatility has negative and statistically significant effects on sectoral exports flows in both intermediate and flexible exchange rate regimes.

3. Foreign Exchange Regimes in Turkey

In the fixed exchange rate regime, the monetary authority fixes the value of its domestic currency to the value of another country's currency, the value of the basket of currencies or the price of gold. The main advantages of fixed exchange rate regimes are to foster investment and international trade by reducing uncertainties about exchange rates and interest rates and by maintaining price stability. In the fixed exchange rate regime, lower exchange rate volatility reduces transaction costs for international trade and international capital flows that contributes to higher growth rates (Schnabl, 2007). Besides, fixed exchange rate regime contributes to macroeconomic stability which is also important for economic growth. The disadvantage is inability to pursue independent monetary policy.

The intermediate exchange rate regimes are in between the flexible and fixed exchange rate regimes. The intermediate exchange rate regimes have remained widespread especially in the developing countries and emerging market economies in spite of impossible trinity theorem, increasing capital mobility and difficulty in controlling exchange rates (Salins and Bénassy-Quéré, 2010). In the intermediate exchange rate regimes, the value of the domestic currency is fixed to another country’s currency or a basket of currencies in different forms (i.e., conventional fixed pegs, horizontal bands, crawling pegs, crawling bands, tightly or other managed floating), but the monetary authority do not strict to commit fixed exchange rates as in the case of the fixed exchange rate regimes (Pınar and Erdal, 2016).

In the intermediate exchange rate regimes, periodical adjustments could be made on targeted or fixed exchange rates. The advantage of intermediate exchange rate regimes relative to fixed exchange rate regime is that the monetary policy could be used partially, and the advantage of intermediate exchange rate regimes relative to flexible exchange rate regime is that they are more advantageous to maintain monetary stability. Salins and Bénassy-Quéré (2010) states that when wages are sticky, the intermediate exchange rate regimes dominate both flexible and fixed exchange rate regimes in case the economy is hit mainly by productivity and foreign interest rate shocks.

The exchange rate regimes implemented in Turkey from 1990 to 2001 can be described as intermediate exchange rate regimes (Reinhart and Rogoff, 2002; Bubula and Ötker-Robe, 2002; Pınar and Erdal, 2016). Beginning from the 1990s, *de jure* flexible exchange rate regime was implemented, the Central Bank of Turkey often intervened the exchange rate

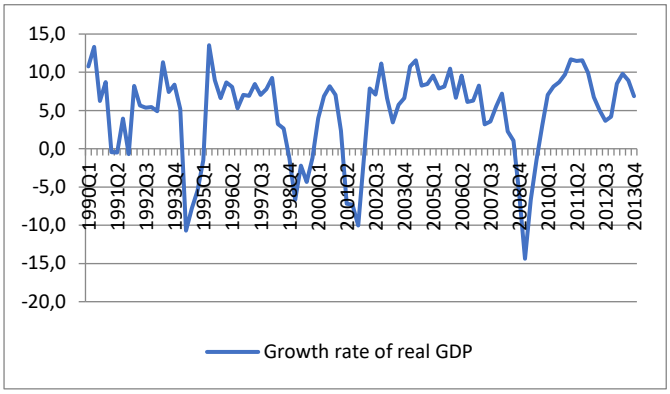
volatility. For that reason, the exchange rate regime was called "managed floating". At the beginning of 1995, the value of the Turkish lira was pegged to the currency basket consisted of 1 US dollar and 1.5 Deutsche mark. It was also decided that the monthly value of the currency basket would be increased with respect to expected monthly inflation rates. The Central Bank of Turkey intervened in the foreign exchange market to maintain predicted increase in the currency basket.

Between 1996 and 1999, the Central Bank of Turkey regulated the foreign exchange rate policy with respect to the monetary policy. In this period, since the primary objective of monetary policy was to maintain stability of the financial markets, the exchange rate policy was used to decrease exchange rate volatility. The devaluations were made with respect to expected inflation rates. So, the exchange rate regime implemented in this period can be described as "managed floating with no predetermined path for the exchange rate".

In December 1999, a stand-by arrangement was signed with the International Monetary Fund (IMF) and within the framework of the disinflation program "forward looking crawling peg exchange rate regime" was started to be implemented. The exchange rate increases were determined in accordance with the targeted inflation rate. The value of the currency basket consisted of 1 US dollar and 0.77 euro was announced for one year. But, after the financial crisis on 21 February 2001, this regime was abandoned and flexible exchange rate regime was adopted. Currently, the Central Bank of Turkey intervenes in the foreign exchange market to minimize excessive exchange rate volatility, and in the case of excess foreign exchange supply in the market buy them to increase its foreign exchange reserves.

In the meantime, it would be good to look at the growth rates of real GDP during the intermediate and flexible exchange rate regimes (Figure 1). As can be seen from Figure 1, the economic growth rates were more volatile in the intermediate exchange rate regimes as compared to those in the flexible exchange rate regime, especially when we exclude externally driven global crisis of 2008-2009. Besides, there were substantial slowdowns in economic growth in financial crisis years such as 1994, 2001 and 2009.

Figure 1. Growth Rate of Real GDP



Source: IFS of the IMF

4. Theoretical Framework

In the theoretical part of the study, a modified Solow model is used to see the effects of additional growth enhancing shift variables (Bhaskara, 2006). The production function can be written as follows:

$$Yt = Ao\ e\ (g1 + g2Z)\ t\ Kt\ p\ Lt\ 1\text{-}p \quad (1)$$

where "Yt" is output, "Ao" is the initial stock of knowledge, and grow over time, "K" is physical capital, "L," is labor, "g" is assumed to be a function of growth promoting shift variable "Z" and is also some unknown trended variables proxies with time. So, the "Z" variable could be openness, foreign aid etc., or a vector of some growth improving variables. Let's take logarithm of both sides of equation. So, the suggestions of this modification are as follows:

$$\ln Yt = \ln Ao + (g1 + g2Zt\ )t + p\ \ln Kt + (1\text{-}\ p)\ \ln Lt \quad (2)$$
$$\Delta \ln Yt = [g1 + g2\ (\Delta Zt\ t + Zt)] + p\Delta\ \ln Kt + (1\text{-}\ p)\ \Delta \ln Lt \quad (3)$$
$$\Delta \ln yt = [g1 + g2\ (\Delta Zt\ t + Z)] + p\Delta\ \ln kt \quad (4)$$
$$\Delta \ln y^* = g1 + g2\ Z \text{ as } \Delta \ln kt \text{ and } \Delta Z \rightarrow 0 \quad (5)$$

If Z is trade openness, economic growth rate will be higher in more open economies in the long-run equilibrium. Let's now consider non-linear form of this equation:

$$Yt = A0\ e\ (p1\ p2/Z)\ t\ Kt\ p\ Lt\ 1\text{-}P \quad (6)$$

In equation (6), if Z is research and development expenditures, the economic growth rate will not perpetually increase with ever increasing research and development expenditures. So, it would be useful to use non-linear specification to see the effects of real exchange rate volatility on economic growth. There are also other macroeconomic variables that affect growth, and so may be considered as control variables or independent variables.

As Chirwa and Odhiambo (2016) state that the determinants of economic growth may change depending on the country's macroeconomic characteristics. In this framework, the variables that may affect economic growth can be determined as real exchange rate, real exchange rate volatility, inflation rate, interest rate, openness of the economy to international markets and financial deepening. So, the following equation is constructed:

GROWTHt= Bo+B1REALEXCHANGERATEt + B2REALEXCHANGERATEVOLt +B3 INFLATIONt + B4INTERESTRATEt + B5OPENNESSt + B6 FINANCIALDEEPENINGt + ut

The dependent variable (GROWTHt) is the growth rate of real GDP at time t. The independent variables and expected signs of their coefficients can be described as follows:

REALEXCHANGERATEt is the nominal exchange rate deflated by inflation rate at time t. The sign of the coefficient is expected to be positive. An increase in real exchange rate

shows depreciation of domestic currency and export volume should increase, import volume should decrease and net exports should increase. An increase in net exports leads do increase of growth rate of real GDP. However, in this study, real effective exchange rate is used as a proxy for real exchange rate. So, an increase in real exchange rate shows appreciation of Turkish lira, then export volume should decrease, import volume should increase and net exports should decrease. The decrease of net exports leads to decrease of the growth rate of real GDP. So, the sign of the coefficient is expected to be negative.

REALEXCHANGERATEVOLt is the real exchange rate volatility at time t. An increase in real exchange rate volatility creates an uncertain environment for investment and international trade. In such an uncertain environment, investors and traders delay their decisions to obtain more information about real exchange rates. Thus, real exchange rate uncertainty depresses investment and international trade, thereby economic growth. So, the sign of the coefficient is expected to be negative (Erdal, 2017).

INFLATIONt is the inflation rate at time t. High inflation rates increase uncertainty about future price levels. This uncertainty may deter investment decisions of the firms, thereby economic growth. So, the sign of the coefficient is expected to be negative. On the other hand, it is also argued that moderate inflation may increase investment and production, and thereby economic growth. A small increase in output prices stimulates producers to increase their production. This increase in inflation rate may lead to higher economic growth. So, the sign of the coefficient is ambiguous and an empirical issue.

INTERESTRATEt is the interest rate at time t. Since, the increase of interest rates leads to decrease in investment, economic growth decreases. So, the sign of the coefficient is expected to be negative. On the other hand, high interest rates may not decrease economic growth if there are mechanisms such as low inflation expectations, economy's attractiveness to foreign investors, the technological transfer effect and the accumulation of domestic savings (Drobyshevsky, Trunin, Bozhechkova and Sinelnikova-Muryleva (2017). In these cases, as interest rate increases, economic growth may also increases. So, the sign of the coefficient is ambiguous and an empirical issue.

OPENNESSt is the openness of economy to international markets at time t. It is expected that countries that are more open to international trade will tend to grow more rapidly, because they can take advantage of larger markets and they can absorb technological developments (Barro and Sala-i-Martin, 2004). As the openness of economy to international markets increases, productivity also increases with the specialization (Erdal, 2017). So, the sign of the coefficient is expected to be positive.

FINANCIALDEEPENINGt is the financial deepening at time t. Financial deepening indicates the level of usage financial system by the economic actors in the economy (Erdal, 2018). Financial deepening is measured by the ratio of money supply measure (M2) to GDP. This ratio is also called the monetization ratio in the economy. The degree of an economy's monetization ratio may have important implications on economic growth and can be affected by the conduct of monetary policy, financial sector reforms and financial crises. So, high financial deepening or high monetization ratio affects economic growth positively. The sign of the coefficient is expected to be positive.
ut is the error term. es.

5. Research Method, Data Description and Data Sources

In the empirical part of the study, the effects of real exchange rate volatility on economic growth under intermediate and flexible exchange rate regimes are analyzed in Turkey. The Johansen cointegration test is done to see if there is a long-term relationship between the variables and Error Correction Models (ECM) are estimated to see if there are short-term adjustments for variables to return to their long-run values. The data used in the empirical part of the study is quarterly and covers the period from first quarter 1990 to first quarter 2001 for the intermediate exchange rate regime and from first quarter 2002 to fourth quarter 2013 for flexible exchange rate regime. The estimation equation is as follows:

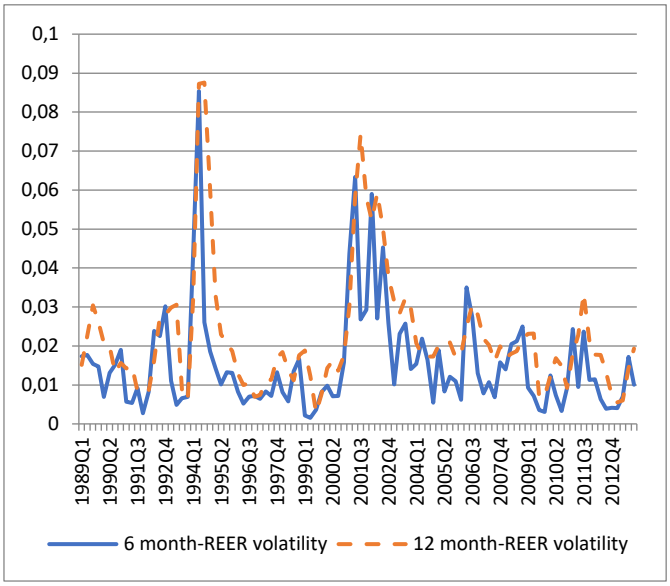
$$GROWTH_t = \boldsymbol{B_o} + B_1 REALFX_t + B_2 REALFXVOL_t + B_3\, INF_t + B_4 INT_t + B_5 OPEN_t + B_6 FINDEEP_t + u_t$$

In this equation, real exchange rate, real exchange rate volatility, inflation rate and interest rate are in logarithmic forms and economic growth, openness of the economy to international markets and financial deepening are in levels, because they are in the ratio form. The dependent variable $GROWTH_t$ is measured by the the growth rate of real GDP. Real GDP is calculated as nominal GDP divided by Consumer Price Index (CPI). Source: International Financial Statistics (IFS) of the International Monetary Fund (IMF). The construction of independent variables and their data sources can be described as follows:

REALFX: Real Effective Exchange Rates Based on Manufacturing Consumer Price Index for Turkey (Index 2015=100, not seasonally adjusted) is used. Source: Federal Reserve Bank of St. Louis Economic Data (FREDII).

REALFXVOL: Volatility can be defined as the standard deviation of the change in value of a financial instrument and is considered a proxy for risk. Barguellil, Ben-Salha and Zmami (2018) state that both nominal and real exchange rates evolve in a highly correlated fashion in the flexible exchange rate regime that explains the non-sensitivity of estimation results regarding whether nominal or real the exchange rate proxy used. In this study, both past 12 months' standard deviation and past 6 months' standard deviation are used as a proxy for real exchange rate volatility. As can be seen in Figure 2, both volatility measures have very similar patterns and move very close to each other. So, volatility measured by standard deviation of past 6 months' real exchange rate is used in the estimations.

Figure 2. Real Exchange Rate Volatility Measures



Source: IFS of the IMF

INF_t: Inflation rate is the annual percentage change of Consumer Price Index (CPI) (2003 = 100). Source: Turkish Statistical Institute.

INT_t: Treasury bill rate is used as a proxy for interest rate. The Treasury bill rate is the average compound interest rates of Treasury's domestic borrowing. Source: The Economic and Social Indicators of the Ministry of Development.

$OPEN_t$: The ratio of foreign trade to GDP (i.e., exports+imports/GDP). Source: IFS of the IMF.

$FINDEEP_t$: is measured by the ratio of M2 to GDP. Source: M2 data is taken from the Federal Reserve Bank of St. Louis Economic Data (FREDII). The GDP data is taken from the IFS of the IMF.

u_t is the error term.

6. Empirical Results

The cointegration analysis is done using the variables that are integrated in the same order. Therefore, firstly, all the variables are tested whether they have a unit root. Then, Johansen cointegration test is done if there is a long-term relationship between the variables and the ECMs are estimated to see the short-term adjustments. The E-views econometric program is used in the empirical analysis.

6.1 Unit Root Test

Each of the variables is tested using Augmented DickeyFuller (ADF) test whether the variable has a unit root. The ADF test consists of regressing each series on its lagged value and lagged difference terms (Dickey and Fuller, 1981). The ADF test results are shown in Table 1.

The ADF test results show that in the intermediate exchange rate regime all the variables have a unit root at their levels and in the flexible exchange rate regime all the variables, except openness of the economy, have a unit root at their levels. Then, first differences of the non-stationary variables are taken and ADF test is done again. The ADF test results show that the first differences of the variables have no unit root that means they are integrated of order one.

Table 1. ADF Unit Root Test Results

INTERMEDIATE EXCHANGE RATE REGIME			
Variable name	**Level**	**First Difference**	**Second Difference**
GROWTH	-0.32	-19.91***	-
REALFX	-1.59	-5.92***	-
REALFXVOL	-3.52	-6.55***	-
INF	-0.39	-4.09***	-
INT	-2.72	-5.37***	-
OPEN	-1.85	-2.62*	-18.18***
FINDEEP	-2.08	8.52***	-
FLEXIBLE EXCHANGE RATE REGIME			
Variable name	**Level**	**First Difference**	**Second Difference**
GROWTH	-2.59*	-3.55**	-8.06***
REALFX	-3.44**	-6.32***	-
REALFXVOL	-2.35	-9.03***	-
INF	-2.66*	-2.71*	-7.08***
INT	-2.14	-5.44	-
OPEN	-3.93***	-	-
FIN DEEP	-0.70	-2.87	-29.35***

"***" shows that the variable is stationary at 1 % level, "**" shows that the variable is stationary at 5 % level and "*" shows that the variable is stationary at 10 % level. McKinnon critical values for intermediate exchange rate regime: -3.58 for 1 %, -2.92 for 5 % and -2.60 for 10 % level. McKinnon critical values for flexible exchange rate regime: -3.57 for 1%, -2.92 for 5%, -2.59 for 10%.

6.2 Cointegration

The Johansen cointegration analysis is done using the Johansen test statistics Trace and Maximum Eigenvalue (Engel and Granger, 1987). The cointegration test results for the growth rate of real GDP, real exchange rate, real exchange rate volatility, inflation rate, interest rate, openness of the economy and financial deepening are presented in Table 2. Both Trace and Maximum Eigenvalue test results show that cointegration exists between all the variables in both intermediate and flexible exchange rate regimes. The existence of cointegration means that there is a long-run relationship between all the variables in both intermediate and flexible exchange rate regimes.

Table 2. Cointegration Test Results

INTERMEDIATE EXCHANGE RATE REGIME				
Trace Statistic				
All the variables	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability**
None*	0.73	167.22	125.61	0.000
At most 1	0.59	107.36	95.75	0.006
At most 2	0.45	67.16	69.81	0.080
At most 3	0.36	39.88	47.85	0.226
At most 4	0.22	19.42	29.79	0.463
At most 5	0.13	8.13	15.49	0.450
At most 6	0.03	1.66	5.84	0.196
Max-Eigen Statistic				
All the variables	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Probability**
None*	0.73	59.86	46.23	0.001
At most 1	0.59	40.20	40.07	0.048
At most 2	0.45	27.27	33.87	0.248
At most 3	0.36	20.46	27.58	0.310
At most 4	0.22	11.28	21.15	0.619
At most 5	0.13	6.47	14.26	0.553
At most 6	0.03	1.66	3.84	0.196
Trace test and Max-Eigenvalue test indicates 2 cointegrating equations at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level. ** MacKinnon-Haug-Michelis (1999) p-values.-				
FLEXIBLE EXCHANGE RATE REGIME				
Trace Statistic				
All the variables	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability**
None*	0.70	142.02	95.75	0.000
At most 1	0.50	82.62	69.81	0.003
At most 2	0.40	48.64	47.85	0.042
At most 3	0.24	24.02	29.79	0.199
At most 4	0.14	10.27	15.49	0.260
At most 5	0.06	2.98	3.84	0.084
Max-Eigen Statistic				
All the variables	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Probability**
None*	0.70	59.39	40.07	0.000
At most 1	0.50	33.97	33.87	0.048
At most 2	0.40	24.61	27.58	0.114
At most 3	0.24	13.75	21.13	0.385
At most 4	0.14	7.29	14.26	0.455
At most 5	0.06	2.98	3.84	0.084
Trace test indicates 3 and Max-Eigenvalue indicate 2 cointegrating equations at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level. ** MacKinnon-Haug-Michelis (1999) p-values.-				

The estimation of long-run cointegrating relationship for growth rate of real GDP, real exchange rate, real exchange rate volatility, inflation rate, interest rate, openness of the economy and financial deepening under intermediate and flexible exchange rate regimes are presented in Table 3. As mentioned previously, the cointegration analysis is done using the variables that are integrated in the same order. In the flexible exchange rate regime, openness of the economy does not have

a unit root at its level or it is stationary at its level. So, when estimating the long-run relationship for the flexible exchange rate regime period, openness of the economy is excluded.

Table 3. Estimation of Long-Run Relationship

Dependent variable GROWTH	**INTERMEDIATE EXCHANGE RATE REGIME**	**FLEXIBLE EXCHANGE RATE REGIME**
Independent variables	**Coefficient**	**Coefficient**
REALFX	11.98** (3.64)	-2.34** (2.88)
REALFXVOL	-0.44** (0.04)	-36.10** (8.89)
INF	10.18** (4.75)	0.43** (2.38)
INT	-1.37** (1.71)	0.99** (4.12)
OPEN	-1.67 (1.23)	-
FİNDEEP	6.95** (8.47)	0.39** (3.0)

Note: "**" shows that the variable is significant at 5 % level. The values in the parenthesis are t-statistics. T- statistic table value for intermediate exchange rate regime (45 observations) and for flexible exchange rate regime (48 observations): (45, 48, 0.05) = 1.6775.

As can be seen from Table 3, the sign of the real exchange rate volatility coefficient is negative and statistically significant in both intermediate and flexible exchange rate regimes. These estimation results show that real exchange rate volatility has depressing effects on economic growth in both intermediate and flexible exchange rate regimes in the long-run.

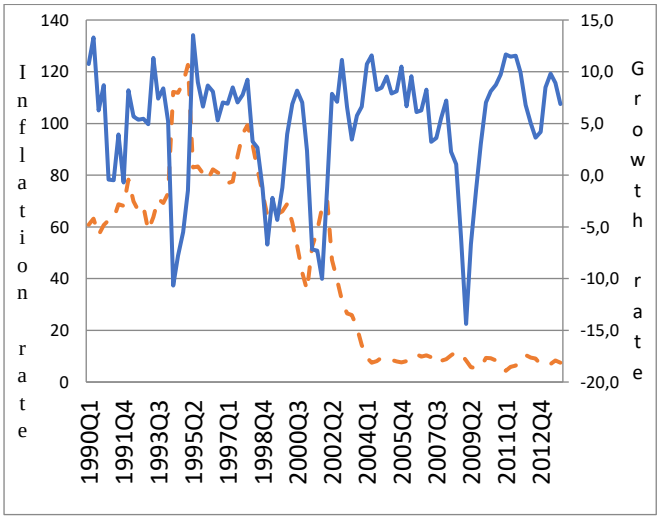
The sign of the real exchange rate coefficient is negative and statistically significant in the flexible exchange rate regime and positive and statistically significant in the intermediate exchange rate regime. Since, real effective exchange rate is used in the empirical part of the study, an increase of real effective exchange rate shows an appreciation of Turkish lira. Therefore, it could be said that while the appreciation of Turkish lira has negative effects on economic growth in the flexible exchange rate regime, it has positive effects on economic growth in the intermediate exchange rate regimes. This positive effect could be interpreted as the dependency of both domestic production and exporting goods on imported intermediate goods. So, an appreciation of Turkish lira leads to cheaper imported intermediate goods for production, and thereby higher production and economic growth.

In Turkey, the highest share of total exports belongs to manufactured goods followed by machinery&transport equipment and miscellannous manufactured goods (Erdal and Pınar 2017). The manufacturing sector production depends heavily on importing goods including energy. So the appreciation of Turkish lira leads to lower production costs for exporting goods, thereby net exports increase, and it causes higher economic growth. Kızıldere and Kabadayı (2014) also find that the Turkish trade structure is shaped by import dependency and significant reliance on re-exports. Uğurlu (2006) also finds a positive correlation between the real exchange rate and GDP for the period from first quarter of 1989 to third quarter of 2001.

The sign of the inflation rate coefficient is positive and statistically significant in both intermediate and flexible exchange rate regimes. This outcome could be interpreted as inflation rate has positive effects on economic growth in both intermediate and flexible exchange rate regimes. The movements of growth rate of real GDP and inflation rate during intermediate and flexible exchange rate regimes are presented in Figure 3. But, the intermediate and flexible exchange rate regime periods had different characteristics in Turkey and thereby the reasons for positive relationship between inflation rate and economic growth under these two regimes are also different.

In the intermediate exchange rate regime period, while the inflation rate was on average 75 percent, growth rate was around 4 percent. During this period, due to high and volatile inflation rates, the link between inflation rate and economic growth may be disrupted. On the other hand, in the flexible exchange rate regime period, while the inflation rate was on average 13 percent, growth rate was on average 6 percent. The positive relationship between inflation rate and economic growth could be interpreted as moderate inflation may increase investment, and thereby economic growth.

Figure 3. Growth Rate of Real GDP and Inflation Rate



Source: IFS of the IMF

The sign of the interest rate coefficient is negative and statistically significant in the intermediate exchange rate regime as expected in the study. An increase in interest rate

leads to decrease of investment, and therefore economic growth. On the other hand, the sign of the interest rate coefficient is positive and statistically significant in the flexible exchange rate regime. Drobyshevsky, Trunin, Bozhechkova and Sinelnikova-Muryleva (2017) analyze theoretical concepts and international economic practices in high interest rate environments to justify that high nominal and real interest rates may not dampen economic growth if there are mechanisms such as low inflation expectations, economy's attractiveness to foreign investors, the technological transfer effect and the accumulation of domestic savings.

Drobyshevsky, Trunin, Bozhechkova and Sinelnikova-Muryleva (2017) state some countries' experiences, i.e., Brazil (2000−2008), Turkey (2002−2007), India (1980−2013) and Chile (1984−2013), show that economic growth can be seen in high real interest rate environments. The macroeconomic analysis of Turkey during the flexible exchange rate regime period shows that medium-term and long-term economic growth rates are high with high interest rates due to following mechanisms: Firstly, after 2001 financial crisis a rise of interest rates contributed to a decline in the inflation rate and inflation rate volatility.

Secondly, high interest rates made the Turkish economy more attractive to international capital flows, and therefore she attracted capital in the form of portfolio investments and bank credits. Additionally, the privatization of state-owned enterprises encouraged foreign direct investment. As a result of these capital inflows economic growth rate increased. Thirdly, high economic growth rates were also encouraged by institutional reforms. During this period, Turkey implemented a banking reform consisting of restructuring, privatization and banking supervision changes, trade liberalization, a tax reform and a labor market reform which contributed to a substantial growth in the proportion of women in the labor force

The openness of the economy variable is excluded from the cointegration analysis in the flexible exchange rate regime due to its stationarity at its level. In the intermediate exchange rate regime, the coefficient of the openness of the economy is statistically insignificant.

The sign of the financial deepening coefficient is positive and statistically significant in both intermediate and flexible exchange rate regimes as expected. The estimation results show that high level of financial deepening affects economic growth positively in both of the regimes in the long-run. The efficient use of financial system by economic actors leads to more investment and, therefore higher economic growth rates.

6.3 Error Correction Model

As a third step, the Error Correction Models (ECMs) are estimated. The long-run relationship will be supported if the coefficient of the lag of the error correction model (ECM_{t-1}) carries a negative and statistically significant coefficient. Besides, the coefficient of ECM_{t-1} represents the proportion of disequilibrium in the variables in one period corrected in the next period.

To do the ECM estimations, three period lags of the independent variables are included in the regressions and they are estimated. The statistically insignificant variables are dropped from the regressions and the statistically significant ones are kept and the regressions are re-estimated. The residuals of estimated equations are saved as ECMs. Then, the regression using first differences of both dependent and independent variables and the lag of the ECM (i.e., ECM_{t-1}) are estimated. The estimation results of these regressions, in other words, ECMs are given in Table 4. As can be seen in Table 4, the coefficient of the ECM_{t-1} is negative and statistically significant in the regression that shows the cointegration is supported. The value of the ECM_{t-1} coefficient shows that the short-run dynamics converge to long-run relationship with a high speed of adjustment.

Table 4. Error Correction Model (ECM) Estimation Results

Dependent variable GROWTH	**INTERMEDIATE EXCHANGE RATE REGIME**	**FLEXIBLE EXCHANGE RATE REGIME**
Independent variables	**Coefficient**	**Coefficient**
ΔREALFX	-1.79** (3.64)	-0.46** (-1.78)
ΔREALFXVOL	-4.09** (-3.42)	-0.63 (-1.23)
ΔINF	-0.49** (-1.93)	0.08 (1.36)
ΔINT	-0.09 (-0.94)	0.08 (0.84)
ΔOPEN	-0.50** (-2.60)	-
ΔFINDEEP	-0.59** (-8.10)	0.12** (3.97)
ECM_{t-1}	-1.21** (-8.06)	-1.71** (-13.20)

Note: "Δ" shows the first difference of the variable "**" shows the variable is significant at 5 % level. The values in the parenthesis are t-statistics.

7. Conclusion

This paper analyzed empirically the effects of real exchange rate volatility on economic growth under intermediate and flexible exchange rate regimes in Turkey. The empirical results show that real exchange rate volatility depressing effects on economic growth in both intermediate and flexible exchange rate regimes. Erdal and Pınar (2017) also show that real exchange rate volatility has depressing effects on sectoral exports flows in both intermediate and flexible exchange rate regimes.

The appreciation of Turkish lira has negative effects on economic growth in the flexible exchange rate regime as expected and it has positive effects on economic growth in the intermediate exchange rate regimes. The positive effects of Turkish lira appreciation on economic growth in the intermediate exchange rate regime period could be interpreted as the dependency of both domestic production and exporting goods on imported intermediate goods. So, an appreciation of Turkish lira leads to cheaper imported intermediate goods for production, and thereby higher production and economic growth.

An increase in inflation rate leads to higher economic growth in both intermediate and flexible exchange rate regimes. But the reasons of this positive relationship between high inflation rate and high economic growth are different in two exchange rate regimes. In the intermediate exchange rate regime, due to high and volatile inflation rate, the link between inflation and economic growth was disrupted, hence in a high inflationary environment economic growth was also high. On the other hand, under the flexible exchange rate regime moderate inflation led to increase of investment, and thereby economic growth. A small increase of output prices stimulates producers to increase their production capacity.

The sign of the interest rate coefficient is negative and statistically significant in the intermediate exchange rate regime as expected. An increase in interest rate leads to decrease of economic growth. On the other hand, the sign of the interest rate coefficient is positive and statistically significant in the flexible exchange rate regime. The positive effects of interest rates on economic growth during the flexible exchange rate regime period could be explained by the intensive re-structuring period after the February 2001 foreign exchange and banking crisis. During the aforementioned period, the banking sector reform, rehabilitation of the public finance and institutional structuring together with the privatization process of state-owned enterprises attracted international capital flows. The success of the comprehensive structuring program and supportive external environment positively affected the confidence of consumers and investors, and therefore the economic growth.

The openness of the economy variable is excluded from the cointegration analysis in the flexible exchange rate regime due to its stationarity at its level. In the intermediate exchange rate regime, the coefficient of the openness of the economy is statistically insignificant. The financial deepening of the economy has positive effects on economic growth in both intermediate and flexible exchange rate regimes. The financial deepening ratio is affected from the conduct of monetary policy, financial sector reforms and financial crises. So, high financial deepening affects economic growth positively. The error correction model estimation results show that the short-run dynamics converge to their long-run values with a high speed of adjustment.

Consequently, it could be concluded that the implemented exchange rate regime is important for economic growth. This study shows that real exchange rate volatility may have depressing effects on economic growth and avoiding exchange rate volatility enables countries to use their resources efficiently for economic growth. Of course, exchange rate regimes cannot substitute the high savings, labor force and foreign investment friendly environment, but it can help to growth by encouraging the movements of resources into the manufacturing sectors and receive productivity gains in a short period of time.

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Labor Productivity and Real Unit Wage Index in Turkey

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Abstract

We provide the causality between real wage and productivity in the Turkish economy. The results are also provided at the sectoral levels. We employ a Granger causality analysis to observe the flow of causation. We find that labor productivity statistically causes real wage movements. This estimation is also valid for the manufacturing sector and the electricity, gas, steam, and air conditioning supply sectors. Besides, there exists a bi-directional relationship in the mining and quarrying sector.

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1. Introduction

Even though several studies indicate the relationship between labor productivity and unit labor cost, the economic theory has difficulty discovering an effective and convincing causal relationship between these variables. Several explanations, in theory, can be split into two groups. The orthodox microeconomic theory insists that changes in labor productivity bring about changes in real wages. In contrast, remaining theories claim to opposite this causality by indicating changes in labor productivity stem from changes in real wages.

The empirical literature gives mixed causality between labor productivity and unit labor cost. Several studies aim to reverse the orthodox theory in developed economies such as G7 and OECD countries (Nayoran and Smyth, 2009; Veerger and Kleinknecht, 2011 and 2014; Storm and Noostegad, 2009; Madsen and Domania, 2001; Hein and Tarassow, 2009; Pyo, 2018) while some studies focus on individual countries (Weisskopf et al. 1983 for the U.S.; Sylos and Labini, 1983 for U.S. and Italy; Valadkhani, 2003 for Australia; Marquetti, 2004 for the U.S.; Brida et al. 2010 for Mexico; Vera, 2021 for Venezuela; Kumar et al. 2012 for Australia; Upender and Sujan, 2008 for India; Wakeford, 2004 for South Africa). All these studies find that labor productivity statistically causes real wage movements.

On the other hand, Mendez and Hernandez (2014) show that the relationship is bi-directional in Colombia, while Marquetti (2004) and Yusof (2007) indicate that higher productivity leads to higher wages in the U.S. and Malaysian, respectively. Together with the studies for individual countries, it is relatively scarce for Turkey. Karaalp and Orhan (2007) indicate that real wages affect labor productivity in the long run while there is no statistical causality between them in the short run. Yıldırım (2015) analyzes the relationship between productivity, real wage, and inflation in the Turkish manufacturing industry and shows unidirectional causality from real wages to productivity. Pazarlıoğlu and Çevik (2007) examine the relationship between productivity, real wages, and unemployment over 1945-2005 and determine a bi-directional causality between real wage and productivity between 1969 and 2005.

This study provides the causality between real wage and productivity in the Turkish economy. The paper contributes to the literature by analyzing this causality at the sectoral level for the first time to our best knowledge. We employ a Granger causality analysis to observe the flow of causation. We confirm the orthodox approach that real wages are adjusted in response to a change in labor productivity. A similar relation also appears in the manufacturing sector and the electricity,

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gas, steam, and air conditioning supply sectors. Besides, there exists a bi-directional relationship in the mining and quarrying sector.

The structure of the paper is as follows: We introduce the data we used in the analysis in Section 2. In Section 3, we build our expectations about causality and observe the breaking points in the time series. We present our methodology in Section 4. We show our results and robustness checks in Sections 5 and 6, respectively. Then we conclude.

2. Data

This study uses the real unit wage index for Turkiye calculated and published by the Presidency of Strategy and Budget for the periods 2009Q1-2021Q3 (PSB, 2021). According to the definition given by the U.S. Bureau of Labor Statistics, the term labor productivity is a measure that collates the number of goods and services with the number of hours spent on the production of these outputs. In other words, it is the ratio of the volume of gross output and the volume of labor inputs, hours worked. The unit labor cost, which is a measure of price competitiveness, is defined as the ratio of the average cost of labor to output produced. Accordingly, the Presidency of Strategy and Budget identifies the unit wage index as the ratio of total labor cost per hour worked to labor productivity.

The Presidency of Strategy and Budget obtains hourly labor productivity as the ratio of industrial production index to hours worked index, which TURKSTAT calculates. Following this, the Presidency of Strategy and Budget calculates the nominal unit wage index as the ratio hourly labor cost index in the industry based on 2015, calculated by TURKSTAT, to hourly labor productivity. Accordingly, the reel unit wage index is calculated by Presidency of Strategy and Budget while dividing the nominal unit wage index by Consumer Price Index.

Figure 1. Seasonality of Real Unit Wage Index and Labor Productivity in Total Industry

Source: Data of Presidency of Strategy and Budget and authors' calculations

Figure 1[1] shows that the unadjusted series of real unit wage index and labor productivity include a seasonality. So, we decided to use the seasonally adjusted series in our analysis.

3. Conceptual Background

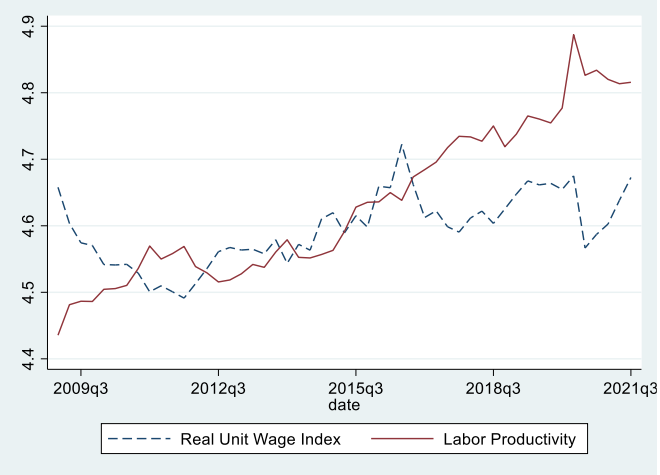
The relation over time of real unit wage index and labor productivity can be observed in Figure 2. Here the variables are expressed as a logarithm. Note that the trend of the variables seems to be the same within the period between 2009 and 2015.

The Minimum Wage Determination Commission has declared the minimum wage as monthly 1.647,00 TL put in place on 30.12.2015. This increase in the minimum wage broke the harmony of the relation between the real unit wage index and labor productivity. The level shift in the real unit wage index resulted in a gap between the growth of the series.

The chart below shows the relationship between the real unit wage index and labor productivity in total industry. As can be seen, the increase in the real unit wage index is delayed for one period. In other words, after an increase in productivity is observed, there is an increase in the real unit wage in the following period. Based on the observation from Figure 2, we expect to estimate a causal relation that labor productivity statistically causes real wage movements.

[1] The numbers seen between x and y axis of graphs (1, 2, 3 and 4) present the quarter periods of the year.

Figure 2. Real Unit Wage Index vs. Labor Productivity in Total Industry



Source: Data of Presidency of Strategy and Budget and authors' calculations

4. Methodolgy

Our model aims to analyze the relationship between the real unit wage index and labor productivity in the Turkish economy. To do so, we exploit from causality test: Granger test (1969). To perform this test, we need stationary variables to avoid spurious regression. Hence, we apply the Augmented Dickey-Fuller (ADF) Test and Phillips-Perron (P.P.) Test to test the null hypothesis that a unit root exists in a time series sample.

Table 1 shows the unit root test that we apply for the real unit wage index and labor productivity series and the first differences. Note that the probabilities are greater than 0.05, meaning that we accept the presence of a unit root as these series are not stationary at level. However, when we take the first differences, the test results indicate that both time series are stationary variables at first differences. Also, note that at the sectoral level, we show that both the real unit wage index and labor productivity series are $I(1)$. The unit-root test results for the sectors are presented in Appendix A1-A3.

Table 1. Unit root tests (Total Industry)

Variables	Augmented Dickey-Fuller Test	Prob.	Phillips-Perron Test	Prob.
Log(LP)	-0.883	0.793	-0.786	0.823
Log(UWI)	-2.019	0.278	-2.126	0.234
D.Log(LP)	-8.652	0.000	-8.875	0.000
D.Log(UWI)	-7.953	0.000	-7.973	0.000

Notes: L.P.: Labor productivity, UWI: Unit wage index, D.Log: First difference. ADF and P.P. sans lag and without trend nor intercept

Suppose that the following simple Autoregressive Distributed Lag (ADL) model holds:

$$Y_t = \alpha + \gamma Y_{t-1} + \beta_1 X_{t-1} + \varepsilon_t \quad (1)$$

The coefficient of β_1 is a measure of the effect past values of X. If $\beta_1 = 0$, we can say that X does not Granger cause Y. In general, we could assume that (X, Y) relation is described by an ADL(p, q) model (**unrestricted model**):

$$Y_t = \alpha + \delta t + \gamma_1 Y_{t-1} + \cdots + \gamma_p Y_{t-p} + \beta_1 X_{t-1} + \cdots + \beta_q X_{t-q} + \varepsilon_t \quad (2)$$

Here, we can say that X does not Granger cause Y if all $\beta_i = 0$. The **restricted** version of this model can be written as:

$$Y_t = \alpha + \delta t + \gamma_1 Y_{t-1} + \cdots + \gamma_p Y_{t-p} + \varepsilon_t \quad (3)$$

If all $\beta_i = 0$, the unrestricted and restricted models are more or less the same. The F-statistics that is used for the causality test:

$$F = \frac{(SSR_R - SSR_{UR})/q}{SSR_{UR}/(T - q - p - 2)} \sim F(q, T - q - p - 2) \quad (4)$$

5. Results

Table 2 presents the Granger causality test for the total industry. We conduct the analysis at levels and differences, with different lags. The probabilities obtained by the causality test do not vary as the number of lags change. The results indicate that at levels, labor productivity Granger cause real unit wage. There is more unlikely to reject the null hypothesis that real unit wage does not Granger cause labor productivity.

Table 2. Granger causality tests (Total Industry)

H_0	Number of lags	F-statistic	Prob.
Log(LP) does not Granger-cause Log(UWI)	2	14.302	0.001
Log(UWI) does not Granger-cause Log(LP)	2	9.302	0.010
Log(LP) does not Granger-cause Log(UWI)	3	17.033	0.001
Log(UWI) does not Granger-cause Log(LP)	3	12.516	0.006
D.Log(LP) does not Granger-cause D.Log(UWI)	2	16.461	0.000
D.Log(UWI) does not Granger-cause D.Log(LP)	2	0.258	0.879
D.Log(LP) does not Granger-cause D.Log(UWI)	3	17.421	0.001
D.Log(UWI) does not Granger-cause D.Log(LP)	3	0.375	0.945

Also, note that both variables are not stationary; Wooldridge (2015) asserts that the coefficients are biased. We include variables at differences in the model instead of levels to overcome this issue. We have somehow the same

conclusion. Although we accept the null hypothesis that real unit wage does not Granger cause labor productivity, the test results indicate that labor productivity Granger cause real unit wage.

We replicate the same analysis at the sectoral level. The results are presented in Appendix Tables A4-A6. The manufacturing sector results are essentially the same as the results for the total industry. We most likely reject both null hypotheses for the mining and quarrying sector, meaning a bi-directional causality exists between labor productivity and the real unit wage index. The results differ between levels and differences for the electricity, gas, steam, and air conditioning supply sector. We can also say that the flow of causation stems from labor productivity to real wages at the 5% level of significance.

6. Robutness

We can apply the cointegration tests between labor productivity and the real unit wage index to see how robust the estimates are. To determine whether labor productivity and real unit wage index are cointegrated, we perform Engle and Granger (1987) test, which analyzes the residuals' stationarity.

We consider labor productivity as a dependent variable and the real unit wage index as an explanatory variable. At different numbers of lags, we calculate the ADF test statistics. The results indicate no long-term relationship between labor productivity and the real unit wage index. We obtain the same results for the different sectors (Tables A7-A9). Thus, we do not need to follow the error correction models.

Table 3. Cointegration tests between real unit wage index and labor productivity (Total Industry)

Dependent Variable	Regressor	Coefficients		Number of Lags	ADF Test	Prob.
		Constant	*Beta*			*Constant*
Log(LP)	Log(UWI)	-0.990	1.224	1	-2.230	0.195
Log(LP)	Log(UWI)	-0.990	1.224	2	-2.172	0.216
Log(LP)	Log(UWI)	-0.990	1.224	3	-2.293	0.174
Log(LP)	Log(UWI)	-0.990	1.224	4	-1.629	0.468

7. Concluding Remarks

This paper analyzes the causal relationship between labor productivity and the real unit wage index. We have estimated that in total industry labor productivity Granger causes real unit wage. The results confirm the orthodox approach that real wages are adjusted in response to a change in labor productivity.

The paper has also provided the estimates at the sectoral level. We have shown that the flow of causation stems from labor productivity to real wages in the manufacturing sector. We have found a bi-directional causal relationship between labor productivity and the real unit wage index in the mining and quarrying sector. For the electricity, gas, steam, and air conditioning supply sector, we have also found a decrease in labor productivity forces a decrease in the real wage.

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Are R&D Loans Relevant for Supporting Industrial R&D: The Case of TTGV in Turkey

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Abstract

In this paper, the relevance of R&D loans in Turkey has been investigated by using the example of TTGV. Descriptive analysis has been made with the help of the contemporary R&D funding literature. As a result, among the years between 1992 and 2010, R&D loans provided by TTGV under the "Technology Development Projects" program seem relevant and beneficial even though its effect was small on economic development. Its capacity might have been enlarged bymaking it more attractive and compatible with the needs of firms, particularly SMEs.

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1. Introduction

R&D funding is a crucial mechanism for government policies to boost the innovative and technological performance of an industry, region, country, etc. There are certain types of this mechanism, such as tax incentives, grants, loans, and sharing the financial risk of R&D and innovative actions within a firm.

Recently, two contradictory views have informally emerged about the relevance of the R&D loans (particularly soft loans). One view suggests that loans are irrelevant in an environment in which grants are provided. The opposite view argues that loans help foster the R&D performances of an innovative firm.

In Turkey, R&D loans were provided by the Technology Development Foundation of Turkey (TTGV) between the years 1992 and 2010. The core business of TTGV was R&D funding and this foundation supported R&D projects of industrial firms by those loans for about two decades. TTGV, the only soft-loan provider institution in the Turkish National Innovation System, had almost created an R&D volume of 600 million US dollars between the period concerned via providing R&D support with back payment.

In this paper, the relevance of R&D loans in Turkey will be investigated by using the example of TTGV. A descriptive analysis will be made with the help of the contemporary R&D funding literature, the results of "The Industrial Technology Report" written by Taymaz (2006) will be used and the results "DID (difference in difference) estimation models" established by Taymaz (2006) and Özçelik and Taymaz (2008) will be utilized to quantitatively analyze the effect of R&D support provided by TTGV. As a result, it is expected to put a light on the functionality of R&D loans in the Turkish National Innovation System so that further policy recommendations can be made in the future.

For attaining this aim, in the next section, a theoretical framework will be set up to analyze R&D loans on a scientific basis. Then, a brief history of TTGV is summarized and the support mechanisms of that foundation will be explained. Therefore, the evaluation of an R&D loan program (namely, Technology Development Projects Support Program) provided by TTGV will be examined qualitatively and quantitatively via using several studies in the literature. Finally, the paper concludes the last section.

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2. Theoretical Background

In a neo-classical economy, it is expected that government does not intervene in the markets because the "invisible hand" allocates the resources optimally. Optimal resource allocation can only be provided in perfect markets that have a full rivalry. In a market economy, there are three prerequisites of this optimality. Those are excludability, rivalry, and transparency of goods. Excludability and rivalry refer to that good can be consumed only once and once a good is consumed, it cannot be used again. Furthermore, transparency is defined as having full information about the production or consumption of goods by economic agents in economic activities. However, Nelson (1959) clearly explained the fault behind this logic (particularly in some cases) as follows;

"(…) when the marginal value of a "good" to society exceeds the marginal value of the good to the individual who pays for it, the allocation of resources that maximizes private profits will not be optimal. In these cases, private profit opportunities do not adequately reflect social benefit, and in the absence of positive public policy, the competitive economy will tend to spend less on that good "than it should". Therefore, it is in the interest of society collectively to support the production of that good". (Nelson 1959)

Nelson's those arguments and Arrow's (1962) supporting arguments suggested that technological knowledge and technology products do not depict the characteristics of a good in terms of neo-classical economy and thus, points out the term "market failure". The failure of the markets is naturally equal to the failure of the resource allocation optimality and government intervention becomes necessary to generate technological knowledge and innovative technologies for economic development and growth. (Arrow 1962)

Government intervention may be in three kinds aiming at boosting technological activity, research and development (R&D), invention, and innovation to foster economic development and public welfare. Those are made through performing R&D directly (publicly funded R&D); giving R&D subsidies (grants and loans) and providing tax incentives. Governments have been implementing those methods for decades and several studies have been carried on to examine the "additionality effects" of those subsidies and incentives. (Busom 2000; Hall and Reenen 2000; Hall 2002; Lach 2002; Trajtenberg 2002) In evaluating the R&D subsidy, the main question is "what the subsidized firm would have spent on R&D had it not received the subsidy". (Lach 2002, 369) There are direct and indirect effects of those subsidies on firm performance. The direct effect is the increase of total expenditure of firm on R&D (holding firm financed part of R&D expenditure constant) while indirect effects come from the firm response. Firms' response may be in two ways: the first one is that company might augment its R&D expenditure in response to R&D subsidy or the company displaces the subsidized amount with its part. Of course, the former is better for productivity and in the context of what is aimed by giving R&D subsidy; and the latter is not. Furthermore, there are some other benefits of R&D subsidies. Those supports might lower the private cost of R&D and turn an unprofitable project into a profitable one; it may speed up an ongoing project or upgrade research facilities in such a way that further R&D projects can be afforded with lesser costs. Firms also gain know-how and learning capabilities as much as performing R&D activities.

To my knowledge, studies concerning R&D subsidies particularly major on R&D grants and tax incentives; however, R&D loans have taken little attention. Studies concentrated on loans are especially towards credits provided by banks and mutual guarantee consortiums which are very common especially in Europe. (Ughetto and Vezzulli 2008) Myers and Majluf (1984) highlighted the limited capability of banks in sustaining investments in innovation and mutual-guarantee consortiums can assess the R&D activity more suitable and represents easier financial opportunities, particularly for SMEs. (Myers and Majluf 1984) Furthermore, it is widely accepted in the literature that SMEs have more financial constraints on performing R&D and their opportunities to reach capital is more limited concerning larger firms and incumbents. This case is more evident in developing countries where investment venture capital opportunities and the public equity market are lagging. (Hall 2002) Hence, SMEs require more easy ways to reach the finance to perform R&D. As a result, it is expected that the propensity to innovate in small firms increases relatively more for larger ones as argued by Lach (2002), Özçelik and Taymaz (2008), Busom (2000) and this case is particularly the same for high-tech firms. (Carpenter and Petersen 2002) Further support comes to this argument from Himmelberg and Petersen (2001) and these scholars suggest that "the principal determinant of investment for small and high-tech firms is internal finance and (…) large firms are unlikely to face significant internal financial constraints because they have better access to external finance and generate cash flows over investment needs". (Himmelberg and Petersen 2001) In conclusion, one can deduce that R&D subsidies are more helpful for small firms, and good support mechanisms enhance and foster their innovative activities. Those mechanisms also target market failures that prevent optimal resource allocation to technological development and scientific research.

3. TTGV as an R&D loan provider

3.1 A Brief History of TTGV

Efforts for establishing the national innovation system of Turkey had speeded up after the year, 1990, and Technology Development Foundation of Turkey (TTGV, Turkish acronym) was one of the fruits of those newly flourishing efforts. In 1991, World Bank had made a loan agreement with Turkey; and a model executed by the cooperation between South Korea and World was chosen in this context. One of three pillars of this agreement was the "Technology Development Project" to compensate the financial requirements of Turkish industry concerning R&D. (Göker 2008) TTGV was established as a result, and the functions of the foundation were stated as follows;

- To increase the competitiveness of Turkey in international markets changing continuously,
- To provide the mechanisms of seed capital required for the improvement of Turkish industrial infrastructure. (Göker 2008, 55)

World Bank provided 100 million US dollars to the Undersecretariat of Foreign Trade and the 43,3 million US dollars of this amount was given to TTGV as a gratuitous transfer to support every kind of project concerning research, development, technology adoption and to contribute financially to strategic focus projects for enhancing R&D potential and technological infrastructure inside the country. On the agreement, there was a striking point that TTGV was responsible for compensating its operating costs and the transferred amount was excluded from the operation. TTGV was obliged to pay at least 20 percent and at least 33 percent of its operating costs on its own from the services it provided. Supports were under the control of the Undersecretariat of Foreign Trade and independent auditors.

The major mission of TTGV is to bring competitiveness in global markets to Turkish industry and it is the forerunner of the R&D support mechanism in Turkey. TTGV is a unique example and established in the status of a "foundation". As Göker (2008) stated, the aim is to provide an independent entity that is flexible and in which public and private sector has equal effect in the process of decision-making. The Board of directors involves both public and private delegates. As a result, TTGV is mainly under the ownership and supervision of the state, and also it is an autonomous and independent institution. (Göker 2008, 58)

In 1999, the "Industrial Technology Project" (ITP) was signed as an extension of the development project between the World Bank and the Turkish Republic. TTGV was assigned as a partner on R&D funding; and again, a considerable amount of money (about 60 million USD) was allocated to the foundation and 50 percent of this allocation is with no back pay.

TTGV used this resource as an R&D fund for industrial technology projects. After a grant mechanism established by The Scientific and Technological Research Council of Turkey (TÜBİTAK, Turkish acronym), TÜBİTAK and TTGV support has become complementary and TUBİTAK provide grants for R&D projects while TTGV provides those support on a loan basis.

The ITP finished in the year, 2006, and TTGV had begun to use the "Support and Price Stability Fund" provided by the Undersecretariat of Foreign Trade. 75 percent of the loan provided by TTGV came from this mechanism. The other 25 percent part was compensated from TTGV's resources.

In this period, TTGV also tried to generate new support mechanisms such as the "Joint Technology Development Project" and "Commercialization Project" which were the outcomes of the "An Assessment of the Industrial Technology Project-Final Report" written by Taymaz (2006). (Taymaz 2006) Those were the unique mechanisms firstly implemented in Turkey; however, their implementation had not gone further from the pilot application. The explanation of those mechanisms and the evaluation of TTGV's R&D funding performance will be made in the next part. Not only has TTGV executed R&D funding mechanisms but also it has made some other contributions to the development of the national innovation system (NIS) in Turkey. TTGV established or partly been a shareholder in the establishment of private service centers such as Esim Co. and Novagenix Co.; the former was a test center for electromagnetism and vibration and the latter was a bioanalytic drug R&D center for bioavailability and bioequivalence. It also contributed to the establishment of technoparks such as Arı Teknokent in İstanbul and Bilkent Cyberpark in Ankara.

Proper to its mission determined by the agreements, TTGV assisted in the development of venture and risk capital funds, namely İş Girişim, Turkven, İstanbul Venture Capital Initiative (iVCi). It also established "Teknoloji Yatırım A. Ş. (Technology Investment Co., synonymous in English) to make start-up investments.

TTGV collaborated with the Ministry of Environment in "Phase-out of Ozon- Depleting Substance Project" with World Bank funds and the project was completed successfully and has prepared the infrastructure for environmental supports of the foundation towards eco-innovation which are the unique mechanisms in Turkish NIS.

Finally, for encouraging scientific and technological efforts through the country and providing industry and university collaboration, TTGV arranges some honorary awards, namely "Technology Awards" (by collaborating with TÜSİAD and TÜBİTAK) and "Dr. Akın ÇAKMAKCI Thesis Awards for University-Industry Collaboration". TTGV is a member of TAFTIE (The Association for Technology Implementation in Europe) and also represents TÜBİTAK and Small and Medium Enterprises Development Organization (KOSGEB,

Turkish acronym) in the association. TTGV became the Chief organization of TAFTIE in 2007 and was on the board of the association in the former and the latter years.

3.2 Supporting and Funding Mechanisms of TTGV

TTGV support mechanisms might be divided into three parts. The first one was "Technology Development Projects Support". It was the major support program that provides R&D loans for industrial R&D within firms. The second one was "The Environmental Projects Support" which was the only support mechanism within the National Innovation System of Turkey aiming at developing eco-innovation. The last one was about the risk capital and entrepreneurship and the mechanisms within this "Technology and Entrepreneurship Program" were sustained by Teknoloji Yatırım A. Ş.

3.2.1 Technology Development Projects Support

In this support scheme, R&D loans (soft loans) are provided for industrial R&D projects. 50 percent of the project budget proposed by the applicant firm is supported in the context of this mechanism. The ratio of the support is fixed notwithstanding the technology base, firm size, and foresighted effect of the project. The duration of the project is up to 24 months. Firms are obliged to pay back the granted amount of money and payback is started one year later after the project has been completed. The granted amount is repaid in three years period with seven installments departed by six months. Firms use the soft loan on a US dollars basis and the back payment of the firm is also on the same currency; thus, the applicant firm also undertakes the exchange rate risk which is a problem for especially SMEs as proved by the several crises because of the macro-economic instability within the country. The upper limit of the support is one million US dollars and this means that applicant firms can offer project budgets up to 2 million US dollars. 75 percent of this fund offered by TTGV is allocated from the Undersecretariat of Foreign Trade and 25 percent is compensated from the own resources of the foundation. On the evaluation of applicant projects, several academicians and private sector specialists (namely Field Committee Members) are utilized to accept or refuse the project proposal. The acceptance and refusal of the project are determined via using Frascati and Oslo Manuals and by taking into account the current R&D condition of the country. Thus, for being supported, it is not obliged to have radical or high-tech innovations. TTGV could support incremental product and process innovations involving industrial R&D on international, national, and even firm-level. After being accepted, a field committee member is charged as a "project viewer" to monitor the development of the project and usually make valuable recommendations about technical aspects of the project; hence university-industry collaboration is generated to some extent. In the end, technological know-how is left for the company that has proposed the project, and the commercialization ability of the project is also taken into account because the support is given on a loan basis; hence the support provider needs to get the provided money back. For this reason, TTGV demands a guarantee from the applicant firm at changing rates. Lastly, it should be mentioned that projects about investing in infrastructure or production are not under the scope of this support.

As an outcome of the report written by Taymaz (2006) for the assessment of Industrial Technology Project; under technology development projects support, it is determined to create a "Commercialization Support" mechanism to enable the commercialization of supported R&D projects, to make possible the benefits of economies of scale and to compete in international markets. The upper limit is 1 million US dollars as well the support is a soft loan with no interest but a service fee. In the scope of this mechanism, a pilot application was held and seven projects that completed their R&D were supported to be commercialized. However, this mechanism has not continued even though it is the sole one directed to the commercialization of R&D projects within the national innovation system.

As another outcome of the same report (Taymaz (2006)), "Joint Technology Development Projects Support" was designated. The aim of the support was towards fostering the vertical and horizontal pre-competition and in-competition relationships and R&D between firms and the upper limit was fixed as 2,5 million US dollars on a loan basis. A pilot project was implemented; however, the mechanism did not work properly because of the property rights problem that emerged during the pilot implementation.

3.2.2 Environmental Projects Support

TTGV is used to implement support programs since its establishment. With the help of this experience, the foundation provides project support concerning the environment. The terms of this support mechanism are similar to "Technology Development Supports Project". In this context, R&D loans up to 1 million US dollars are provided for "Renewable Energy", "Energy Efficiency" and "Environmental Technologies" projects back payments are collected in four years containing one year of the grace period. The project duration is limited to one and a half years. The ratio of the TTGV support is fixed to 50 percent of the project budget. There is no interest but 6 percent of TTGV funding is required for the service fee which could be admitted as an interest or cost for the applicant firm.

3.2.3 Technology and Entrepreneurship Support

One of the objectives of TTGV is to enhance and foster risk capital within the country to encourage entrepreneurship on a technological basis. For attaining this aim, Teknoloji Yatırım

A. Ş. was established and technology and entrepreneurship supports are provided via this company.

There are three support programs. The first one is "Pre-Incubation Support" for entrepreneurs who have innovative ideas and try to establish their company. This mechanism includes research, consultancy, and office setup services. The upper limit is 50.000 US dollars and the duration cannot exceed two years. However, this mechanism is at its infantry and has not been implemented yet. The second one is "Risk Sharing Facility Support" aiming at providing capital for technological product and process innovations to generate technology-based companies that have high growth potential. Projects with low-budget and high risk are in the scope of this support. The upper limit is 200.000 US dollars and TTGV funded 50 percent of the project budget for at least two years. The fund is provided on a loan basis. The last mechanism is "Start-up Support" directed towards talented entrepreneurs that have creative, unique, and advanced-technology ideas and vision. Rational business models and leading-edge technologies are prerequisites for this program. The upper limit is 400.000 US dollars and TTGV provides this money as equity capital. High investment returns are supposed such as a return of 10 times the invested total in 5 or 7 years. Especially the latter two of these mechanisms were implemented and Teknoloji Yatırım A. Ş. provided 3 million €.

In the next section, the paper will investigate particularly the Technology Development Projects Support mechanism of the foundation. Environmental concerns and risk and venture capital are beyond the scope of this paper. The focus is on R&D loans and their contributions and additionality effect to R&D.

3.3 The Assessment of Technology Development Projects Support

3.3.1 The Structure of the Mechanism

As stated above, Technology Development Project Support is the major program of TTGV and provides R&D loans for industrial technology development projects. It has been continued since 1992 (the establishment of TTGV). It is the extension of the completed "Technology Development Project" and "Industrial Technology Project" between the Turkish government and the World Bank as mentioned above. However, TTGV sustained the program, collaborated with the Undersecretariat of Foreign Trade and the details of the program are aforementioned in the previous section.

The quantitative information about this program is stated as follows; (TTGV 2010)

Table 1. Information about Technology Development Projects (Source: TTGV, 2010)

Periods	*1992-1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*TOTAL*
# of Applicant Projects (1)	576	87	121	133	160	229	132	128	155	238	228	**2187**
# of Supported Projects (2)	179	55	32	51	67	64	25	101	88	116	113	**891**
SME Ratio in Supported Projects (3)	67%	83%	66%	81%	94%	78%	81%	87%	88%	88%	80%	**76%**
Contracted Fund (in million US dollars) (4)	72	18,4	10	16,4	15,4	25,3	7,4	29,7	29,5	41,3	33.1	**298,5**
Total Project Budget (in million US dollars) (5)	150,9	38,6	19,8	34	30,8	50,9	14,4	59,4	59	82,6	66.2	**606,6**
Provided Funds (in million US dollars) (6)	47,1	7,2	9,6	7,4	12,9	14,9	11,9	17,3	17,6	21,3	24,8	**192**
# of Completed Projects (7)	146	17	30	40	44	35	78	73	73	66	95	**697**
Back Payment (in million US dollars) (8)	17,9	7,2	4	4,6	6,6	7,5	9,4	13,3	16,8	19,2	17,2	**123,7**

As seen from Table 1, 2187 projects were applied and 891 projects were supported. The ratio of supported projects is 40,7 percent. This number depicts that TTGV seriously investigates the R&D sufficiency of applicant projects.

Figure 1. Number of applicant projects (Source: TTGV, 2010)

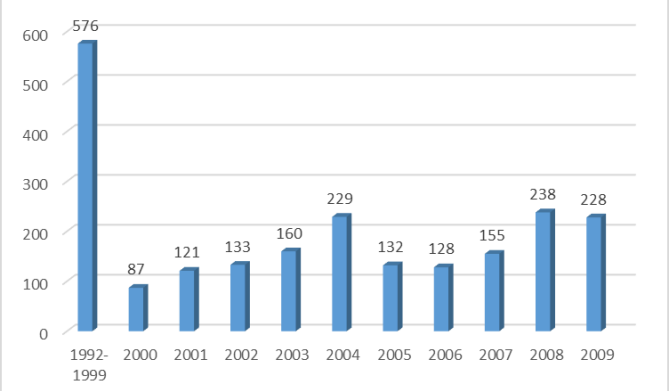
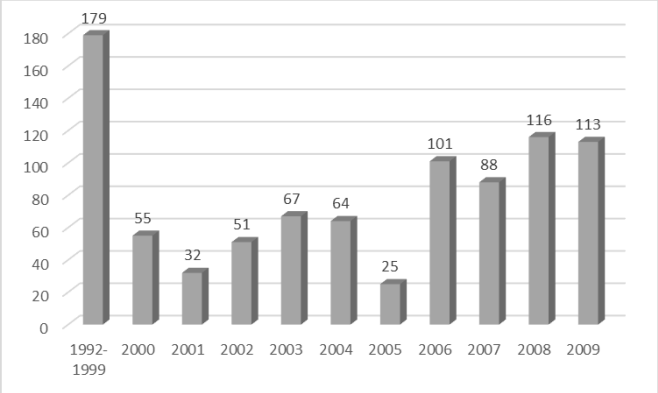


Figure 2. Number of supported projects (Source: TTGV, 2010)



There was instability in the number of applicant projects, nevertheless, it could be stated that applicants are increased with a peak in those years, 2004, 2008, and 2009. As expected, the number of supported projects was also greater than before, particularly in the last four years.

Figure 3. Contracted funds (year by year in million US dollars) (Source: TTGV, 2010)

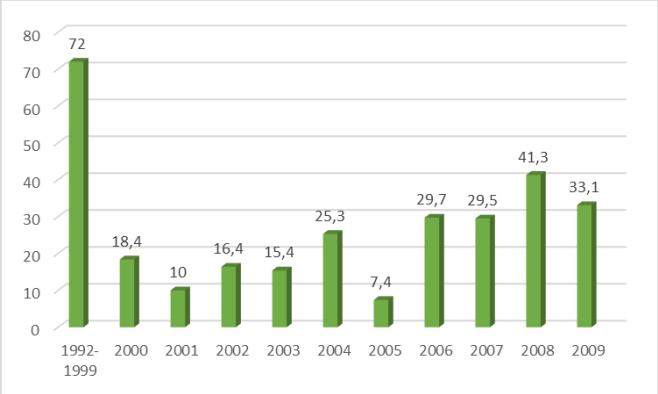
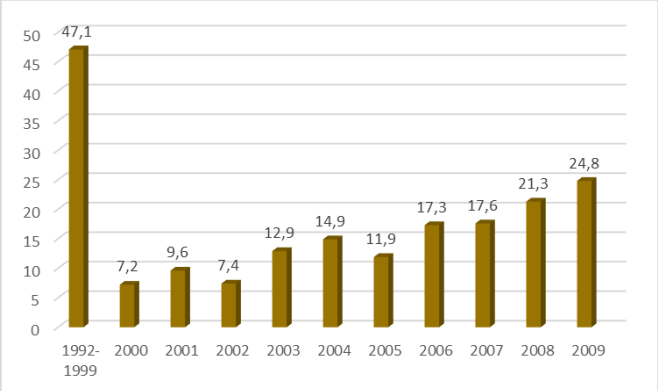


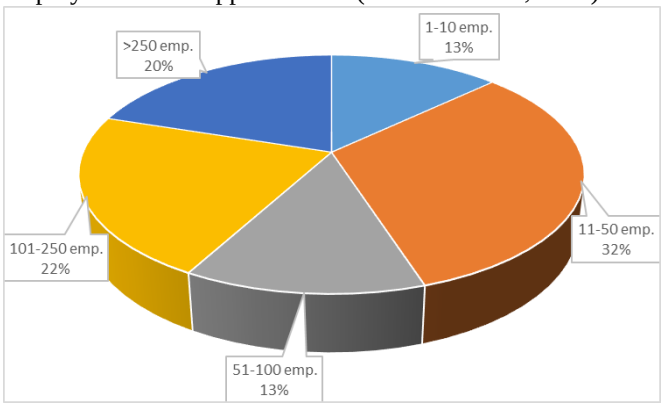
Figure 4. Provided funds (year by year in million US dollars) (Source: TTGV, 2010)



For 891 supported projects, the total budget of the projects is 602 million US dollars; 298,5 million US dollars has been contracted, and 192,0 million of this amount has been used by the applicant firms. Totally 697 projects had been completed and 194 projects were ongoing by the year 2010.123,7 million US dollars of the used amount had been repaid to TTGV. Contracted funds had been at their peak in 2008, and they had been at their larger values in the last four years in which also used funds steadily increased and reached their peak value of 24,8 million US dollars in 2009. It was reasonable that after the highest value of money contracted in 2008, the usage of those funds was also high in the consequent year. It can be concluded that TTGV increased its performance especially in 2008 and 2009 in which a serious economic crisis had been experienced all over the world. Finally, Table 1 depicts that 80 percent of supported projects belong to SMEs in 2009; and this ratio has been between 67 percent (in 2001 at its lowest) and 94 percent (in 2003 at its highest). It is explicit that this support mechanism of TTGV was highly directed to the financial requirements of SMEs which had financial constraints and need liquidity in their operations. Here, we should point out that the exchange rates of currencies had been highly stable in Turkey in the given period.

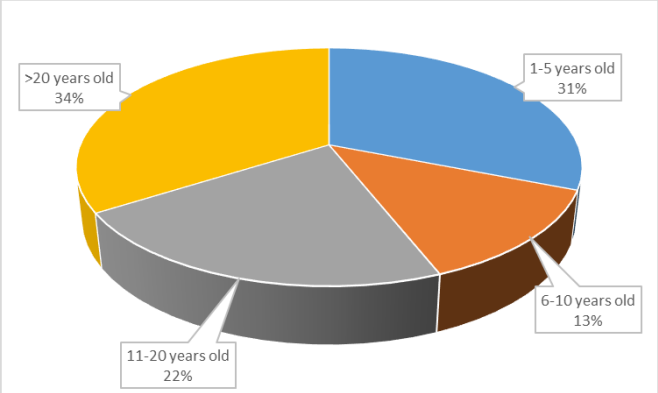
Further conclusions could be made from the below graphs that belong to the statistics related to the years between 2005 and 2009. (TTGV 2010, 15-18)

Figure 5. Share of projects concerning the number of employees of the supported firm (Source: TTGV, 2010)



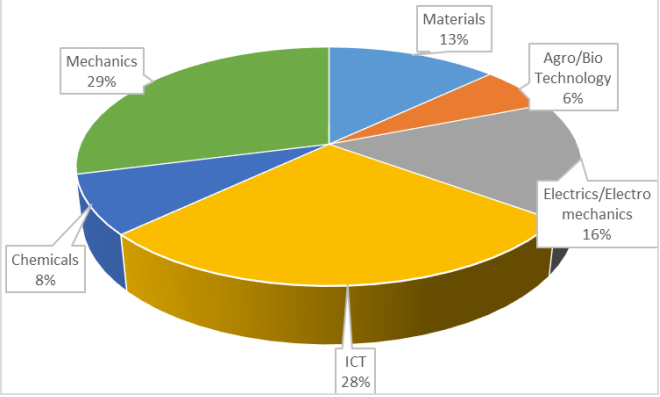
According to Figure 5, 45 percent of the supported projects belong to firms that have 11-100 numbers of workers. Only 22 percent of the projects belong to firms that have more than 250 workers; thus, this finding also supports the argument that generally SMEs benefit from this kind of mechanism.

Figure 6. Share of supported firms according to firms' age (Source: TTGV, 2010)



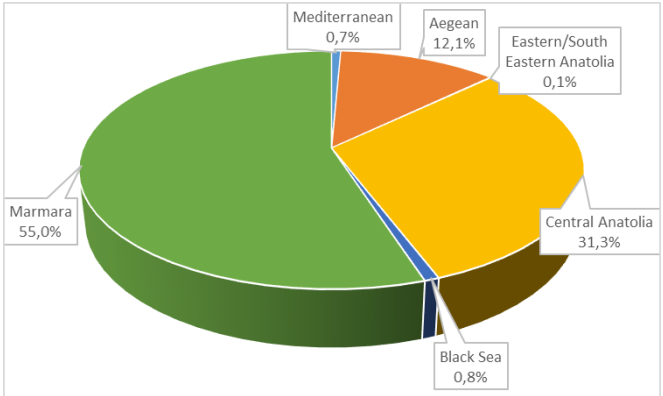
There is nearly an even distribution between the firms' age and support and can be suggested that several firms of several ages apply to the supports of the foundation.

Figure 7. Share of supported projects according to related technological fields and sectors (Source: TTGV, 2010)



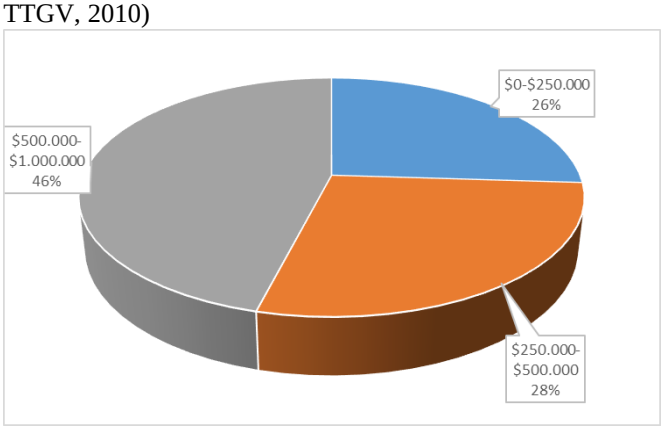
The distribution of TTGV support concerning technological fields is not surprising that the most supported projects have come from the machine industry and are related to the technological field of mechanics. It is a realistic outcome while taking into account the weight of the machine sector in the Turkish industry. The point that deserves attention is that the ICT sector is in second place with its 28 percent and its percentage is nearly equal to the machine industry. This can be highly related to the support mechanism and software projects that have generally project budgets weighted on personnel costs can perceive this mechanism as highly attractive and suitable.

Figure 8. The share of geographical regions according to the project (Source: TTGV, 2010)



The distribution of TTGV support according to geographical regions is also unsurprising and Marmara Region has more than one-half of the support with its value of 55 percent. İç Anadolu (Middle Anatolia) is the second with 31,3 percent and Ege (Aegean) Region is the third with 12,1 percent. However, when taking into account the industrial intensification of the regions, it is expected that Ege Region would not have fallen behind so seriously concerning İç Anadolu and in this condition, the distance of Izmir (the largest trade and industry center of Aegean Region) to Ankara may be effective. The share of other regions (namely, Akdeniz (Mediterranean), Doğu Anadolu (East Anatolia), GüneyDoğu Anadolu (South Eastern Anatolia), and Karadeniz (Black Sea) is unfortunately negligible due to the lack of homogeny distribution of industrial facilities in Turkey.

Figure 9. Contracted TTGV support per project (Source: TTGV, 2010)



Lastly, the TTGV support in the project budget is evenly distributed and TTGV compensates an amount of 0-500.000 US dollars to 54 percent of the supported projects where this compensation is above 500.000 US dollars in 46 percent of the projects.

3.3.2 Benefits of the Mechanism

The above findings could be sufficient to summarize the structure of TTGV support; nevertheless, the additionality

effect or the provided benefits of this support mechanism should be further explained scientifically. First of all, it can be posed whether this mechanism is a subsidy or not? TTGV funds are generated from World Bank subsidies and provided to TTGV as summarized above and this money was not taken back from TTGV. In addition, 75 percent of the ongoing support fund is taken from the Undersecretariat of Foreign Trade. These funds are allocated from a public source and the "government makes use of the fund in hand and thus, abandons its possible earnings and undertake its opportunity cost. In both cases, this can be defined as subsidy concerning World Trade agreements". (TTGV 2010, 70)

The second question could be asked whether this support offers significant benefits for industrial R&D and thus, for the national economy and growth. There are two important studies made about this subject. (Özçelik and Taymaz 2008; Taymaz 2006)

In their study, Özçelik and Taymaz (2008) tried to find the "crowding in" or "crowding out" effects of R&D subsidies (both of subsidies; R&D grants by TÜBİTAK and R&D loans by TTGV) and for this reason, they establish five models based on DID (difference-in-difference estimators). The dataset involves the years between 1992 and 2001. In the scope of this paper, I solely focus on the findings related to TTGV. Please note that those data years belong to the first TDP project and the beginning of the ITP project sustained by TTGV. Firstly, those scholars depict that the share of R&D loans of TTGV reduced, particularly after R&D grants had been provided by TÜBİTAK and its effects on the macroeconomic scale had become limited as shown by Fig. 10.

Figure 10. R&D loans, grants, the value of supported projects, and R&D expenditures between 1992 and 2001. (Source: Özçelik and Taymaz (2008))

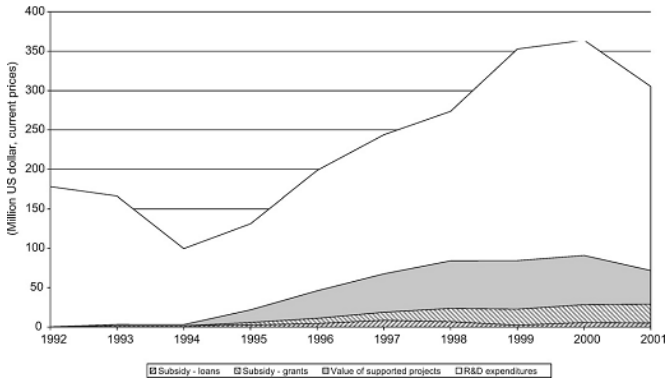


Figure 11. R&D loans, grants, the value of supported projects between 2000 and 2008.

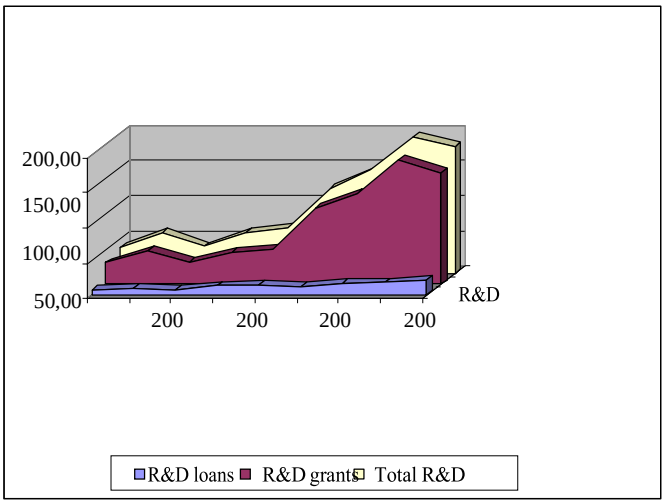
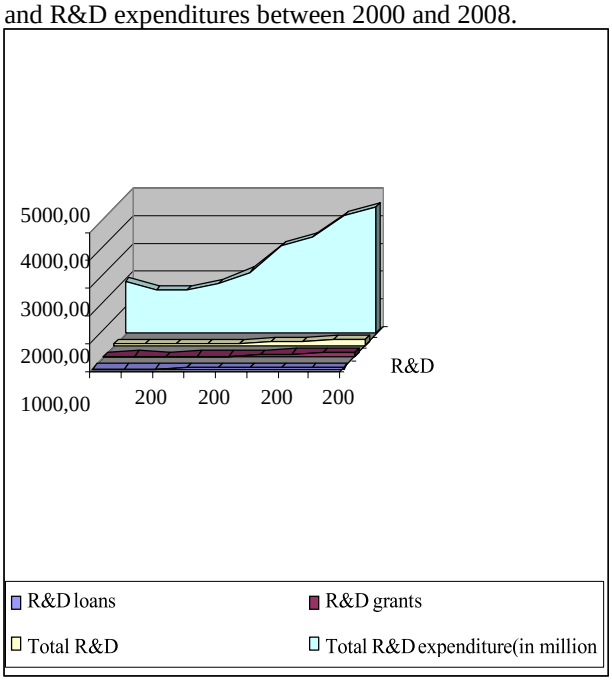


Figure 12. R&D loans, grants, the value of supported projects, and R&D expenditures between 2000 and 2008.



Further support for the above argument comes from Fig. 10 and Fig. 11 in which it is displayed that the share of R&D loans has been decreased steadily.[1] Also they show that the amount of R&D subsidy in the total amount of the R&D expenditure is considerably low even if the amount of R&D grants provided by TTGV has speeded up recently. To sum up, TTGV support seems too low in scale for making macroeconomic effects fostering economic growth and development.

[1]Data in Fig. 11 and 12 has been taken from TÜBİTAK, TÜİK (Turkish Statistical Institute), and TTGV statistics.

In their study, Özçelik and Taymaz (2008) have also found that R&D intensity (the ratio of R&D expenditure to output) of R&D performers increased from 1,45 percent in 1993 to 3,62 percent in 2001 (for loan receiving firms; 5,95% in 1993 to 10,58% in 2001 and for grants receiving 3,13% in 1995(the year program started) to 4,88% in 2001). They also provide the information that "support-receiving firms, on average, exhibit much higher R&D intensities than the non-supported ones". Also, an average R&D performer has an R&D intensity of 2,27 percent in those years between 1993 and 2001 (5,98% for loan recipients and 3,41 for grants recipients). Subsidized R&D intensity is 1,55 percent and 0,82 percent for loan and grants recipients respectively. The total subsidized amount of R&D is no more than 20 percent of total R&D spending. (Özçelik and Taymaz 2008)

This paper will not examine the methodology Özçelik and Taymaz (2008) used in their econometric models; however, some related outputs of the models should be mentioned. Those outputs can be summarized as follows;

- Public R&D support does not crowd out private R&D activity. Especially, R&D grants enhanced the firm financing part of R&D activity.
- The results show that incumbent firms spend more on R&D and this confirms the well-known Schumpeterian hypothesis; however, small R&D performers tend to benefit more from R&D subsidies concerning incumbents.
- Thanks to R&D subsidies, an "acceleration effect" on R&D activities is present notwithstanding the type of subsidy provided since an average firm has increased its R&D intensity when subsidized.
- R&D grants and loans are more effective policy tools concerning R&D tax incentives to create a "crowd in" effect in industrial R&D spending. (Özçelik and Taymaz 2008, 16)

Complementary to this study, Taymaz evaluated more broadly the effect of TTGV support in another study. Taymaz (2006) used a wide set of data[2] to statistically analyze the effect of the ITP project. As I analyze that study, I choose subsequent findings related to the subject of this paper. Taymaz (2006) firstly stated that the number of applicants has doubled in ITP concerning TDP and one-third of those projects had been supported. The share of SMEs remained about 80 percent and those findings are following the general structure stated above. Taymaz (2006) also found that the repayment ratio was above 80 percent for TDP and 94 percent for ITP and "the repayment ratio is extremely high for such a risky activity". (Taymaz 2006) According to this study, TTGV program is the least known concerning TÜBİTAK and KOSGEB among the industrial firms; and software firms are more knowledgeable about TTGV support because of the information externalities related to being located in technoparks. Also, this study found that the share of R&D loans in business expenditures on R&D is about 2 percent. In the interview, TTGV clients determined the main reasons for not applying for TTGV support as high loan costs, sufficient own resources, and inconvenience of getting TTGV support almost at equal proportions. (Taymaz 2006, 20) Firms also complained about the paperwork for applying and carrying on the project and the length of the response time. Nevertheless, "the great majority of firms were pleased that the quality of evaluation and monitoring improved over time". (Taymaz 2006, 22)

Since ITP was aimed at generating additional R&D, Taymaz (2006) measured this additionality effect via using interviews and econometric analysis. In interviews, it was asked whether supported firms afford the R&D activity unless their applications were accepted and whether rejected firms made R&D activity notwithstanding their rejection. In this context, the interviews were implemented in 211 firms of which at least one R&D project was supported by TTGV. 12 percent of large corporations and 27 percent of SMEs responded that they would not carry on the project. Half of the firms with rejection stated that they would reduce the project budget by 40 percent. As a result, firms totally would spend 34 percent less on R&D without R&D support. These findings suggest that "TTGV's R&D support program has a substantial additionality effect, especially on SMEs". Further support for this argument comes from the rejected projects. More than 40 percent of those projects had been terminated and in addition to this, the projects not terminated had been scaled down. Thus, R&D expenditures have been reduced by 50 percent. (Taymaz 2006, 24)

Taymaz (2006) also tested this suggestion via using econometric analysis. A DID (difference-in-difference) estimation model was used for attaining this aim. As a result, Taymaz (2006) stated that the R&D intensity and own R&D intensity of TTGV clients had increased 5,22 percent and 3,79 percent respectively and the difference between those values in favor of R&D intensity could be attributed to supported projects. Furthermore, there is almost no rise in the R&D intensity of non-participants. With the help of another model, the increase for only R&D performers was measured and the result is the same. As Taymaz (2006) noted, "TTGV clients experienced 3.67 percentage points increase in R&D intensity and

2.35 percentage points increase in own R&D intensity, whereas the matched control group raised R&D intensity only by 0.06 percentage points. These results indicate that there could be an "acceleration effect" because an average firm increases its R&D spending if it receives any R&D support". As a result, TTGV support was determined as statistically and economically significant on R&D activities. (Taymaz 2006, 26)

[2] This data set involves The Annual Survey of Manufacturing Statistics, The R&D Survey, The Innovation Surveys (1998, 2002, 2005), The Industrial Technology Services Survey, a database of TTGV clients, and a large number of interviews.

Taymaz (2006) also provided "qualitative evidence" for TTGV support. Accordingly, the main benefits of TTGV support were argued as "the time discipline and tight R&D process management introduced by TTGV, the advice provided by the supervisors (academic and industrial) and the prestige attached to winning TTGV projects". (Taymaz 2006, 29) Also, firms stated that the evaluation and monitoring of TTGV on the project were also beneficial and they saved a lot of money and could sustain a positive relationship with universities which they could not establish unless they gained the support. Taymaz (2006) also noticed that firms have gained technology culture and the capability of preparing R&D project proposals, R&D budget, R&D plans, and managing R&D projects. Taymaz also furthered his study to measure the impact of R&D support on productivity, competitiveness, employment, and performance dynamics. Taymaz (2006) concluded that TTGV clients are more productive concerning non-clients, particularly in low-tech industries. He suggested that TTGV clients especially on services are more competitive (has significant export intensity). On employment, the emphasis on making R&D and the considerable increase in TTGV clients are mainly related to the increase in R&D spending, not on TTGV support; since non- supported R&D performers also increase their employment almost as large as TTGV clients. Nevertheless, TTGV clients need more researchers after they had been supported. (Üçdoğruk 2005) Finally, it is found that as in low- and high-technology manufacturing, TTGV clients in services had the highest growth rate in wages. The innovative performance of small TTGV clients in services is outstanding. (Taymaz 2006, 29-34)

4. Conclusion

This paper has descriptively examined the relevance of R&D loans provided by TTGV to generate technological advancement in the Turkish National Innovation System. From this examination, it is found that a major part of the number of accepted projects was owned by SMEs. This argument is following the suggestions about SMEs in Section 2. The constraints in internal finance and difficult entry to credit markets are problems for SMEs and TTGV seems to be helpful in this way by providing R&D loans that are easier to take. SMEs reach finance via using TTGV's support mechanism and as stated above one of the most beneficial aspects of this support is its capability to provide stable liquidity for supported projects. This benefit seems lesser for small firms on a microscale and large firms. Among supported SMEs, smaller ones with less than 10 employees have fewer propensities to be subsidized. Particularly, those firms struggle to present a guarantee which is required by TTGV and those kinds of projects are terminated before the contract is signed up. Also, this support of TTGV maintains the industry and university relationship with its field committee members and project viewers generally stimulate the project positively as interviews suggested. Furthermore, the monitoring mechanism generates a management culture concerning R&D projects and provides tight discipline for the firm. Therefore, those direct and indirect effects provide additionality effects on R&D expenditures and trigger further R&D expenditure in the industry. It can also be suggested that TTGV support mechanism is significantly beneficial for SMEs in fostering their competitiveness and productivity.

Despite those benefits, TTGV's R&D loan program can be criticized for its financial requirements concerning back payment and those requirements can inhibit R&D since the supported firms take the responsibility of exchange rate risk and give a service fee to the program. In this manner, a feasibility study should be performed before applying and sometimes firms withdraw their application for these reasons.

It can also be suggested that the overall impact of the program on the economy is too small when taking into consideration the amount that is contracted and funded. Its macroeconomic effect seems very limited in terms of provided amount. R&D loans cannot increase their scale in line with R&D grants and overall R&D expenditures. However, to provide access to finance for innovative SMEs, R&D loans might be considered as an option by policymakers even though the final support in the form of R&D loans had been given a decade ago. This might be perceived as further research by taking into consideration the current needs and bottlenecks of the Turkish Innovation Ecosystem.

To conclude, R&D loans provided by TTGV under the "Technology Development Projects" program seem relevant and beneficial even though their effect is small on economic development. Its capacity might be enlarged by making it more attractive and compatible with the needs of firms, particularly SMEs. Further research should focus on these issues and this tool should be more effectively used for abandoning the market failures that prevent technological advance, industrial development, and optimal resource allocation to R&D.

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