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HELLENIC DEFENCE INDUSTRIAL BASE IN THE ERA OF ECONOMIC CRISIS

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Abstract
The Hellenic Defence Industrial Base (HDIB) is at a crossroads because of the reduced military spending and the absence of coherent policies for its further development. Neighbouring countries, such as Israel and Turkey, possess robust defence industrial bases that serve both their respective armed forces and their national economies. This paper argues that the HDIB should be considered an integral part of the Greek national defence framework. Consequently, the ownership structure and management of major defence industrial enterprises should be reformed within the European framework. A small but viable HDIB requires technology and skilled manpower. Greek institutions of higher education should support this effort.

JEL Classification: F52, H56, H57, O14
Key Words: Defence industry, Defence R&D, Dual Use technology, Military spending, Procurement

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1. Introduction

Greece is in the midst of a multiyear economic and fiscal crisis, which has depressed the economic output by 25% during the 2009-2015 time period, has caused massive unemployment, and has severely curtailed governmental spending, including expenditure on national security. Since 2009 defence spending has dramatically decreased, including money spent on new acquisition programmes. This reduction in acquisition programmes has affected the Hellenic Defence Industrial Base (HDIB), because of its dependency on contracts from the Hellenic National Defence Forces (HNDF) (IHS Jane's 2015a). Reduced dual-use domestic acquisition programmes, combined with the particular conditions of the Greek defence market (Research & Markets 2015), have decreased HDIB production activities and as well as revenues. The HNDF cannot be totally dependent on imports in the future — particularly in times of crisis or actual armed conflict — not only concerning advanced weapons systems, their major components, and spare parts, but also small arms, munitions, and consumables. As a matter thereof, the long-term sustainability of the HDIB in developing and introducing new products and technologies is of concern to the HNDF. Indeed, it is the author's view that the HDIB industrial concerns make it imperative it should implement diverse strategies in partnership with the HNDF.

Driven by such realities and assessments, this paper discusses potential policies so that the HDIB remains in business on a long-term basis, by keeping its production lines open. This in turn, will result in increasing its GDP, whilst adequately supporting HNDF's missions and tasks. The remainder of the paper is structured as follows: Section 2 presents a brief account of the theoretical perspective of the defence industrial base, and the impact of military spending on a country's economic growth and security. Section 3 introduces the necessity of military preparedness. Section 4 presents the current Turkish threat to Greece, which justifies the requirement for a defence industrial base. Section 5 briefly examines the development of the Israeli and Turkish DIBs. Section 6 presents the HDIB and Section 7 offers some recommendations for the future course of the HDIB, while concluding remarks are summarised in Section 8.

2. Theoretical Perspectives and Literature Review

Literature research conducted suggests that the reasons counties produce arms are mostly related with their national security. As Brauer (2007, 982) recounted: 'states produce arms for ostensibly defensive purposes, namely, the preservation of territorial integrity and the maintenance of spheres of influence.' He also indicated that a country's decision to import or produce arms depends on the level of the technical efficiency of its domestic defence industry and the scale of its military spending. By acknowledging the fact that companies produce for profit (Blanco 2015), governments may induce firms to design/offer specific products/services

through public demand to satisfy their needs and project "soft power" (Nye and Welch 2011, 42) to other countries through defence procurement.

Hartley (1991, 124) described what constitutes a country's defence industrial base (DIB). He said that a country's DIB could be defined as all its firms receiving ministry of defence contracts; or as a minimum core of key national defence assets; or as a system of defence industries that would be determined by market forces. He concludes that the defence industrial base includes all defence capabilities within a country, which makes possible or maintain a strong domestic defence production for the state's military and strategic benefits. Hartley also (1991, 126) summarised the benefits and the cost for a country to sustain its own defence industrial base. He described benefits as a matter of independence, 'security of supply and responsiveness in emergencies and war, the ability to be an informed buyer, together with the need to provide equipment specially designed for the requirements of national forces.' Thus, military spending and the country's relevant technical efficiency trigger and further enable the development of its own DIB.

Dunne (1995, 402) also highlighted the defence industrial base as those companies in the interior of a country that provide defence and defence-related equipment to the defence ministry. Watts (2008, 40) explained the relationships among defence industries, as well as between enterprises and the U.S. government. A country's defence industrial base involves a network of heterogeneous actors. Such actors mainly include unions of states, alliances, governments, parliaments, governmental and non–governmental agencies, ministries of defence, armed forces and defence equipment companies.

Extensive research (Schofield 1993; Foray and Cowan 1995; Molas-Gallart 1997; Haico and Smit 2003) has highlighted the importance of a developing industry that produces dual–use equipment products and technologies, particularly in times of decreased defence expenditure. Such products either integrate technologies from the military into the civilian sector and vice versa, or, after some transformations, such technologies are used by both sectors. These researchers pointed out the importance of duality for a national defence industrial base. Industry duality enables timely transfers of advanced technologies as well as lower production costs. Korkmaz (2015) concluded that, while military spending in ten Mediterranean countries negatively affects their economic growth rates, the development of industry producing dual-use items and equipment may have an enhancing effect on employment. Indeed, such industrial duality may lead to multi-product firms and economies of scope (Panzar and Willig 1981), capable of delivering various military and civilian products in a wide range of sectors such as 3D printing or software development.

Markusen (2003, xv) highlighted the South Korean defence companies' paradigm in the late 1990s: they managed to diversify their production, perceived their military industrial obligations as an opportunity cost, and increased their civilian output in

times of lower military spending. Markusen also pointed out that the governments of Israel, South Korea and Spain succeeded in applying strategic conversion plans so as to gradually privatise and reconstruct their state-owned defence industries, and achieved positive economic results.

Bitzinger (2009, 2) commented on the hierarchical nature of the global defence industry and categorised arms producing countries into three tiers: the U.S. and the four largest European arms producers (Britain, France, Germany, and Italy); a typical group of countries with advanced defence industrial capabilities; and countries with very limited and low-tech arms production capabilities. Ungaro (2013) pointed out the importance of collaboration for countries to peruse and implement initiatives, such as offset or co-production programmes. Blom, Castellacci, and Fevolden (2013) investigated innovation and defence industrial policy in the context of a European liberalised market and concluded that such a market would introduce into the Norwegian defence sector a higher degree of international competitiveness. Meanwhile, the transfer of technological innovation from the military to the civil sector and vice-versa can create a positive economic impact in producing countries (Sköns and Dunne 2008).

Wang, Shyu, and Chou (2012, 2104) present evidence, based on productivity analysis, that 'the appropriate allocation of defence expenditure can increase regional economic productivity effectively across Asia, Oceania, and Europe.' In such cases, 'the effective defence expenditure strategies undertaken *by [a] government are important for improving economic productivity of countries together with their military preparedness.'

3. Military Preparedness

Hartley (2010, 413) evaluated security and observed that military spending is assumed to develop a country's capacity to protect its national interests and counter its enemies. Thus, it produces defence, and ensures national security, which is the classic example of a 'pure public good,' (Hartley 1991, 30; Córdoba and Torres 2016, 556). Although military spending has macro-economic implications because it affects a county's finances, nation-states spend on defence to maintain, and materially sustain armed forces for the preservation of their sovereignty and territorial integrity, as well as for the protection of their respective populations. Through the centuries, the reasoning of war and peace has remained unchanged. What Thucydides recounted in the Melian Dialogue is still more or less valid (Strassler 1996). It is usually true that, mutual respect exists between equals and 'as the world goes, [right] is only in question between equals in power [countries], while the strong do what they can and the weak suffer what they must.' Such mutual respect usually exists when there is relative balance of military power between countries. As Buchan (1968, 7; also quoted in Blainey 2013, 122) pointed out, lack of military balance between countries

increases fears for armed conflicts because such lack 'creates a clear temptation to aggression,' that can easily escalate to war.

As Gilpin (2001, 18) states *"national security is and always will be the principal concern of states. In a 'self-help' international system,[…] states must constantly guard against actual or potential threats to their political and economic independence. Concern with security means that power—military, economic, and/or psychological—will be vitally important in international affairs; states must be continually attentive to changes in power relations and the consequences for their own national interests of shifts in the international balance of power."* Indeed, this fact has not changed much today, when actors or events around the globe are inter-dependent. As such, challenges are created that represent dilemmas to be faced and effectively addressed not only by a single country but by the entire global community (Nye and Welch 2011, 255).

The level of military spending affects the whole system of national defence. The amount of spending usually contributes to a nation's military strength and preparedness (Galvin 2014) and its ability to protect its national interests, project power, or counter its rivalries. Collins (2004) argues that *"military preparedness demands personnel, weapons, equipment, and supplies of adequate quality in the proper mix and in sufficient quantities to accomplish assigned missions wherever and whenever directed. Preparations take present and projected requirements into account. Perceived threats, doctrines, plans, programs, military infrastructure, the industrial base, and budgets strongly shape results. Problems develop whenever any aspect becomes deficient."*

Modern armed conflicts, even of a short duration, are highly intensive. For example, the U.S. aerial resupply effort for the State of Israel during the October 1973 war in the Middle East included conventional ammunition, main battle tanks, combat aircraft, electronic warfare systems, and precision guided munitions (Boyne 2003). If a country largely depends on imported munitions and materiel, this may pose considerable threat to its national defence, in particular during a period of crisis. Depending on the duration of an armed conflict, existing ammunition stocks and materiel may or may not be sufficient. However, the importation of such military consumables may be negatively impacted by political or economic factors, and potential unilateral or multi-lateral embargoes by exporting countries (e.g., embargoes of military exports to Greece 1967, Israel 1967, Turkey 1974-1978, Iran 1980-1988, etc.). Meanwhile, domestic ammunition production is not similarly constrained in the context of military preparedness and steady-rate production of long-runs. Solutions such as long-term purchasing contracts from abroad or last-minute purchases make a country vulnerable because the international system is mainly a self-help system. In this system "states must rely on themselves" to protect their national security interests (Goldberg 2016). 'To do otherwise

runs the risk of manipulation or betrayal at the hands of another state' (Hastedt 2014, 35). Therefore, much of countries' spending is directed to their DIBs in an effort to reduce dependency on military technology imports, as well as to ensure arms exports and further boost their respective economies.

Driven by such motives for war and peace, or due to a realist's perspective when conducting international relations, Israel and Turkey have had the highest military spending in the Eastern Mediterranean region (IISS 2015). The existence of strong DIBs increases Israel's and Turkey's self-confidence when exercising their national security strategies and enables them to counter their security threats. Bitzinger (2009) places both countries in the second-tier arms producers of developing and newly-industrialised countries with advanced military-industrial complexes.

On the other hand, Greece could presently be categorised as being a third-tier arms producer country, because of current HDIB dynamics (Curtis 1994; Kollias and Rafailidis 2003; Dunne, Nikolaidou, and Mylonidis, 2003). The country mainly produces items of modest technological content that do not secure HNDF supply lines or sustainment. In the past, Greece had difficulties in sustaining its army in wartime or during crises. During WW II Greece was unable to convince Great Britain to dedicate one of its munitions factories to the production of ammunition for Hellenic Army weapons, particularly artillery (primarily of French, Czech, and German origin). During the 1963-1964 and 1974 Cyprus crises, when an armed conflict with Turkey was a distinct and imminent possibility, Greece increased ammunition imports from other countries. Given the current Turkish threat against Greece, the HDIB should increase its capacity and reduce the HNDF dependency on foreign imports, so that Greece can be adequately prepared for a potential crisis or even an actual armed conflict with Turkey.

4. The Turkish Threat to Greece

Greece and Turkey are long-term opponents in the region but allies within NATO (HIS Jane's 2016; Nation 2003; Couloumbis and Dokos 1994). Both countries also maintain close relations with the U.S. and other Western powers. Since the early 1970s, Turkish policies towards Greece have included elements of '*coercive gradualism*,' (as this term is defined by Pierce, Douds, and Marra 2015), i.e., Turkey advances its interests against Greece through a gradual systematic process and the use of threats and intimidation so as to achieve its national objectives at Greece's expense (Ploumis 2016, 34). In the Balkans, Turkey's leverage, combined with the on-going regional instability, gives the impression of the establishment of a 'Turkish network' in the region and arouses fear of isolation in Greece and Bulgaria (Couloumbis and Dokos 1994, 282). In the Eastern Mediterranean, the discoveries of confirmed and significant undersea natural gas deposits within the exclusive economic zones (EEZs) of Cyprus, Israel, Egypt, and Lebanon, further complicate

the existing geopolitical scene (Kariotis 2007; Tzanetakis 2014). Such undersea fuel deposits most probably also exist within the Syrian EEZ as well, but are not present within the Turkish EEZ.

Currently, while Greece is suffering from the economic crisis and large migrant inflows from the Middle East and Africa, the Hellenic National Defence General Staff (HNDGS 2016) reports that Turkey continues to challenge and violate Greek sovereignty even more intensively than in the past. Meanwhile, Turkey has adopted a rather risky foreign policy with active and counterproductive involvement in the Syrian crisis (Itani and Stein 2016; Grigoriadis 2015; Stein 2014) and continuous and unabated challenges to Greek and Cypriot sovereignty and territorial integrity *(To Vima* Newspaper 2016). It is also suffering from increased levels of unpredictable domestic political instability, especially after the failed coup in the summer of 2016 (*The Economist* 2016a; *The Guardian* 2016; Cook 2016). When comparing Turkey to Greece, Turkey has a military advantage (IISS, 2015) that will be increasing in the near future. Meanwhile, the relationship between Greece and Turkey has not been improved (Grigoriadis 2012). In the absence of a relative balance of forces, a limited or more conventional military confrontation between Greek and Turkish military forces is a distinct possibility (e.g., Cyprus 1974, Aegean Sea crises of 1976, 1987, and 1996 at the Imia islets).

These realities amount to a continuous and credible symmetric threat for Greek national security interests in the region. Meantime, as some scholars recounted (Sandler and Hartley 1999; Brauer, 2002), NATO does not provide any form of security guarantees to Greece in the event of a military confrontation with Turkey, since 'the allies are only pledged to consult as a group by Article 5 prior to determining the necessary response.' In such circumstances, as has historically been demonstrated in the past (Cyprus 1974, Imia Crisis 1996), the alliance goal is to preserve 'unity' in NATO's Southern flank (Bozikas 1998, 23; Kassimeris 2008, 104). The European Union (EU) is assumed to follow the same approach through its common foreign and security policy (CFSP) (Mix 2013, 8). NATO and the EU, as well as the U.S., only provide Greece fora to discuss actual and potential aggression and manage the peaceful resolution of friction and disputes with unclear results.

The preceding brief analysis demonstrates that Greece should maintain adequate military capabilities to protect its sovereignty and territorial integrity. The existence of a strong DIB would support sustainment of the HNDF combat capabilities and reduce Greek vulnerabilities and dependency on defence imports in case of crisis or war. In an effort to reform and improve the HDIB and reduce the defence import dependence, the Israeli and Turkish best practices of developing their respective DIBs provide concrete examples for further action and review.

5. Israeli and Turkish DIBs

In the second half of the 20th Century, both Israel and Turkey followed the theory of the developmental state (Gilpin 2001, 305) and generated programmes of import substitution in the development of their respective DIBs. At present, as indicated by the Stockholm Peace Research Institute (SIPRI 2015), both countries rank high as exporters of sophisticated defence items. These countries enabled their DIBs to grow by introducing various mechanisms to ensure that their national armed forces would award arms and munitions acquisition contracts to domestic industries. Furthermore, domestic military technology research and development (R&D, inclusive of 'reverse engineering' and appropriate combinations of foreign technologies, e.g., the Israeli Kfir fighter aircraft), has been and still is heavily supported through government funds. For example, from the free annual $3 billion U.S. military assistance to Israel, 26.3% currently flows directly to the Israeli defence industry (Reuters, *The New York Times* 2016). It is worth mentioning, at this point, that Israel has managed to capitalise on this assistance by empowering its defence industry.

Israel started developing its DIB with modifications to imported military equipment, e.g., installation of U.S.-made engines and replacement of the central gun in British-made Centurion main battle tanks (MBTs) (Vekstein 1999). The French arms embargo on Israel, following the June 1967 Six-Day War in the Middle East, provided the impetus for the rapid evolution of the Israeli defence aerospace industry. Nowadays, despite the very respectable free annual United States military assistance to Israel, Israel itself ranks high as an exporter of sophisticated defence items to other countries, often in competition with U.S.-based defence industries (HIS Jane's 2015b; Metz 1990). Elbit Systems, Israeli Aerospace Systems and Rafael were among SIPRI's 100 top Israeli arms-producing global companies in 2015, generating sales worth $7,710 million. These companies have also established a number of joint ventures and co-production schemes with U.S. firms for developing innovative weaponry, such as the Arrow Theater Missile Defense, the Iron Dome or equipment to counter drones (Defense One 2017; Defense Industry Daily 2017, 2016).

Turkey, Greece's main national security concern in the region, has also followed an ambitious and costly programme of import substitution in the development of its domestic defence industry (Eceral and Korglu 2015), particularly after the U.S. arms embargo following the Turkish invasion of Cyprus in 1974. The Turkish model is noteworthy because it has combined the development of the domestic defence industrial base with the role that the Turkish military command structure and its institutions have traditionally played in domestic Turkish economy (Tartter 1996). For example, OYAK, the supplemental retirement benefits institution for the Turkish Armed Forces, is the owner of major defence industries, such as ASELSAN (defence electronics) and ROKETSAN (rockets and missiles), while it also owns civilian manufacturing operations, such as the Renault automotive factory in Turkey, a major steel mill, and extensive real estate properties.

In this manner, successive Turkish governments have consistently supported the evolution of the domestic defence industrial base through both direct and indirect state subsidies. Although there are reasonable doubts as to whether domestic Turkish defence industries are financially self-sustained in the absence of continuous governmental support subsidies and procurement contracts from the Turkish armed forces, Turkey's exports of defence articles are on the rise, e.g., wheeled armoured vehicles. Furthermore, Turkish defence industrial enterprises are capable of producing weapons systems of increasing sophistication, e.g., reconnaissance and unmanned combat aerial vehicles (UAVs, UCAVs) (De Larrinaga, 2015), theatre ballistic missiles (TBMs), surface warships equipped with indigenous electronic systems, etc. Turkish defence equipment manufacturers have benefited from the inflows of military technology and 'know-how' from multiple countries and, indeed, at a high level. This has included the co-production of F-16 fighter aircraft (Turkish Aerospace Industries (TAI) and the U.S. Lockheed Martin), partnership involvement in the Lockheed Martin F-35 Joint Strike Fighter programme, and use of Chinese technology for developing the indigenous Yildirim TBM (IHS Jane's, 2013a).

While there are differences between Greece, Israel, and Turkey, all three countries have some common ground in the process of developing their respective DIBs that highlight some of the Israeli and Turkish efforts as best practices for Greece. The main difference between Greece and the two countries is the fact that these states intensified their efforts to develop their respective DIBs after they had to undergo arms embargos. Arms embargos were major incentives that led both countries to reduce their dependency on arms-producing countries. Another difference is that Greece is a European Union (EU) member and has to manage governmental initiatives for the HDIB within the EU framework. Therefore, Greece implements the European legislation on defence contracting (EUR-Lex 2013) (e.g. Directive 2009/81/EC) that places EU's defence sector in the context of a liberalising market (Hartley 2003), while it also observes the rules and provisions of the European Defence Agency (EDA).

On the other hand, Greece, Israel and Turkey are close allies with the United States, and have been recipients of U. S. Security Assistance programmes since WW II (U.S. military assistance to Turkey was partially interrupted in 1974-1978) (Bozikas 1998, 15; Aseltine *et al*, 2015, A2-5). Under the legal framework of the U.S. Foreign Assistance Act (FAA), and the U.S. Arms Export Control Act (AECA), the U.S. has provided finance, arms sales, and technological support to these countries so that they might develop their respective DIBs through various programmes including co-production, licensed production, out-sourcing, or military technology transfer arrangements. Israel and Turkey have taken advantage of these programmes in an evolutionary fashion and largely developed their respective DIBs by primarily using their high military spending to fund domestic defence industrial production and import substitution. In the recent past, both countries, and Israel in particular, succeeded in becoming major arms exporters further developing the technological capabilities of their respective DIBs.

The HDIB has partially benefited from U.S. military assistance programmes in the past. However, despite the high level of Greek defence expenditure prior to the recent economic crisis, the HDIB did not follow the strategic course of import substitution. Rather, it could be argued that the transfer of military equipment under the U.S. Military Assistance Programme (MAP) at an initially low capital cost in the 1950s and 1960s, actually acted as a disincentive for more robust development of the HDIB. Although more serious attempts were made in buttressing the HDIB during the late-1970s (aftermath of 1974 Cyprus crisis), and in the 1980s, a clear preference for imported military technology clearly deviated from the targets that governed corresponding Israeli and Turkish defence industrial policies.

6. The Hellenic Defence Industrial Base

The majority of Greek defence enterprises produces components, such as metalworking, casts and moulds, mechanical engineering, electrical and electronic equipment, or provide defence contracting services. The HDIB includes shipyards (e.g., Hellenic Shipyards, Neorion-Elefsis Shipyards, etc.) with a dual civilian and military role, as well as some very innovative enterprises with a significant amount of exports of cutting-edge defence equipment. The latter are specialised systems producers or manufacturers of complete sub-systems, assemblies, and major components (e.g., the Hellenic Aerospace Industry (HAI), the Intracom Defence Electronics (IDE), ISI-Signaal Hellas, SSMART S.A., Theon Sensors, etc.). HDIB annual sales are below €500 million (SIPRI 2015). In the absence of detailed data regarding the Hellenic defence industry itself (GDDIA 2017; Frost & Sullivan 2004), empirical research (AMEF 2015; ICMAIF 2015) indicates that of the total sales, about €200 million represent exports, while the rest is attributed to HNDF contracting.

In the 1980s and 1990s, the Hellenic Ministry of Defence (HMOD) promoted offset initiatives in the procurement of major weapons systems (Antonakis 1996). Due to these initiatives, the Greek domestic defence industry managed to develop and gain valuable experience through various practices, such as licensed co-production or other collaborative programmes. Collaborative defence production projects in Greece, based on offset arrangements, have included the joint construction and/or modification of Hellenic Navy U209/214 submarines of German design, between HDW and the Hellenic Shipyards; the Greek assembly, by Hellenic Defence Vehicle Systems, of 90 Leopard 2A6 HEL MBTs of the 126 procured from the German firm of Krauss-Maffei Wegmann (IHS Jane's 2013b); the co-production of rear fuselages for F-16 fighter aircraft, between Lockheed Martin and the HAI, and other programmes, such as the unmanned aerial combat vehicle or UCAV nEUROn, involving the French Dassault Aviation, other European aerospace and defence electronics firms (e.g., EADS, Saab, Thales, etc.) and the HAI. However, some military procurement offset arrangements with foreign firms were directed towards

non-defence related economic activities, such as the development of tourism or the promotion of agricultural exports and did not provide any recurring benefits to the HDIB (e.g., through continuous transfers of military technology 'know how').

Table 1. The 7 Biggest Hellenic Defence Industries

	Sector	Total Sales (€)/ FY	Employees	Arms Share of total sales (%)	Exports share (%)	Status
Metka	Comp & sup (MV, Sub)	606491000 (2013)	800	3.2%	95%	Pr/Vent
HAI	Comp & sup (Ac /UAVs, El)	88230099 (2013)	1369	97%	52.5%	Sta/own
EAS	SA/A	54019575 (2013)	533	100%	73%	Sta/own
IDE	Comp & sup (El)	49855647 (2013)	393	100%	98.4%	Pr/Vent
Elefsis Sh.	Sh	43227880 (2013)	585	86.67%	0%	Pr/Vent
Hellenic Sh.	Sh, Sub	26318045 (2011)	1300	N/A	N/A	Pr/Vent
ELVO	MV	5817951 (2012)	376	99,6%	N/A	Sta/con

Notes: Comp & sup = components & supply; MV = Motor Vehicles; Sub = submarines; Ac = aircraft; UAVs = unmanned aerial vehicles; El = electronics; SA/A = small arms /ammunition; Sh = ships; Pr/Vent= private venture; sta/own = state-owned; sta/con = state controlled; N/A= Not Available; Sales in € at current prices and exchange rates.

Source: The author created this table based on data received from companies' publicly available annual balance sheets & websites, as well as from the companies' responses to a questionnaire prepared by the author.

Since 2009, the majority of Greek defence contractors have had difficulties in sustaining operations, because of reduced military spending, and the consequences of the unification of the European defence market (Giannitsopoulos 2016; 2015). After the last Memorandum of Understanding for the Greek economy (EC 2015, 7) between the European Commission and Greece, Greece has had to further reduce its military spending on procurement, which, in turn, will further affect the HDIB. Consequently, the vast majority of the HNDF's procurement concerns upgrades of existing major weapons systems and platforms, such as the upgrade of five P-3 Orion maritime surveillance aircraft that belong to the Hellenic Navy and Hellenic Air Force inventory.

Table 2. Greece's Defence Expenditure 2009-2016 (€ million current prices)

		Distribution of Defence Expenditure by Category (%)			
	Defence Expenditures	Equipment	Personnel	Infrastructure	Other
2009	7.311	27.75	56.52	0.84	14.88
2010	5.966	17.98	65.07	0.76	16.19
2011	4.934	5.86	76.03	1.26	16.84
2012	4.384	7.47	73.19	0.79	18.55
2013	3.999	12.06	74.56	0.63	12.75
2014	3.939	8.17	77.18	1.10	13.55
2015	4.190	12.77	70.04	0.77	16.42
2016	4.155	14.91	69.93	0.49	14.67

Source: NATO (2016). Figures for 2016 are estimates. The author created the table using information from the source.

Meanwhile, the HDIB has been negatively affected by the introduction of European Directive 2009/81/EC concerning defence contracting, which was incorporated into the Greek legislative system in 2011. This directive established a unified defence market between European countries (TNO 2009) by abolishing the existing protective measures for the DIBs of EU member states. The unification of the defence market in Europe led to further shrinkage of the small HDIB, because the latter faced fierce competition from major Western European defence equipment firms with longer production runs and lower average and marginal costs. With long production runs, the average unit cost of a defence item declines and better absorbs initial ('up front') and sunk R&D economic costs. Similarly, with an embedded technological and industrial production base, a major military equipment manufacturer can produce additional units of a defence item at a marginally lower cost. Thus, a major defence manufacturer with significant economies of scale can better price-compete for defence contracts.

This outcome has also reduced the confidence level of the HNDF when it comes to relying on the HDIB for its on-going supply and sustainment needs. Consequently, the HDIB covered only 9% of the HNDF procurement needs in 2016 while the Hellenic Ministry of Defence target announced is 20% (Vivienne 2016). This development is disturbing for a number of reasons. The HNDF would definitely prefer to rely for its procurement on a larger share of domestic content. However, the defence items at issue need to be timely delivered and must meet prerequisite specifications, because such deliveries affect the HNDF's readiness and deterrence capabilities. In the context of the ongoing economic and fiscal crisis, the majority of the HNDF military mission and task requirements cannot yet be met by the HDIB output except in few cases.

Under the provisions (Article 346) of the Treaty on the Function of the European Union (TFEU), (EUR-Lex 2007), European countries have the right to protect their domestic defence production when they appropriately justify any essential national security interests. Although Greece had the opportunity to legislate exemptions from this general rule, such legislative initiatives have not been undertaken. Instead, Greece unified its small DIB with the strong European defence industrial base (EDIB) and military equipment acquisition market.

Research concluded indicates that a number of European countries tend to ignore competition procedures *per se*. Indeed, Germany recently announced that it will issue its industry with a €1.5bn for the purpose of purchasing warships (Reuters 2017), while France proclaimed the nationalisation of its biggest shipyard at St-Nazaire (Topham 2017). Moreover, other European firms are free to enjoy government economic assistance even if engaging in purely commercial ventures (e.g., the undertaking of Electricité De France (EDF) and the nuclear equipment manufacturer Areva to build a two-unit nuclear power generating station in the UK) (Landauro 2016; Macalister 2016). In the aftermath of the United Kingdom's referendum vote for Brexit, the situation in the European defence industry is becoming much more uncertain (Ghez *et al*. 2017, 8).

The realities of the protracted economic and fiscal crisis, combined with Greece's security concerns, demand a national strategy for restructuring and optimising the HDIB. This restructuring and optimisation need to take place in the context of the overall Greek national security strategy, i.e., this strategy does not and cannot rest on the resources and capabilities of the HNDF alone. This restructuring must explicitly recognise the existing and future environment of symmetric and asymmetric national security threats that Greece has to overcome based on its *own* ways and means of national power. The conventional thinking is that an economically viable HDIB must be able to compete in the international and European defence equipment markets. However, the involvement in new technologies -enhanced through collaborative R&D projects (e.g., EU and NATO defence research grants)- and better utilisation of highly educated Greek human capital can create a more adaptable and cost-effective HDIB.

7. The Way Forward

Appropriate allocation of defence expenditure from European governments can support their respective defence industrial bases on national security grounds and, hence, increase the country's economic productivity (EC 2016, 4; Vitsas 2016). Because of the dramatic economic change in Greece over the last 8 years, the Greek government should negotiate with the European Commission an appropriate legal framework that will enable its defence industry to remain in business within the single European market for defence. This approach must also highlight 'the

paradox that is required by the European Union and NATO to increase their defence expenses' and 'at the same time, Greece's, while the country also has to reduce its defence budget by up to 30%' because of the economic crisis (Kammenos 2017).

In the absence of new enabling legislation, Greece must comply with applicable EU rules and provisions. For example, in the dual-use industry, if government aid investment is used for both economic and military purposes, and no separate accounts are kept, the European Commission will still scrutinise the economic activity for overcompensation under article 107 TFEU (Jensen 2013), as the European Court of Justice (2013) ruled in case C-246/12P – Ellinika Nafpigeia *v.* Commission in 2013. Meanwhile, Greece should be actively engaged in the effort to establish the common European defence. Within this context, Greece should request that the European Commission support the country's industry through adequate funding from European Defence Fund, or, where possible, form the EU budget (EC 2016, 5) for research, and defence capabilities development.

The Greek government should also examine the issue of a sustainable HDIB in a comprehensive manner that encompasses the support of the several small and medium-sized (SMEs) private defence enterprises. Mergers and synergies to face the competition from abroad should be encouraged. In addition to this, re-structuring, re-capitalisation and modernisation of the corresponding state-owned or state-controlled companies is deemed to be of importance.

As regards the latter, it is the author's view that the Greek government, after undertaking a study on a firm-by-firm basis, should develop strategic conversion plans involving organisational restructuring, gradual privatisation and a focused conversion policy. The piecemeal 'privatisation' and/or outright liquidation of these firms will only provide a temporary solution (i.e., a short-term reduction of budgetary deficits that also goes hand-in-hand with a commensurate increase in national unemployment levels). Such a solution is inimical to the long-term interests of Greek national security. An alternative route involves a new form of ownership, recapitalisation and management of major defence enterprises in Greece so that they may participate in multi-national programmes or privatisation, and a focused conversion, in a "way that will safeguard both Greek national security and economic interests" (Dokos and Kollias 2013).

Research concluded suggests that the in-country highly qualified scientific potential is indeed supportive to such initiatives on purely business grounds. Additionally, initiatives, such as the conversion of the HDIB into dual-use or multi-product industry, would keep industrial production lines open and enable domestic producers to remain in the market for the benefit of HNDF sustainment (Xenokostas 2015). Greek shipyards are very well suited for this role (Grevatt 2016), as they seem to have a comparative advantage with regard to building ferries and cruise ships, providing a competitive ship-repair zone (Soumeli 2000) while also simultaneously supporting the Hellenic Fleet.

In this era of economic crisis, Greek contractors have struggled to ensure entering new markets abroad, even though they have the technological foundations and the necessary workforce skills. Therefore, the Greek government should support their efforts to access new markets. Events, such as the annual Association of the United States Army (AUSA) arms exhibition in Washington, D.C. or elsewhere, provide fora for Greek defence equipment enterprises and the Greek government should actively support their presence at such venues. Similarly, procurement of new military equipment or modernisation of existing weapons systems should involve co-production and military technology transfer arrangements with foreign defence firms (a perennial tactic for Turkey's military procurement programmes), rather than the loosely defined and often unproductive economic offset arrangements of the past.

The HDIB can benefit from the formal renegotiation of older military assistance agreements with other countries, e.g., the defence economic/industrial cooperation agreements (DECA/DIECA 1997) with the U.S. In this manner, the HNDF can enjoy better and long-term benefits through domestically produced advanced military technology. A similar agreement can be pursued with Germany with the unsettled Greek WW II reparation claims at its core (e.g., paralleling the Israeli approach for the acquisition of modern German-built and financed submarines), (Nuclear Threat Initiative 2015; *The Economist* 2016b).

It is the author's view that in order to have a small yet viable HDIB, project-prioritisation and the call for integrated solutions are of paramount importance so as to facilitate sustainability, in particular during periods of economic downturns. This should cover a wide and diverse market range from joint projects, upgrades and maintenance to the development of "smart" solutions for countering rivalries with advance technologies through spending less money. Certain HDIB industrial concerns can continue to focus on heavy industrial production designed to sustain the HNDF needs, e.g., production of ammunition and other consumables, maintenance and retrofit of armoured vehicles, warship and combat aircraft upgrades, etc. Other HDIB concerns need to focus on cutting edge technologies and more closely and *institutionally* collaborate with human resources available at Greek academic institutions and the indigenous R&D and production elements of the HNDF. For example, the rapidly evolving technologies of computer controlled three dimensional (3-D) printing can provide the basis for cost-effective but limited production runs for manufacturing essential parts that can keep major HNDF combat systems operational, thus foregoing the importation of expensive spare parts. There needs to be a renewed emphasis on defence electronics and a rejection of the "we cannot produce anything" syndrome (i.e., the reverse engineering that has been practised for a long time by Israeli and Turkish defence firms is an example). Greece possesses both the human capital and the technical resources needed for

the development and operational deployment of unmanned aerial and sea vehicles. In view of the protracted economic and fiscal crisis, it is self-evident that the use of UAVs for tactical and strategic area reconnaissance is a more cost-effective method than the routine and continuous employment of very expensive and valuable manned platforms that must be preserved for more critical military missions and tasks.

Integrated solutions should engage all key-stakeholders. For example, the concept of national security is often -and erroneously- viewed as 'the job' of the HNDF alone. This provides an unbalanced frame of reference and, unlike Israel and Turkey, does not involve essential actors. A small but viable HDIB requires technology and skilled manpower. In turn, this mandates the concrete involvement of Greek institutions of higher education in conjunction with the HNDF and domestic defence firms.

In the past, Greek civilian institutions of higher education were largely reluctant to become involved in defence-related research or accept NATO research grants, despite the existence of such programmes (Fenstad 2009, 491, 494). Such steps were taken long ago in Israel (1950s) and, more recently, in Turkey. HMOD needs to develop initiatives and connect HDIB with higher educational institutions in Greece and abroad and NATO (2015), as well for HNDF benefit. Since the [Metsovio] National Technical University of Athens faculty and students were able to develop appropriate and predictive software for automotive traffic patterns for Athens metropolitan area well in advance of parallel smart phone applications or 'apps,' (NTUA 2017), such institutions can easily provide software solutions for military technology applications (e.g., command, control, communications, computers and intelligence or C4I), and for information and cyberspace warfare. They can also engage in technological dual-use leaps, e.g., composite materials and 3-D printing (Song, 2012; Tadjdeh, 2014; Walsh 2015) for the domestic production of essential weapons systems components and spare parts.

It is a well-known fact that the rapid development of high technology firms and output within the Israeli economy has been and still is the result of the synergistic effect between the Israeli Defence Force (IDF), the Israeli DIB, and Israel's institutions of higher education. The collaboration of young Israelis while serving at the IDF often formed the basis of high technology ventures that became mutually supportive, while continuing to operate in Israel (*The Economist* 2016c). This approach, which is well known as the national innovation system concept (Lundvall 2007; Freeman 2002), could be used by Greek Authorities as an effective paradigm.

8. Concluding Remarks

This paper concludes that the HDIB suffers from the absence of a long-term national strategy for enabling its evolutionary and viable development, and the lack of an appropriate legal protective framework in an era of reduced Greek military spending for arms acquisition programmes.

Furthermore, it should be stated that the HDIB forms an integral part of the Greek national defence framework, and serves long-term national security interests. Israel and Turkey have set the example and created robust DIBs which benefit both their countries' economies through high exports, and the sustainment of their respective national armed forces. The Greek government, on national security grounds, should follow their example and negotiate appropriate paths within the European Union. The ownership and management structure for major defence industrial enterprises in Greece is in dire need of fundamental change and these enterprises must be treated as a genuine and integral part of the national defence framework. Such a change should be accompanied by much needed re-capitalisation, modernisation, and fundamental improvements in efficiency and productivity. The Greek government needs to develop a strategy that will enable the development of the HDIB and should use such a plan and direction to ensure that Greece's limited military spending promotes the development of its domestic arms production.

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ENDOGENISING TOTAL FACTOR PRODUCTIVITY: THE FOREIGN DIRECT INVESTMENT CHANNEL IN THE CASE OF BULGARIA (2004-2013)

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Abstract
This paper estimates the contribution of Foreign Direct Investment (FDI) to the Total Factor Productivity (TFP) of Bulgaria for the period 2004-2013. As predicted by theory, a positive relationship between TFP and FDI is documented. The standard Ramsey (optimal) growth model, augmented through the FDI channel is used to compare the rate of convergence to an identical setup without FDI. Convergence simulations prove that ignoring the implications of this model leads to a distorted view of the growth path of the economy. The results of the study can serve as justification for developing governmental strategies to attract FDI inflows.

JEL Classification: E13, E17, E22, O33
Key Words: Simulation, Endogenous Growth, TFP, FDI

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1. Introduction

Foreign direct investment (FDI) is an inevitable consequence of an open-market economy and its effect on economic growth has been one of the most noticeable and discussed topics in the past several decades. FDI is a bridge between economies and it is considered a tool for transferring skills, technology, and knowledge between countries. The impact of FDI is expected to be growth-enhancing through the introduction and incorporation of new inputs of technologies, which influence both labour and physical capital efficiency. Some of the documented effects of FDI are unemployment reduction, improved population welfare, productivity growth (TFP) and accelerated economic growth.

A number of studies associate increase in Total Factor Productivity (TFP) with increase in FDI; however, an unconditionally positive relationship between FDI and TFP has not yet been proven. Some studies provide proof that the impact of FDI is indeed positive, but it seems that results depend on the level of development and openness of the economy. Because FDI is seen as a key channel for transferring more advanced organisational forms and technologies in industrialised and developing countries (Isaksson, 2007), evidence documenting the positive impact of FDI on TFP would provide justification for the introduction of policies and the development of governmental strategies to attract FDI inflows.

Bulgaria is a good case for exploring this subject as the country is a transitional economy. Based on the level of country development, it can be supported that the country needs to find ways of accumulating capital and knowledge. Proving that FDI is a channel satisfying these needs will encourage expansion in this direction. Furthermore, Bulgarian studies and empirical experiments are scarce, so an important objective of this paper is to provide a theoretical alternative for both policymakers and future academic researchers.

This research provides a brief review of existing literature on FDI, TFP and knowledge accumulation and applies the theory for the Bulgarian economy, proving the positive link between the variables. Furthermore, the measured impact is incorporated in simulations predicting future development of the economy. The remainder of the paper is organised as follows: in Section 2, we will look at the existing literature on the connection between FDI and TFP growth. We will include a brief analysis of the results of the studies and comment on the differences between them. Section 3 describes the theoretical framework and the structure of the model and Section 4 describes the estimation strategy and data. Section 5 presents data analysis, econometric results and concerns. Section 6 will be used for the formulation of predictions based on Section 5 results and Section 7 is reserved for conclusions.

2. Literature Review

We will focus on articles and studies that describe the relationship between TFP and FDI. Even though this connection can be studied at a micro level or spill-over effects of FDI within a certain sector, we will focus on the aggregate level. Few studies so far have examined the impact of FDI on TFP at the macro level with predominantly positive results; however, there are several authors who argue that variables might be negatively related. We will discuss both of these options and proceed to examine the Bulgarian case.

TFP has long been perceived as an exogenous variable that in the standard output model. However, this is not observed in open market economies, as stated by Romer (1990). In his study of TFP endogeneity, he finds that integration can increase growth, since integration into world markets means openness and possibility to invest and receive investments from abroad. An inference that can be made from this finding is that FDI, as the channel of moving funds between economies, would also lead to increased productivity growth, similarly to efficiency improvement due to the presence of trade.

Arısoy (2012) takes a look at the effect of FDI on both TFP and economic growth for Turkey for the period 1960–2005. His empirical results, based on regressing TFP and GDP on FDI only, show that FDI has a positive impact on both, through technological spill-over and capital accumulation. Pessoa (2005) receives positive results for a panel of OECD countries and concludes that FDI has a positive impact on a host country's TFP. He attributes this to the fact that FDI is a channel through which technologies are transferred internationally. In addition, Woo (2009) shows that for the period 1970-2000, in a large sample of countries, FDI had positive effect on TFP growth.

Positive linkages between TFP and FDI vary in nature, particularly for developing and transitional economies. For example, Zhang (2002) studies the contribution of FDI to productivity growth in cross-region analysis in China for the 1984 to 1997 period, and finds a bidirectional causal linkage between FDI and TFP. The results of the study suggest that China's growth is largely due to rapid expansion of physical investment in fixed assets from FDI and not so much to technology transfer. This is a result of inefficiency and lack of capability to assimilate technology. Nevertheless, FDI invested in more labour-intensive sectors did have positive effect on labour productivity.

Even when a positive link is shown between variables, developed countries seem to experience the effects of FDI in a different manner than developing ones. In Keller and Yeaple's (2003) study of plants in the US (1987-1996), the FDI effect was more pronounced in more technologically oriented sectors because of better communication with international companies. More than 10% of the increase in productivity growth is attributed to FDI spill-over effects. FDI effect seems to get more concrete the more organised and advanced an economy is.

Likewise, the positive relationship authors perceive can be country specific. Mello (1999) estimates the impact of FDI on capital accumulation, output and TFP growth and comes to the conclusion that FDI influence is country-specific due to factors that are unobservable in time series analysis. The impact of FDI depends on whether the receiving country is a leader or a laggard, since effects of technological transfer are lower in a country that is developing. These observations are based on a time-series panel data for a sample of OECD and non-OECD countries in the period 1970-1990.

The absence of direct positive effect of FDI on TFP is usually explained on the grounds of low absorption efficiency of the economy, thus making it impossible for the country to benefit from any increase in human capital and technology (Borensztein *et al.,* 1998). Furthermore, the levels of economic freedom, openness of the economy and establishment of efficient financial environment also play an important role. For example, a negative relationship between FDI and TFP was present in a study by Sadik and Bolbol (2001). For several developing Arab countries (Egypt, Jordan, Morocco, Oman, Saudi Arabia and Tunisia), they investigate whether FDI affects TFP through technology spill-over effects to find that FDI actually had a "very significant and negative effect" on most countries included in the study. However, these authors clearly establish that the results might be caused by inefficient governmental policies and institutions, lack of investment efficiency and inadequate appreciation and availability of technological innovation.

Given the inconsistencies in literature, a model is being proposed based on the idea that FDI has an effect on TFP; however, additional variables that could influence TFP will not be excluded. So far, most studies have incorporated additional variables expected to have positive influence on TFP; nevertheless, we have decided to include aspects of the economy that could also have negative effect on TFP.

3. Model Setup

In neoclassical growth models (Solow, 1956), technological progress is modelled as being determined outside of the model, in the absence of exogenously growing TFP, while growth monotonically decreases and asymptotically goes to zero, as the economy converges to the steady state. Modern growth theory (Romer, 1990) tries to explain how progress arises and, therefore, can be enhanced - in other words, it tries to endogenise the variable. For that purpose, the neoclassical model is expanded to incorporate explanations for knowledge generation and accumulation.

Bulgaria is a perfect case for applying and studying the modern view over technological change, as the country had to go through a process of knowledge and capital accumulation in order to come out of the crisis in the 1990s. After the disbandment of the communist block and the dissolution of the "iron curtain", Bulgaria faced the challenge of acquiring, developing and accumulating modern

knowledge and capital. Like many post-communist countries, a combination of economic failures, lack of understanding of market economy principles and selfish practices of political leaders led the country to hyperinflation in 1997. Economic conditions did not start significantly improving until the early 2000s. The country was forced to open its market to western influence and FDI was one of the channels to achieve this.

FDI was expected to expand the productivity of the country through labour force training, skill acquisition, and introduction of alternative management practices and organisational arrangements. These were expected to be implemented through cooperation with foreign companies and acceptance of foreign investment, which means that we expected the growing FDI into the country to have a positive effect on productivity. This effect has been proven for some industrialised countries that have better data, but it needs to be further proven for developing countries, such as Bulgaria. The country needs to promote innovation and progress, and demonstrating that FDI is, in fact, a tool for achieving this goal, could further promote practices enhancing international cooperation.

Because most theories suggest that FDI has a spill-over effect on technological change, we will take TFP as a dependent variable indicating technological progress. TFP does not only reflect technological improvement, but also increase in a country's knowledge and efficiency. The idea of learning-by-doing and its economic implications was developed and expanded by Arrow (1962), who incorporated the notion that knowledge changes lead to shifts in the production function. In the model, every new machine or any capital accumulated is capable of changing the environment while learning to use this capital is taking place. This model, however, is oversimplified as it does not include additional variables that influence the learning process. Nevertheless, we will base our assumptions and model on the idea that learning reflects increase in TFP, and occurs as a side effect of the production of new capital.

The model used in calculating the influence of FDI and proving the assumptions presented above on the effect of FDI on TFP is based on aforementioned idea of knowledge accumulation through learning-by-doing. In this model an increase of TFP or increase of knowledge, is a function of the increase in capital. Similarly it will here be assumed that TFP is a function of FDI:

$$A_t = B_t F_t^{\gamma} e^{\varepsilon_t} A_t = B_t F_t^{\gamma} e^{\varepsilon_t} \quad (1)$$

or

$$lnA_t = lnB_t + \gamma lnF_t + \varepsilon_t, lnA_t = lnB_t + \gamma lnF_t + \varepsilon_t, \quad (2)$$

where A is TFP in stationary form (as discussed in section 5), B is a shifting parameter representing additional variables influencing TFP, F is FDI stock and γ is a parameter between 0 and 1 (based on the natural phenomenon of diminishing returns to rival production factors). An important point that needs to be added is that for the purposes of this model FDI considered an exogenous variable. We have regarded FDI as exogenous, simply because Bulgaria is a small open economy that does not leave an important imprint on the world's economy. While it is true that FDI's endogeneity is an important issue that needs further exploration, research into it is not the primary purpose of this study.

What we have decided to employ for the purpose of this study is quarterly data of FDI stock in millions of Bulgarian currency in real terms (2010 prices). We preferred stock values due to the existing delay in the effect of any investment on production due to the time needed to build physical capital, teach workers to use new equipment or incorporate a new organisation structure. As FDI flows can rarely be incorporated into the existing system at the time they have been received, we consider stock to be a better measure of FDI impact on TFP (Arisoy, 2012). In the model of this paper, and due to data limitations (no distinction can be made between investment *vs.* non-investment), we assume all FDI is structural. Thus, our results are to be taken as an upper bound effect on TFP.

The effect of FDI is represented by γ in the model presented and we expect to find it to be positive, as we expect it to have enhancing properties. The shifting parameter is included in the model, as there are a number of variables that could enhance or decrease the influence of FDI. In the econometric analysis, the regression for this equation would take the following form:

$$ln\widehat{A_t} = a_0 + b_1 lnF_t + b_2 X_t + b_3 lnY_t + b_4 lnZ_t + \varepsilon_t \quad (3)$$

where $b_1 = \gamma$, F is FDI stock and X, Y, Z are control variables that lie in B and impact the effects of FDI on TFP. All variables are de-trended following the methods in Section 5.

The additional variables we have decided to include into our regression are Government spending on Health, Education and Social protection and spending for Research and Development (R&D)[1]. We have decided to incorporate these variables because of their probable effects on the productivity of the country. Government spending on health, education and R&D are straight forward and are expected to have positive effect on TFP, since they are intended to make the labour force more productive.

1. Due to its small size, government spending on R&D always needs to be used cautiously in regressions. Nevertheless, it varies sufficiently for the figure to be individually significant in the regression. In addition, the F-test for joint significance cannot reject the joint importance of R&D and the remaining right-hand-side variables. Dropping R&D could bias the FDI coefficient estimated downward.

Expenditure for social protection is expected to have a negative effect on TFP, since it provides an excuse for people to be absent from work, thus decreasing productivity. Such expenditures cover sickness / healthcare benefits (paid sick leave, medical care and the provision of medication), disability benefits, old-age benefits, survivors' benefits, family and children benefits (pregnancy, childbirth, childbearing and caring for dependent family members), unemployment benefits, housing benefits and others. Unemployment benefits are a relatively small part of expenditure on social protection. A much larger share represents social pensions, widow's benefits, invalidity pensions, children benefits, in-kind benefits (energy subsidies, timber, electricity vouchers, food stamps, food packages, etc.). For example a handicapped person's pension is for life, and it is much more generous than the unemployment payout, which makes it more attractive for non-workers and could lead to some embezzlement schemes.

4. Data

Measuring TFP could become problematic if incorrect data and methods are used. Therefore, we are going to replicate the method already established by Ganev (2005) for measuring Bulgarian TFP. The period he covered was 1991-2003, using annual data; however, in this study, we are going to examine quarterly data from the period 2004-2013, which was selected because its start corresponds with the increase in structural FDI in Bulgaria. Given that data is quarterly, we decided to take an earlier end point, in order to avoid problems with later data revisions.

As we have established, Total Factor Productivity represents technological change and productivity. It also represents an additional factor that influences GDP growth regardless of relative change in capital and labour. In this study, TFP is calculated using the Cobb-Douglas production function:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} \tag{4}$$

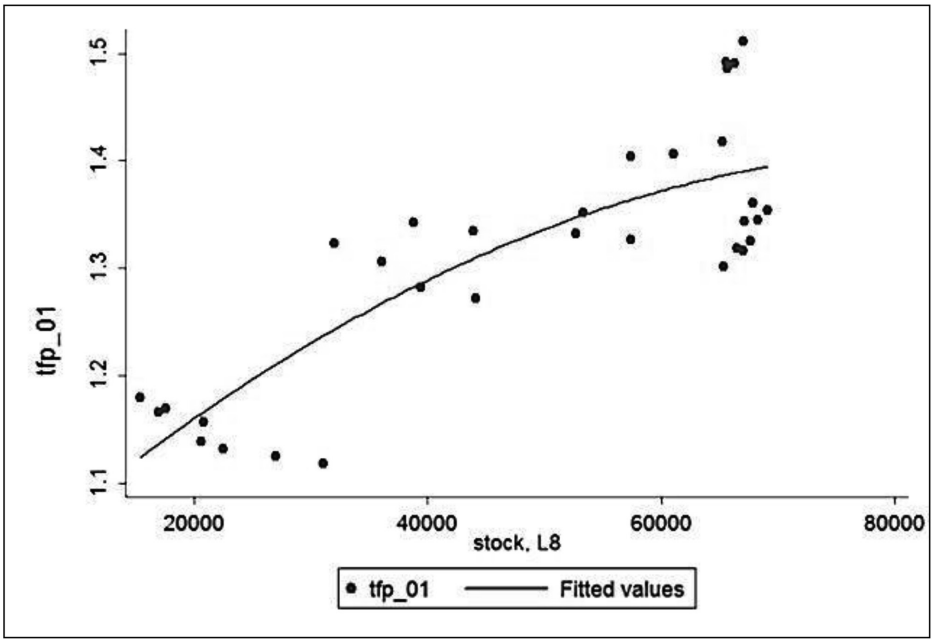
In equation (4), Y_t represents real GDP for a specific time t, A_t is TFP, and L_t and K_t are labour and capital, respectively. The symbols α and β represent output elasticity of capital and labour, respectively, and α + β = 1, since we assume constant return to scale. A_t is current year development level and is found as a residual from the equation, L_t is measured as the total number of hours worked during the current year and K_t is the real value of physical capital in the current year.

Data on labour and GDP are collected by the National Statistical Institute in Bulgaria. Capital is calculated using the perpetual inventory method (Appendix 1) and α is found by calculating the ratio of compensation of employees and net mixed income to GDP. All data are seasonally adjusted and in real terms (2010 prices) – the process of adjustment can be found in Appendix 2. Data on FDI stock are collected by the Bulgarian National Bank and represents only the stock of inward FDI for the period under study.

Values for Health, Education, Social welfare, and R&D expenditure are calculated using Eurostat data. In the original dataset, the values of variables were presented as annual GDP percentage rates; however, as we need quarterly information (unfortunately not available for either of the variables), we have calculated a time series for each variable using the quarterly GDP variable. Because GDP is, in fact, in millions of Bulgarian currency, seasonally adjusted and in real terms, the 4 variables are also presented in the same manner.

When creating a scatter plot of TFP and FDI stock values in Bulgaria for the period 2004-2013 (TFP values on the vertical axis and FDI values on the horizontal one) a negative relationship for the first two years is can be observed. For the next 8 years a boom in TFP growth is present, although FDI barely increased. A reason for this might be possibly delayed FDI effects on TFP. In fact, if we incorporate the 8th lag of FDI stock in the same scatter plot (equal to a two-year gap), we receive the graph in Figure 1, which supports the claims of a positive relationship between variables.

Figure 1. TFP-FDI scatter plot[3]



3. Data source - BNB (2014), authors' calculations.

The decision to use the 8th lag is further reinforced by the idea that any investment needs time to produce results. There are several studies on the time-to-build and time-to-plan theories, the most prominent one being that by Kydland and Prescott (1982). Although we are aware that they were not the first to make this observation, we chose their reference because these authors were the first to operationalise the mechanism in a general dynamic equilibrium context. These authors found that there was no evidence that capital goods could be built faster if more money was invested, which means that the time needed for building an investment is independent of its size. Mayer (1960) came to the conclusion that the time to plan and finish a project was 21 months. Those studies, even though supporting the fact that time is needed for an investment to start paying off, focus on how policies could be employed to strengthen production in an economy. In fact, the time for finishing a project is not specific and depends on the economy and the level of the currently available technology.

In the case of Bulgaria, the lag chosen is based on reasons connected with the bureaucracy of Bulgaria. Pre-building preparations and building permits could take up to 6 or 7 months, according to several private companies in the construction industry. Legislation on Public Procurement / Public Procurement Act could prolong the process by 3 to 6 months if purchases are worth more than BGN 100 000. Furthermore, Bulgaria is still a developing country, so, even if the physical capital is upgraded and new technology introduced, human capital still needs to be educated. Having Mayer's calculation and these conditions in mind, we have decided to employ a two year lag of the FDI effect on TFP.

5. Empirical results

Our first step is to check the stationarity of the series as many macroeconomic series may contain a unit root due to using the Augmented Dickey–Fuller unit-root test. The test is based on the null hypothesis that a unit root exists in the series and, in order to continue with regressing the variables, we need to make the series stationary. We conduct ADF, assuming the existence of trend and drift and lag of 4, because of the serial correlation present. Results can be seen in Table 2.

All variables show unit roots; however, we take into consideration the differences in variables and simply readjust the test. For TFP, results show the existence of a trend, but no drift. Differencing does not solve the problem, so we employ the Hodrick–Prescott filter in order to get rid of the trend. Given the number of right-hand-side variables in the regression, and a sample of 40 observations, we cannot get sensible estimates when more than one lag is included. In addition, the HP filter approach is also chosen to make results comparable to other papers in the literature. Readjusting the ADF test and running it again results in stationarity of the variable.

For FDI, we have run ADF without trend, as it appears insignificant in the initial test, having received no unit root. The Research and Development, Government expenditure for Education and Government Protection expenditure variables show unit roots brought to stationarity using differencing. For Government spending on Health, differencing does not solve the problem, and, therefore, we employ the HP filter once again, which makes the series stationary.

Table 1. Regression of TFP on FDI with 8th lag of FDI

Variable	Coefficient	Std. Err	t	P>|t|	95% Conf. Indterval	
L8.lnFDI	.147	.0179	0.000	.111	.184	.147
_cons	-1.307	.192	0.000	-1.7	-.916	-1.308
Number of observations =32		R-squared=0.692		Adj. R-squared =0.6817		

Table 2. Augmented Dickey-Fuller Test with 4 lags, trend and a constant

Variable	Mackinnon p-value	Trend p-value	Const p-value
lnTFP	0.2856	0.011	0.155
lnFDI	0.1392	0.455	0.003
lnR&D	0.2439	0.012	0.011
lnHealth	0.1501	0.034	0.007
lnEducation	0.6433	0.619	0.065
lnSocialWelfare	0.7569	0.179	0.098

We can start by running a regression of the pure model, as stated in equation (2). In order to receive meaningful results we take into consideration the FDI lag. Results of the regression of TFP on FDI (8th lag of FDI) can be seen in Table 1. Although we receive very promising results, supporting the claims discussed in the previous section, the regression is not full as it disregards most of the additional variables that could influence TFP.

In order to correct this problem we need to run the regression of equation (3), which takes this form:

$$lnTFP_t = a_0 + b_1 lnFDI_{t-8} + b_2 lnRD_t + b_3 lnHealth_t + b_4 lnEducation_t + b_5 lnSocProt_t + \varepsilon_t, \quad (5)$$

with *lnTFP* and *lnHealth* detrended through the HP filter and *lnRD*, *lnEducation* and *lnSocProt* differenced. In our regressions we incorporate the 8th lag of FDI, as already explained in the previous section. Results of the regression are presented in Table 3.

Table 3. Regression of expanded model including control variables

Variable	Coefficient	Std. Err	t	P>|t|	95% Conf. Interval	
L8.lnFDI	0.03	0.02	1.97	0.059	-0.0014	0.069
D1.lnr_d	-0.09	0.25	-0.36	0.718	-0.606	.423
Detr_lnhealth	.325	.135	2.41	0.023	0.05	0.623
D1.lnedu	-0.22	0.19	-1.15	0.262	-0.627	0.172
D1.lnprot	0.607	0.244	2.49	0.019	0.106	1.108
_cons	-0.371	0.185	-2.01	0.055	-0.751	0.007
Number of observations = 32			R-squared = 0.4846		Adj. R-squared = 0.3855	

It seems that government spending on social welfare, which is provided to households and individuals in need, actually has strong positive effect on TFP, which is counter-intuitive. An explanation for this might be that because the government provides funds to those unable to produce, their families have the freedom to focus on their work and be more productive. The research and development and educational expenditures appear insignificant and, if excluded from the regression, an Adjusted R-squared of 0.4004, significant FDI and coefficient of FDI of 0.0359764 are received. This coefficient is fairly low, but shows moderate correlation. Because of the low Adjusted R-squared, the model signals the existence of internal problems, most probably derived from the insufficient data. Nevertheless, we will accept the results since, even though they are close to 0, they are positive and establish a low threshold for the application of the model in the next section. The upper threshold of the model would be the pure regression of TFP on FDI, which we established in the beginning of the section, the result being 0.15[2]. Both results can be used to establish the effects of the model on the economy, and provide simulation evidence; if the implications of such evidence are ignored, this could lead to a distorted view of the growth path of the economy.

6. Simulations for Bulgaria

So far we have considered a model which shows positive dependency between TFP and FDI. However, we need to take our focus back and see the bigger picture when it comes to TFP and output. We have mentioned the Solow model and we have extensively discussed the Cobb-Douglass production function, so we cannot ignore one of their main applications, namely, finding the steady state of an economy. In this class of exogenous growth without exogenous exponential TFP growth, growth is monotonically decreasing along the transition path and approaches zero as the economy converges to its steady-state. Because TFP plays an essential part in the production function, we need to reconsider the model in its context.

In this section, we use a standard Ramsey (optimal) growth model, augmented using the FDI model described before, to compare the rate of convergence to an identical setup without FDI. We incorporate the TFP/FDI model in order to see whether an economy taking into consideration FDI would reach its steady state faster or more slowly. Results will show that there will be differences in terms of the time needed to reach the steady state in the presence of FDI augmentation and due to ignoring the FDI channel. In our simulation we employ optimisation techniques with respect to consumption and capital accumulation.

2. We consider the estimate as an upper bound for the effect; therefore, results are to be taken with "a grain of salt."

First, let us explain the optimisation methodology. The representative agent maximises total discounted utility, which is a function of consumption. In other words, the agent needs to select the optimal path of consumption over time or, alternatively, allocate output between consumption and capital accumulation (investment) over time. An equation stating these facts is as follows:

$$\max_{\{c_t\}} \sum_{t=0}^{\infty} b^t U\ (c_t), \tag{6}$$

where, $\mathrm{U}\ (c_t)$ is the instantaneous utility function and b is a discount factor such that $0<b<1$, as human beings consider consumption more valuable at early times than consumption further in the future.

The constraint to equation (6) is equation (7) depicting the aggregate consumption in the economy, which depends on the undepreciated capital stock remaining after the current period, the output produced in period t from capital per worker using the technology for the period and the future capital stock:

$$c_t = (1-\delta)k_t + Ak_t^{\alpha} - k_{t+1} \tag{7}$$

The results of equation (6) have already been expressed in the Euler equation, which is a fundamental basis in intertemporal optimisation problems with dynamic constraints:

$$\frac{\mathrm{U}'(c_t)}{\mathrm{bU}'(c_{t+1})} = \frac{\alpha A k_{t+1}^{\alpha-1}+1-\delta}{1} \tag{8}$$

We can interpret equation (8) as the connection between intertemporal rate of substitution of consumption and marginal rate of transformation of capital. At steady state, consumption levels in period t and period $t+1$ must be equal and, thus, utility throughout the periods must be constant:

$$1/b = \alpha A k_{t+1}^{\alpha-1} + 1 - \delta, \tag{9}$$

where $\alpha A k_{t+1}^{\alpha-1} - \delta$ represents the real return on investment after depreciation. Overall, the idea behind both equations (8) and (9) is that, in order for people to choose to invest, they need to receive an additional return or compensation in the next period in order for the utility to remain stable.

In connection to equation (8), we need to take into consideration the empirical fact for balanced growth, namely, that in order to have every component growing at the same rate, the utility function of consumption should be restricted to the CES (constant elasticity of substitution) form or:

$$U(c_t) = \frac{c_t^{1-\sigma}-1}{1-\sigma}, \tag{10}$$

and

$$U'(c_t) = c_t^{-\sigma}. \tag{11}$$

From here we can restate equation (8) to be:

$$c_{t+1}/c_t = [b(\alpha A k_{t+1}^{\alpha-1} + 1 - \delta)]^{1/\sigma}, \tag{12}$$

and we can easily express consumption in one period through consumption in the adjacent one. The intertemporal elasticity of substitution or 1/σ depends on how responsive the growth rate of consumption is to changes in real interest rate.

Finally, the so-called Transversality condition (TVC) has to be imposed. It is a boundary condition that rules out explosive paths, and guarantees stability of equilibrium paths for capital, consumption, investment and output. It necessitates that, at the end of the optimisation horizon, the discounted value of capital is zero.

$$\lim_{t\to\infty} b^t\, U'(c_t) k_{t+1} = 0 \tag{13}$$

In the long run we are expected to encounter the steady state where there is constant capital stock. This means that from equation (9) we can omit period identifications and rearrange the equation in order to receive the steady state capital value:

$$k^* = \left[\frac{\frac{1}{b}+\delta-1}{\alpha A}\right]^{\frac{1}{\alpha-1}}. \tag{14}$$

We assume that k_0 is given as a percentage of the steady state – we will assume that the economy starts at 10% of the steady state. We know what our optimal results are, so we are interested in the point of time at which we are going to reach these optimal results. We translate all of our findings and equations into a simulation that is going to show us at what point the Bulgarian economy is going to reach its steady state using he optimisation method for consumption. The simulation using MATLAB2015 and can be made available upon request.

In order to incorporate the model discussed in the previous sections we are going to assume that the capital of FDI is included in the overall capital and the problem is that economists are understating its influence on productivity and, therefore, do not account for it. This means that we have to restate our production function as:

$$y_t = Bk_t^{\alpha+\gamma}, \tag{15}$$

since

$$A = Bk_t^{\gamma} \tag{16}$$

The stationary parameters used are stated in Table 4, where *b* has been calculated on the basis of capital return equal to $\alpha A k_{t+1}^{\alpha-1} = 1\%$ and the value for σ has been based on estimates of Hansen and Singleton (1983) and chosen to reflect the general tendencies of Bulgaria and the risk aversion of the population. TFP and α are taken as averages from our previous findings and γ_1 and γ_2 are results from our econometric analysis. Nevertheless, the model can be easily adapted to simulate different economic variables. We also need to address the fact that B is calculated on the basis of *k**, although it is present in the model including FDI. We have decided to do so because, in both simulations, the economy is converging towards the same steady state, but at different rates, which is what we are interested in.

Table 4. Parameters of simulation

A	δ	α	b	γ_1	γ_2	σ
1.5	0.05	0.55	0.95	0.03	0.15	1.5

Figure 2 and Figure 3 are a graphical representation of results. Both graphs show that the time needed to reach the steady state, considering the effects of FDI, is longer, which means that, by ignoring it, the standard Ramsey model is underestimating the actual time needed for the economy to converge to the steady state, no matter what the value of γ might be. The reason for this increase in time lies in the increased marginal product of capital when we consider the effects of FDI. This means that reinvestments and updates are necessary after a longer period, or smaller quantities, so as to increase the time of convergence. This result is also consistent with the delay observed before an investment becomes productive.

Figure 2. Application of the model: simulation with γ_1

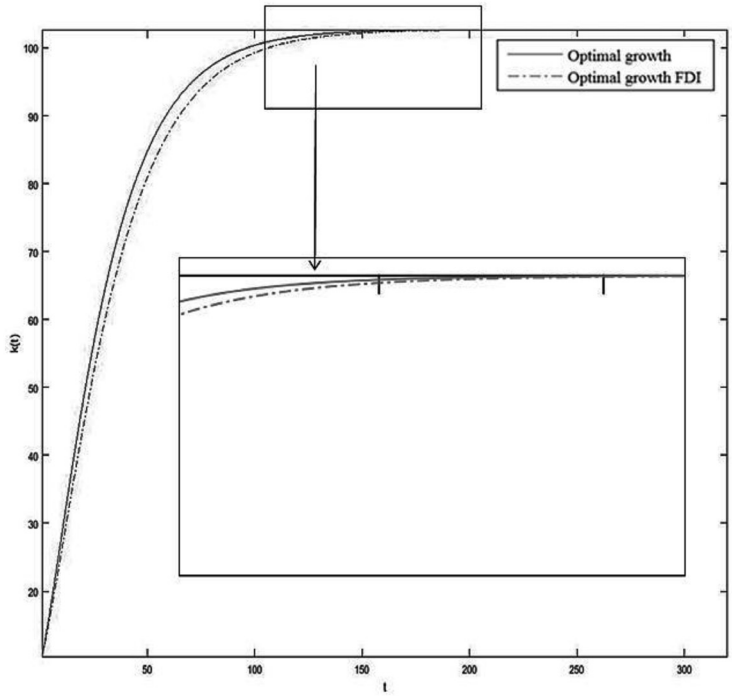
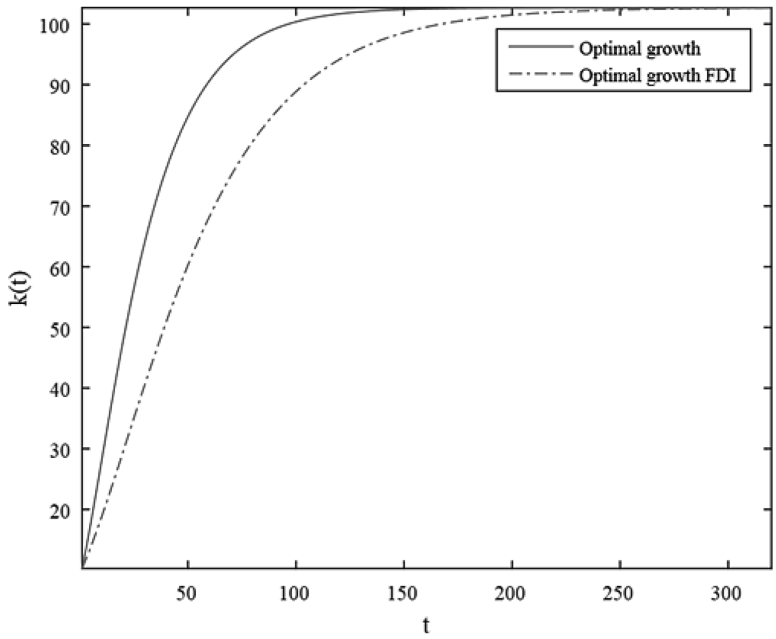


Figure 3. Application of the model: simulation with γ_2



7. Summary and Conclusion

FDI is considered one of the levers that push an economy forward by increasing the productivity of a country. Relevant literature, however, still shows results, which, in some cases, indicate FDI actually has negative influence on TFP. This study argues that differences come from underspecified models, as well as econometric estimation problems, and aims at providing a stepping stone for further development of policies and programmes to attract FDI. In order to solve such problems, we analyse Bulgarian data for the period 2004-2013, employing a model that assumes that TFP or increase in knowledge is a function of new capital or FDI (learning-by-doing approach).

In our study, we have provided a model that not only studies the relationship between FDI and TFP, but also incorporates additional variables in empirical results, which might influence the aforementioned relationship. By doing so, we find evidence that FDI has a positive influence on TFP in the way that the model proposes. We find that, in fact, FDI has a lagged effect on TFP, which could easily change the way policy makers see foreign investments and their effects.

We come to the conclusion that FDI influences TFP in a positive way, but not in a strong manner. We can speculate on what the reason for this could be and the most apparent one is that Bulgaria is still a developing country and does not yet have the proper channels so as to take full advantage of incoming investments. The fact that not every industry in the country receives investments from abroad might limit the actual inflow, which could further influence empirical results and decrease the influence on TFP. Of course, we cannot ignore the fact that data available for research are limited so empirical results might incorporate consequences due to lack of information.

We conclude our study by applying the augmenting qualities of FDI to an optimal growth model, in order to find the effects on the growth path of the economy along the way to convergence to its steady state. Results unequivocally show that no matter what the value of the effect of FDI on TFP may be, the rate of convergence, in comparison to that when FDI is not accounted for, appears longer. Thus we reach the conclusion that, by ignoring FDI effects, the standard optimal growth model distorts the view of the economy and presents an unrealistic time frame.

By using these findings, the reader should be able to better understand the important role of Foreign Direct Investment for productivity in Bulgaria. By revealing the relationship between FDI and TFP, policy makers, politicians, as well as government officials and economists should be able to re-evaluate their positions regarding capital from abroad. We hope that findings similar to ours would encourage future studies on the topic, as well as positive development of the Bulgarian international standing regarding FDI. We firmly believe that facilitating the ease of assimilation of foreign capital would boost the economy and would positively influence future improvement of the country.

Appendix 1: Capital

The Gross Domestic Product published by the National Statistical Institute (NSI) has been used as a measure of Y, and the hours worked by the persons employed, which are also published by (NSI), as a measure of L. Data on K are not published and, therefore, it is additionally calculated through the 'perpetual inventory method' or:

$$K_t = I_t + (1 - \delta)K_{t-1} \quad (1)$$

In this equation, I_t represents total current investment and δ the depreciation rate. A problem occurs in the calculation of the initial capital - K_0. The method used for calculating initial capital is described in equation (2) (Hall *et al.*, 1999) - initial capital equals the ratio of initial investment to depreciation rate. For initial capital, we use the gross fixed capital formation and 5% depreciation δ (Ganev, 2015).

$$K_0 = \frac{I_0}{\delta + g} \quad (2)$$

We assume that growth rate of investments g in long periods is 0, because of high volatility in the years between 1991 and 2014 (Ganev, 2015)

In order to be able to calculate TFP we also need to find the values of α and β. We take advantage of the assumption that α + β = 1, thus we need to find one only of the two. We use the ratio of Labour cost to GDP in order to receive α. Labour cost is calculated as the average wage per hour multiplied by the hours worked in the year. The average wage is in 2010 prices and is taken from the National Statistical Institute.

Appendix 2: Seasonality adjustment

Seasonality adjustment of data is performed by using a centred moving average. The only data that this method used is Labour. We deal with quarterly data, so the periodic effect has a period of 4 observations. We calculate centred moving averages for each observation (excluding the first and last 2) following the formula:

$$CMA = \frac{Y_{n-2}}{8} + \frac{Y_{n-1} + Y_n + Y_{n+1}}{4} + \frac{Y_{n+2}}{8}$$

which represents our centred moving average for the first 5 observations.

We continue by calculating ratios between each observation and its CMA. This shows us how the observation varied from the CMA. We then calculate the 4 quarterly unadjusted seasonal indices – each represents an average of the ratios for each quarter in each year (the average of all first quarter ratios, the average of all second quarter ratios, etc.) and these will give us average deviation percentages for each quarter in our data. We divide each of the indices by the average of the four adjusted seasonal indices received so as to prevent any statistical errors. In order to finally receive our de-seasonalised data, we divide each observation by its respective adjusted seasonal index.

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INTERRELATIONS BETWEEN EXTERNAL AND INTERNAL MACROECONOMIC FACTORS: EMPIRICAL EVIDENCE ON SOME OECD COUNTRIES

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Abstract
In this study, using a data set from 12 OECD countries with floating currency and liberal capital regimes, we analyse interactions between real exchange rates, current account balances, bond yield spread, broad money, industrial production growth and inflation in the framework of panel vector autoregression (PVAR) modelling. Our empirical study shows that changes in real exchange rates may well affect current and capital accounts of the countries under investigation. Empirical findings also highlight that factors influencing the relative price of imports and exports may lead to considerable amount of changes in foreign trade, which, in turn, may affect domestic production. It has been found that improvements in current account balance may deteriorate real economic activity due to a fall in high efficiency intermediate and capital goods. PVAR model estimations imply that short-term interest rates can be used as an efficient tool to eliminate real exchange rate misalignments and to alleviate the negative impact of external imbalances by influencing current accounts and capital accounts. Bond yield differences may have opposite impacts on real exchange rate and current account balance in OECD countries compared to short-term interest rates, while short-term interest rates do not have the capacity to control long-term interest rates.

JEL Classification: E44, E52, F32
Keywords: External Factors, Internal Factors, Monetary Policy, PVAR Model

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1. Introduction

Huge current account deficits and persistent exchange-rate misalignments, leading to massive trade deficits in the United States (U.S.) and some European countries, in combination with surpluses in several emerging Asian economies, are regarded by policymakers and researchers as the source of global economic imbalances. Under current economic conditions, monetary policy authorities aiming to maintain price stability have been incorporating in their decision making the role of external and internal economic factors that may lead to macroeconomic imbalances.

In this study, we analyse the interactions between current account dynamics, real exchange rates, interest rates, broad money, industrial production growth and inflation, in parallel to the Taylor rule principle, as Ferrero *et al.* (2008) implied, that targeting domestic inflation provides the optimal stabilization outcome for macroeconomic variables and external imbalances. Similar to the empirical methodology of Yuan and Chen (2015), we employ PVAR modelling to draw implications concerning monetary policy implementation in 12 OECD countries (Australia, Brazil, Canada, the Czech Republic, Iceland, Israel, Korea, New Zealand, Norway, South Africa, Sweden, and the United Kingdom) from 1999:Q1 to 2017:Q2 due to data availability. Countries included in the panel data-set concern both floating currency regimes and capital control regimes that are not classified as "Wall" by the IMF. Another feature pertaining to countries included in the study is their monetary policy frameworks, namely, inflation targeting. On the other hand, the number of countries included in our panel data-set can be increased regardless of their type of currency regime and capital control regime. However, this choice increases the number of OECD countries and, thus, the risk of an enhanced heterogeneity problem. For instance, the panel data-set of countries can be raised by including countries with a pegged exchange rate regime (Hungary and the Slovak Republic). In order to identify our modelling approach, we conducted the Hausman test, which reveals that fixed-effects models can be appropriate. In this study, PVAR models are employed for a sample of 12 OECD countries to determine interactions among real exchange rates, current account balances, short-term interest rates, differences in bond yields, broad money growth, industrial production growth, and inflation. In this respect, Helmert transformation is used as a technique to remove possible panel fixed effects due to our PVAR model. GMM is used as an estimation strategy because it provides more consistent estimates, particularly in fixed time and relatively large cross-section settings.

The main contribution of our study is that we incorporate both external and internal economic factors in our empirical analysis, since changes in monetary policy transmission truly stem from such factors. We regard the Federal Reserve's possible monetary policy change, in terms of raising interest rates, as an external economic development, since this possible policy is expected to lead to both capital outflows

from the emerging markets and fluctuations in macroeconomic aggregates. As another external factor, we include data on current account balances as a significant factor explaining major fragilities in these countries. Similarly to Yuan and Chen (2015), bilateral real exchange rates are included in the empirical study, and, thus, the dynamics of currency markets and inflation are taken into consideration, constituting another contribution of our study. Within this framework, we aim to show the effects of external factors on internal macroeconomic variables and we discuss how monetary policy authorities should respond to these macroeconomic developments by estimating impulse response functions (IRFs) and variance decompositions (VDCs). The main hypothesis of this paper tests whether changes in external macroeconomic variables may lead to a considerable impact on monetary policy and vice-versa. In this study, we intend to address the issue of whether monetary policy can be designed to lower negative consequences of external imbalances for maintaining financial and economic stability in said countries.

The article proceeds as follows: Section 2 reviews relevant theoretical and empirical studies. Section 3 presents empirical data and the methodological means proposed here to investigate interactions between real exchange rates, current account balances, bond yield spread, real economic activity and inflation. Section 4 sets out the PVAR models and empirical results. Finally, Section 5 concludes the paper and highlights some issues for further research.

2. Literature Review

In order to examine the relationship between internal and external macroeconomic variables, the Balassa-Samuelson effect proposed by Balassa and Samuelson (1964) can well constitute a theoretical base for researchers and policymakers. More specifically, productivity growth in the tradable sector can be recognised as an internal macroeconomic development that is a critical source of fluctuations in the economic growth rate and the real value of exchange rates. Changes in productivity can have impact on external macroeconomic variables, namely, current account balance, through changes in real exchange rates. Real exchange rates may be assumed as an internal macroeconomic variable due to the role of the domestic price level, while real exchange rates can also be regarded as an external macroeconomic variable due to the impact of foreign prices and of the highly globalised foreign exchange market.

Analysing disequilibrium in the balance of payments has rapidly gained ground in international macroeconomics literature due to persistent exchange-rate misalignments leading to massive trade imbalances in several emerging and advanced countries in the 2000s. Béreau *et al.* (2011) analysed a set of advanced and emerging economies, and showed that real exchange rate overvaluations negatively affected economic growth but improved current balance, whereas real exchange rate under-

valuation depressed current account balance by promoting real economic activity. Sallenave (2010) studied the impact of real effective exchange rate misalignments for the G20 countries over the period 1980–2006 using the behavioural equilibrium exchange rates (BEER). He suggested that the rate of convergence to the estimated equilibrium exchange rates was slower for industrialised countries and, moreover, exchange rate misalignments had a negative effect on economic growth, which, in turn, may lead to an improvement in current account balance. For the case of 22 industrialised countries, Gnimassoun and Mignon (2013) used panel techniques and found that the persistence of current account imbalances arose from currency misalignments, while disequilibria were persistent even for very low overvaluations in the euro area, contrary to non-euro area members. Using the BEER and the fundamental equilibrium exchange rate (FEER) approaches, Jeong *et al.* (2010) had findings partially in line with earlier studies, highlighting the importance of current account imbalances and exchange rate misalignments. By asserting that the impact of current account imbalances and exchange rate misalignments had dropped since the outbreak of the crisis in 2007, Jeong *et al.* (2010) revealed that exchange rate misalignments were important for each individual euro area member. In order to determine the dynamics of current account changes, price elasticity of foreign trade should be estimated. In this respect, real exchange rates can be a useful proxy, although the hypothesis of relative prices constancy has been widely criticised in empirical literature. Most studies in the literature found that relative prices are statistically insignificant, and, even when they are significant, price elasticities are very low when compared to income elasticities (Soukiazis *et al.*, 2014). The implication of Soukiazis *et al.* (2014) was supported by Blecker (2009), who indicated that relative prices are more likely to remain constant and current account balance is more sensitive to income than to price changes.

Just like the effects of internal macroeconomic factors on external economic factors, changes in external macroeconomic variables can also have crucial consequences for internal economic factors. Soukiazis *et al.* (2014) studied the case of Italy's experiencing lack of growth in the last decade and facing serious internal imbalances, which had been driven by high deficit and public debt. The authors implemented a scenario analysis based on their theoretical model and it was found that Italy grew at a slower pace than its potential capacity due to supply constraints. They also suggested that economic policies aimed at increasing external competitiveness and, thus, improvements in current account balance can be effective strategies to promote higher growth. Thirlwall's Law proposed by Thirlwall (1979) suggests that no country can grow faster than its balance of payments equilibrium growth rate, unless it can continuously finance external deficits by capital inflows (Soukiazis *et al.*, 2012). In terms of the analysis of disequilibrium in the balance of payments, Aizenman and Sun (2010) asserted that there were interactions between

current account balances among countries and that these interactions were related to differences in growth. They showed that large current account/GDP surpluses of countries might be constrained by the limited sustainability of larger current account deficits/GDP of countries with a slower growth rate. Lane and Pels (2012) revealed that real economic activity, more precisely lower savings and higher construction investment, rather than investment in productive capital, could help examine the dynamics of current account imbalances across Europe. Freund's (2005) study made a major contribution to relevant literature, indicating that current account reversals in industrial economies were accompanied by depreciation of real exchange rates, a decline in GDP growth, investment and imports and a rise in exports. Algieri and Bracke (2011) stated that current account balance adjustments could be driven by relative prices (expenditure switching), suggesting that quantity- and price-driven adjustment cases could be discerned, and, moreover, that the exchange rate regime and the level of economic development did not have significant predictive power for current account imbalances. Additionally, Fratzscher *et al.* (2010) employed a bayesian structural VAR (SVAR) model considering the role of asset prices in the U.S., and obtained outcomes similar to those by Algieri and Bracke (2011). More specifically, Fratzscher *et al.* (2010) found that equity market and housing price shocks were the major determinants of U.S. current account, while shocks to real exchange rates were less relevant for current account changes. Fratzscher *et al.* (2010) suggested that large exchange rate movements might not necessarily be a key element in the adjustment of large current account imbalances, whereas relative global asset price changes might impact the adjustment of current account imbalances. According to Duarte and Schnabl's (2015) study, which identified adjustment channels for global imbalances, it can be asserted that, besides domestic foreign measures, foreign economic developments may trigger current account adjustments, particularly in countries with a high level of openness. More specifically, Debelle and Galati (2005) found that global developments might trigger current account adjustments in industrial countries due to their impact on unwinding domestic imbalances. The authors implied that the bulk of *ex post* financial account adjustment occurred in private sector flows, primarily on the part of foreign investors.

Changes in the monetary policy stance may be recognised as an important factor influencing the relationship between the goods and foreign exchange markets and the current account balance. According to the concept of "overshooting," the implementation of a contractionary monetary policy causes a large initial appreciation in both nominal and real exchange rates followed by subsequent depreciations. More specifically, it is assumed that the short-run effect of a monetary shock on the exchange rate is greater than the long-run effect of the shock on the price of goods and services, which leads to exchange rates overshooting in the short-run. Possible changes in the monetary policy stance of the U.S.,

in terms of raising interest rates, are also expected to result in capital flows across countries, which, in turn, may have deleterious impact on the developing countries' economies, in parallel to the implications of Valente (2009), Bluedorn and Bowdler (2011), Barakchian (2015) and Yuan and Chen (2015). On the other hand, it can be asserted that interest rate differences can be highly influenced by external factors due to increased international capital mobility over the last decade. More specifically, the difference in yield between the bond and a benchmark US Treasury bond of similar maturity can be influenced by external macroeconomic variables. Banerji *et al.* (2014) employed the Structural Vector Autoregression (SVAR) model for China, Indonesia, Malaysia, and the Philippines using monthly data up to September 2009. Banerji *et al.* (2014) found that variations in sovereign spreads are mainly driven by external shocks, with term structure of US interest rates and global risk aversion having the most important direct effect on sovereign spread.

In terms of determining the effects of economic policies on the current account balance, credit volume, which is an internal macroeconomic variable, is critically important as an adjustment mechanism for current account imbalances along with monetary policy and exchange rate changes (Schnabl and Wollmershäuser, 2013). In their study, Schnabl and Wollmershäuser (2013) considered alternative institutional monetary arrangements (floating exchange rates, the European Monetary System, and the European Monetary Union [EMU]), estimating panel regressions for 15 Western European countries. They found that the impact of fiscal policy on current account balances was highly dependent on monetary policy stance, and more so than the exchange rate regime. Yuan and Chen (2015) employed a PVAR model to empirically examine the relationship between monetary policy, fiscal policy, exchange rates and external balances and their effects on GDP growth and price stability in BRICS countries. Due to low level of financial openness, nominal rigidity in the exchange rate and lack of price flexibility, Yuan and Chen (2015) found the impact of fiscal policy on current account balance to be weak. Conversely, it was implied that a rise in interest rates might have improved current account in BRICS countries and an extended loose monetary policy (mainly in the U.S.) would severely exacerbate massive global imbalances. While stressing the importance of interest rate decisions in the U.S. and emerging economies, it was implied that strengthening the trade-weighted real effective rates worsened BRICS countries' overall external positions. Yuan and Chen (2015) also revealed that shocks leading to weaker bilateral exchange rates (vis-à-vis the U.S. dollar) did not help improve these countries' trade balance against the U.S. Along with fiscal policy measures, the determination of the monetary policy framework can be an independently important factor in lowering negative impact in countries with current account deficits.

In this study, we employ similar theoretical and empirical methodology to that of Yuan and Chen (2015) for the analysis of external and internal macroeconomic

variables in 12 OECD countries with PVAR modelling. However, our approach differs from that of Yuan and Chen's (2015) in that we take into account real exchange rate misalignments and current account imbalances, bearing in mind that these external imbalances have had important consequences for economies, particularly in the last decade. Our study also differs from that of Yuan and Chen's (2015) because we analyse the effects of external macroeconomic factors and internal macroeconomic variables and discuss how monetary policy should respond to changes in external macroeconomic variables. Accordingly, what are also studied are possible effects of changes in monetary policy stances that are reflected in interest rate spread on external variables.

3. Research Methodology

3.1 Empirical Model

As for the empirical exercise, we address the relationship between real exchange rates, current account balances, long-term interest rates, credit volume, real economic activity and inflation, based on the estimation of a PVAR model for a sample of 12 countries over the period 1999:Q1 to 2017:Q2, taking into account data availability. We include real exchange rates ($rexch_t$) as a variable in the PVAR model based on the formula $rexch_t^x = p_t^x - p_t^{usa} - nexch_t^{usd/y}$, where $nexch_t^{usd/y}$ is defined in units of currency of country x (y) per unit of the currency of the U.S. (usd) in logarithms, while p_t^x and p_t^{usa} are the price levels of a country under investigation and of the U.S., in logarithms, respectively. The real exchange rate series incorporated into our model specification are based on the CPI, the base year being 2010=100); thus, the dynamics of inflation in the U.S. and the countries under investigation are considered in conjunction with the variations in currency markets.

Real exchange rate misalignments and current account imbalances are incorporated in the model by computing deviations from their long-run equilibrium values. For this purpose, the Hodrick-Prescott Filter is employed to remove the cyclical component of a time series from raw data and to derive the equilibrium real exchange rate series. Following a similar approach, long-run equilibrium values of current account balances are computed and current account imbalances are taken into account by subtracting current account series from their long-run equilibrium value. The Hodrick-Prescott filter is used with a smoothing factor of 1,600, which is what Hodrick-Prescott recommended for quarterly data. Alternative filtering techniques were also used to compute long-run equilibrium values for the series and they provided outcomes supporting the robustness of the Hodrick-Prescott filter implemented in our empirical exercise. The gap of the real exchange rate from its equilibrium value is denoted as (*drexch*), while (*dcur*) refers to the gap between the actual current account balance series (*cur*) from its long-run equilibrium value.

More precisely, the filtered current account series is the structural part of the current account and contains a deterministic or stochastic trend. The gap between the actual current account series and the filtered series reflects the cyclical component of the current account balance series. By subtracting 10-year U.S. government bond yields ($lyie_t^{usa}$)from the 10-year government bond yields of each country ($lyie_t^x$), differences in 10-year government bond yields (*dlyie*) are obtained. Short-term interest rates (*sirt*) reflecting the monetary policy stance of the OECD countries are proxied by call money/interbank rates. Growth rates of broad money (*brog*) and industrial production (*indg*) are expressed in percentage changes over the previous period. This is why we include inflation (*infl*), referring to the change in CPIs over the previous period of the current year. To include the consequences of the financial crisis 2007–2009 for the relations between variables, we investigate dummy variables taking the value of 1 for the period from 2007:Q1 to 2009:Q4. The ordering of variables in PVAR models are; *indg* , *infl* , *brog* , *sirt* , *dlyie* , *drexch* , *dcur* , respectively.

3.2 Identification of the PVAR Model

VAR models can be estimated in conjunction with fixed effects or independently of fixed effects after some transformation with OLS.

$$Y_{i,t} = Y_{i,t-1}A_1 + Y_{i,t-2}A_2 + Y_{i,t-p+1}A_{p-1} + Y_{i,t-p}A_p + X_{i,t}B + u_{i,t} + e_{i,t} \quad (1)$$

In equation (1), p refers to the lag length of the PVAR model, while Y_{it} denotes an $(1\times k)$ vector of dependent variables, and $X_{i,t}$ refers to an $(1\times l)$ vector of exogenous covariates. Dependent variable-specific fixed effects and idiosyncratic errors are represented by $(1\times k)$ vectors u_i and $e_{i,t}$, respectively. Finally, the $(k\times k)$ matrices $A_1, A_2, ..., A_{p-1}, A_p$ and the $(l\times k)$ matrix B are parameters of the model (Abrigo and Love, 2015: 2). Lags of all endogenous variables of all units are included in the model for cross-section i, while $e_{i,t}$ is accepted as correlated across i, and the intercept, the slope, and the variance of shocks $e_{1,i,t}$ may be cross-section specific (Canova and Ciccarelli, 2004: 8).

The model specified in (1) can be estimated using various methods based on the generalised method of moments (GMM); however, these estimations may be inconsistent, particularly in fixed N and T settings. To improve the efficiency of the PVAR with the GMM method, a longer set of lags can be used as instruments and, thus, equation-by-equation, GMM estimation may lead to consistent estimates of the PVAR model. If a number of $L \geq kp + l$ instruments are included in vector $Z_{i,t}$, the transformation of the model in (1) can be specified as follows:

$$Y_{i,t}^* = \overline{Y_{i,t}^*}A + e_{i,t}^* \quad (2)$$

In equation (2), the asterisk denotes the transformations of relevant variables. Thus, we have: $Y^*_{i,t} = [y^{1*}_{i,t}, y^{2*}_{i,t}, ..., y^{k-1}_{i,t}, y^{k*}_{i,t}]$ and $\overline{Y^*_{i,t}} = [Y^*_{i,t-1}, Y^*_{i,t-2}, ..., Y^*_{i,t-p+1}, Y^*_{i,t-p}, X^*_{i,t}]$, $e^*_{i,t} = [e^{1*}_{i,t}, e^{2*}_{i,t}, ..., e^{k-1*}_{i,t}, e^{k*}_{i,t}]$ and $A' = [A_1', A_2', ..., A_{p-1}', A_p', B']$ (Abrigo and Love, 2015: 2–3). PVAR adopts an infinite order vector moving average (VMA) representation to compute impulse response functions and forecast error variance decompositions when the stability condition holds. Thus, the simple impulse response function Φ_i can be expressed by rewriting the model as an infinite VMA as follows:

$$\Phi_i = \sum_{j=1}^{i} \Phi_{t-j} A_j \tag{3}$$

where $I_k = \Phi_0$ and a shock to one variable is accompanied by shocks to other variables, since innovations $e_{i,t}$ in model (1) are correlated contemporaneously. In view of this, a matrix P can be used to orthogonalise innovations as $e_{i,t}P^{-1}$ and to transform the VMA parameters into the orthogonalised impulse responses $P\Phi_i$ (Abrigo and Love, 2015: 6). In addition, Cholesky decomposition determines the structure of the PVAR model and its impulse response estimates. In VAR-type models, VDC is also a crucial tool showing the proportion of movements in dependent variables due to their own shocks, as opposed to shocks to the other variables.

Within PVAR modelling, we examine the effects of real exchange rates and current account balances on monetary policy implementation and economic activity in parallel with the analysis of the monetary policy transmission mechanism in Yuan and Chen (2015). Our paper also contributes to the literature by considering the differences between interest rate policies of monetary authorities reflected in long-term government bond yields. As reflected in the ordering of variables in PVAR models, critical importance is given to the real exchange rates in the models, since real exchange rate misalignments may have considerable impact on current account balance via changes in international competiveness. Within our Cholesky decomposition, we assume that changes in international competiveness, referring to the change in real exchange rates, affect current account balances, which, in turn, affects the capital account and monetary policy stances. Accordingly, it is assumed that monetary policy influences broad money, real economic activity and inflation.

4. Results and Discussion

4.1 Panel Unit Root Analysis

For our empirical analysis, all series required are obtained from the database of the Federal Reserve Bank of St. Louis and databases of relevant central banks. In this regard, we use plausible techniques to generate the series included in our empirical model. The appropriate type of panel data model is determined by employing panel unit root tests based on different assumptions.

Table1. Panel Unit Root Test Results

	Levin, Lin and Chu		Im, Pesaran and Shin		Fisher-ADF		Pesaran	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Critical values at 5%
indg	-13.5107	0.0000	-15.1379	0.0000	439.9242	0.0000	-6.184	-2.09
infl	-13.6783	0.0000	-15.8595	0.0000	524.4702	0.0000	-5.806	-2.09
brog	-5.9470	0.0000	-8.6143	0.0000	179.7746	0.0000	-4.761	-2.09
sirt	-16.3701	0.0000	-17.2000	0.0000	575.1656	0.0000	-6.190	-2.09
dlyie	-1.9046	0.0284	-3.1536	0.0008	62.6254	0.0000	-3.041	-2.09
drexch	-18.1858	0.0000	-14.1437	0.0000	379.1853	0.0000	-6.350	-2.09
dcur	-1.4481	0.0738	-3.7327	0.0001	66.2064	0.0000	-2.971	-2.09

Source: Authors' Computation.

We use the Levin–Lin–Chu (LLC) panel unit root tests (Levin *et al.*, 2002), assuming that persistence parameters are common across cross-sections, whereas we apply the panel unit root tests of Im *et al.* (2003) and Fisher-ADF, based on the assumption that persistence parameters vary across cross-sections. We also take into consideration cross-sections by using Pesaran's (2007) panel unit root test. In Table 1, panel unit root tests indicate that the variables can be accepted as stationary. In this case, it is not possible to explore potential cointegration relationships among variables. Accordingly, variables are included into our empirical model in levels and we apply PVAR modelling due to theoretically accepted interactions among the variables in the study.

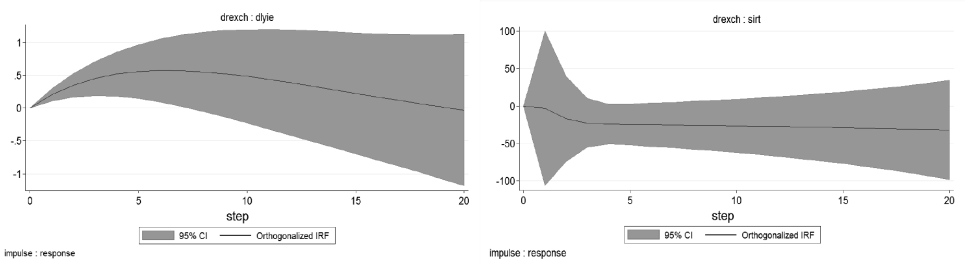
4.2 Empirical Analysis

PVAR models can be used for macroeconomic policy research because they are suitable for the analysis of macroeconomic variables without the need of imposing constant prior on the relationship between variables. In this study, we employ the Stata code written by Abrigo and Love (2015) to estimate our PVAR model and its IRFs and VDCs. We identify the PVAR model similarly to Abrigo and Love (2015) and Canova and Ciccarelli (2004); however, Nickell (1981) states that fixed effects estimators in autoregressive panel data models may be inconsistent. More precisely, Nickell (1981) suggested that fixed effects could be correlated with regressors due to lags in the dependent variable. Following Gnimassoun and Mignon (2013) and Abrigo and Love (2015), we apply the Helmert procedure to remove fixed effects, which allows us to use lagged regressors as instruments and estimate coefficients using the GMM procedure. The PVAR analysis is performed by choosing the optimal lag order in the PVAR specification and the moment condition. We employ the moment and model selection criteria (MMSC) proposed by Andrews and Lu (2001), whereupon VDC and impulse response analysis are conducted based on a PVAR (1) model.

4.2.1 Results of Impulse Response Analysis

Changes in real exchange rates may influence the monetary policy stance, which, in turn, leads to spreads in bond yields between the government bonds of the countries we investigate and those of the U.S. The IRFs reveal that appreciation in the real exchange rates of these countries may increase the spread of bond yields in the short-run; this finding is compatible with that of Fratzscher *et al.* (2010), but inconsistent with uncovered interest rate parity (UIRP) condition. Since net domestic assets are related to net foreign assets, we can assert that appreciation of the currencies of the countries under investigation may cause an outflow of funds from the bond market, which, in turn, negatively affects monetary aggregates and leads to financial and economic instability in the long run.

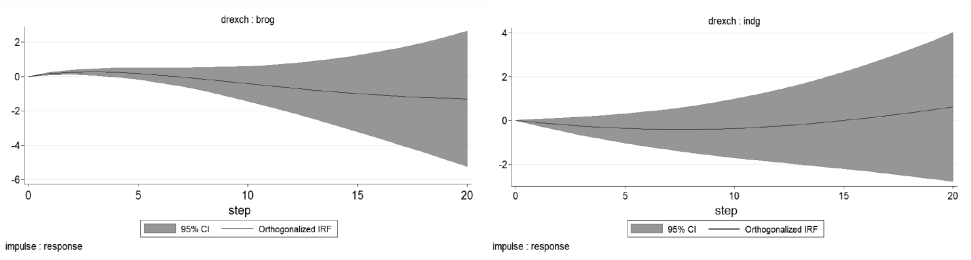
Figure1. Responses of *dlyie* and *sirt* to a *drexch* Shock



Source: Authors' Computation.

Our findings in regard to all the countries we have studied can also be interpreted as demonstrating that appreciation of their currencies against the U.S. dollar makes production factors and investment more expensive in terms of the U.S. dollar. Accordingly, this phenomenon may lower foreign direct investment and the flow of funds from the countries under investigation, leading to an increase in interest rates in these countries over long horizons. In order to avoid capital outflow, monetary policy authorities may use their tools, particularly by raising policy interest rates. On the other hand, as a result of the appreciation of home currencies of the 12 OECD countries against the US dollar, no statistically significant impact on call money/interbank rates has been detected. Thus, it is implied that the dynamics of the interbank money market cannot be influenced by real exchange rate fluctuations or monetary policy decisions in the OECD countries investigated.

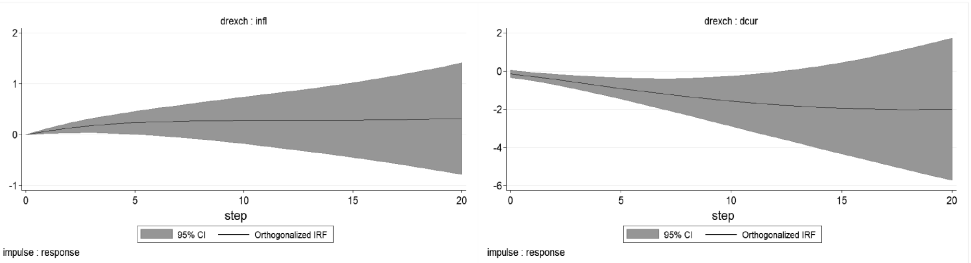
Figure 2. Responses of *brog* and *indg* to a *drexch* Shock



Source: Authors' Computation.

In terms of effects on monetary aggregates, IRFs reveal that real exchange rate appreciation in these countries does not lead to changes in growth rates of real broad money, indicating that channels through which real exchange rates affect broad money may not have a significant impact on other monetary aggregates and aggregate demand. Positive shocks in real exchange rates, namely, the appreciation of currencies of the countries under investigation against the U.S. dollar, influence economic activity in said countries. Contrary to Yuan and Chen (2015), we find that appreciation of real exchange rates may negatively affect industrial production growth, while inflation may increase in the short run. However, responses of industrial production growth and inflation to a positive shock in real exchange rate differences are not statistically significant.

Figure 3. Responses of *infl* and *dcur* to a *drexch* Shock

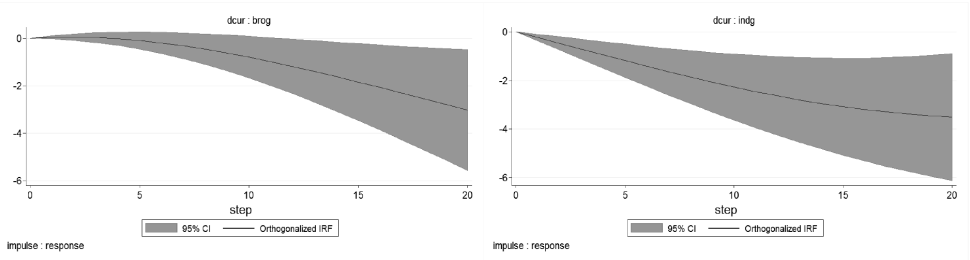


Source: Authors' Computation.

According to Kilian and Vigfusson (2011), the actual difference between these two responses seems small and, thus, it is not easy to make a case for using the asymmetric model on economic grounds, even though differences between positive and

negative shocks may exist in VAR-type models. Accordingly, it can be inferred that the appreciation/depreciation of the currencies of the countries under investigation does not lead to a considerable amount of changes in foreign trade, which, in turn, leads to deterioration/expansion in real economic activity due to potential decrease/increase in domestic production. More specifically, IRFs imply low price elasticity of foreign trade in all countries studied. Figure 3 shows that real exchange rate appreciation in the countries under investigation leads to increased current account deficits in the short-run. However, according to the IRFs, the impact of real exchange rate appreciation on current account balance is not statistically significant after the ensuing 10th quarter, revealing the opposite effects of real exchange rates on imports of final goods and imports of intermediate and capital goods for the countries we examined. It can be implied that current account balance adjustments may have expenditure switching features. More specifically, there may be real shocks (productivity shocks, labour supply shocks, government spending shocks, etc.) that are specific to one country. In this respect, nominal exchange rate changes may also allow for adjustment of relative international prices in the OECD countries under investigation.

Figure 4. Responses of *brog* and *indg* to a *dcur* Shock

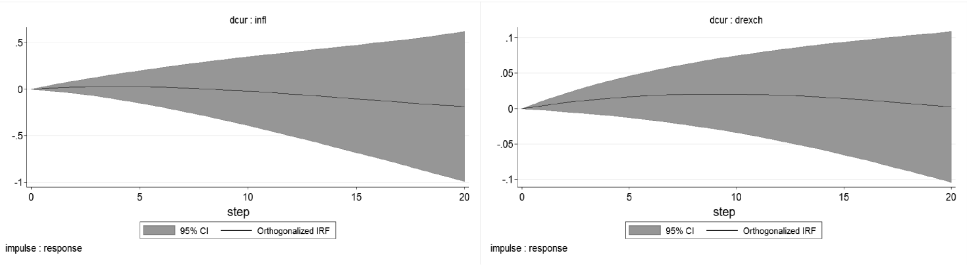


Source: Authors' Computation.

Changes in current account deficit reflect the need for foreign resources that have to be borrowed to fund investments. Current account deficit is also a major factor in terms of influencing risk perception, and, thus, may cause global imbalances. Our impulse response analysis shows that improvements in current account balance lead to a decrease in real broad money growth in all 12 countries. More precisely, we may infer that improvements in current account balance may eventually lead to a fall in capital account and, thus, growth rates of broad money decrease, as net domestic assets are related to net foreign assets. As a result of improvements in current account balance in the countries under investigation, we detect that industrial production growth rate falls in the ensuing periods, while no statistically significant impact on

inflation has been found. Accordingly, our impulse response exercise highlights that imports of relatively high efficiency intermediate and capital goods are critically important to sustain economic growth in the countries under investigation. The IRFs also highlight the importance of the size of balance sheets of central banks and quantitative easing policy of central banks for sustaining economic growth without causing inflation in all 12 countries.

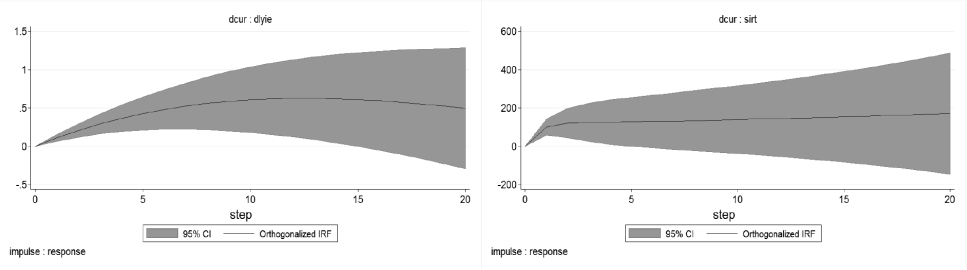
Figure 5. Responses of *infl* and *drexch* to a *dcur* Shock



Source: Authors' Computation.

On the other hand, we find that improvements in current account balance do not lead to statistically significant changes in the values of the currencies of these countries against the U.S. dollar, which is contrary to what Yuan and Chen (2015) support. We can interpret that improvements in current account balance of these countries lower risk perception, and, thus, lead to a fall in interest rates. However, improvements in current account balance can also be recognised as a factor leading to a fall in the flow of funds in domestic markets, which, in turn, increases long-term interest rates in the countries under investigation with respect to the US. We have detected that improvements in current account balance in all 12 countries increase the spread between the government bonds of said countries and the U.S. in ensuing periods. The flow of funds from the 12 OECD countries may also impact the interbank market by negatively influencing short-term financing conditions. Our impulse response exercise is in line with this implication, because short-term interest rates are increased as a result of improvements in current account balance. Therefore, we can infer that the volume of capital and financial account needed to balance the current account may have considerable impact on interest rate policy and the conditions of the money market in the countries we have investigated.

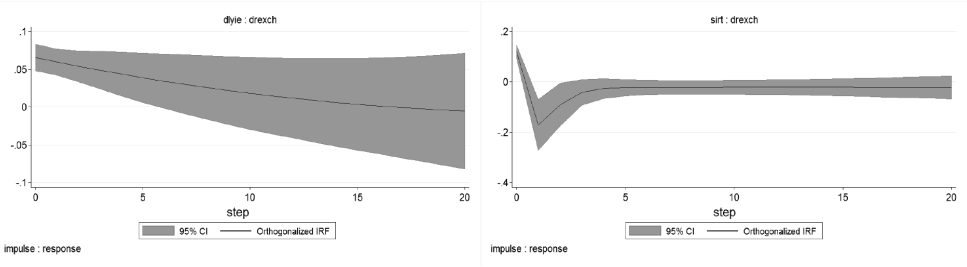
Figure 6. Responses of *dlyie* and *sirt* to a *dcur* Shock



Source: Authors' Computation.

According to our impulse response analysis, an increase in bond yield difference leads to fluctuations in the value of the currencies of the countries under investigation against the U.S. dollar, a finding that is partially in line with Yuan and Chen's one (2015). The response of the real exchange rate gap is not statistically significant after the ensuing 5th quarter; therefore, we cannot argue that implementation of a contractionary monetary policy in all 12 countries does not lead to inflow of funds into their money markets affecting deviations in real exchange rates in the long-term.

Figure 7. Response of *drexch* to a *dlyie* Shock and a *sirt* Shock

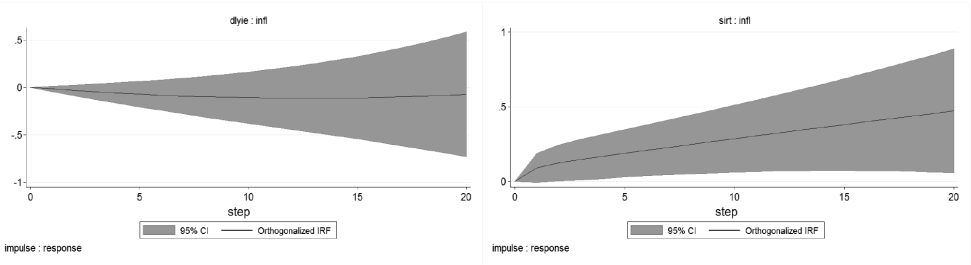


Source: Authors' Computation.

On the other hand, the impulse response exercise indicates that the real exchange rate of the 12 OECD countries may be depreciated up to the ensuing 5th quarter, as a result of a positive shock in the interbank interest rates of these countries contrary to the concept of "overshooting." In this respect, it may be interpreted that increases in short-term interest rates negatively affect expectations related to the economic conditions of the OECD countries we have investigated. Thus, possible capital outflow from these countries supports the existence of the UIP condition in the short-term.

It may be asserted that the short-term interest rate is an effective tool to stabilise real exchange rate fluctuations and eliminate real exchange rate misalignments in the short-term. It may also be interpreted that investors recognise changes in short-term interest rates and a signal of the change in the monetary policy stance of their central banks and, thus, they make their decisions accordingly. Herein, our impulse response exercise implies that long-term bonds are under the influence of the supply and demand dynamics of the bond market and the relationship of the bond market with other financial markets rather than changes in monetary policy stance.

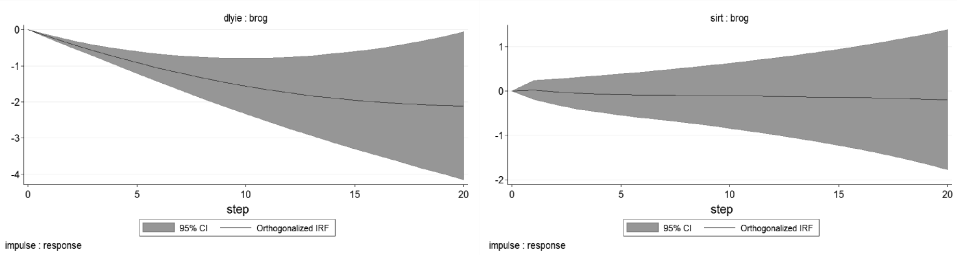
Figure 8. Response of *infl* to a *dlyie* Shock and a *sirt* Shock



Source: Authors' Computation.

The impulse response analysis also shows that an increase in the bond yield difference and interbank interest rate do not lead to a significant increase in inflation, which is inconsistent with the real interest rate parity (RIRP) condition. Our impulse response exercise shows that contractionary monetary policy implementation in the OECD countries under investigation may lead to increased inflation. We may interpret that inflation dynamics in the 12 OECD countries is much more under the influence of changes in aggregate supply than changes in aggregate demand. More precisely, increasing short-term interest rates is a factor negatively affecting the level of investments. It may also be inferred that high interest rates are a significant cost factor because of the high indebtedness of firms in said countries. Thus, the impulse response exercise implies that short-term interest rates may be an effective tool to control inflation in the OECD countries we have investigated.

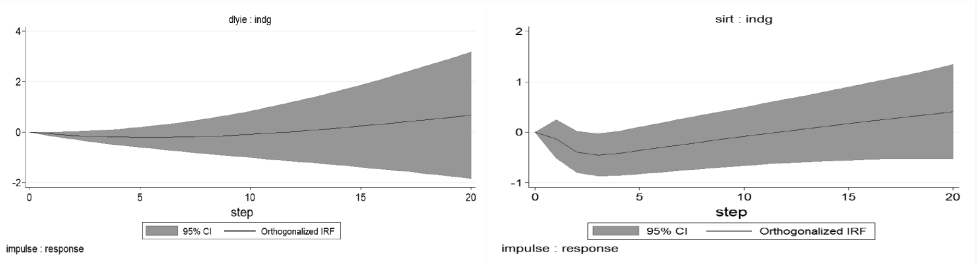
Figure 9. Response of *brog* to a *dlyie* Shock and a *sirt* Shock



Source: Authors' Computation.

Although we have found that an increase in bond yield difference may lead to a fall in broad money due to capital outflows, the impulse response exercise indicates that changes in short-term interest rates do not have any statistically significant impact on broad money growth. It may be asserted that short-term interest rates cannot be recognised as a major factor influencing money demand. Conversely, IRFs indicate that fluctuations in bond markets have crucial effects on money demand, in line with the liquidity preference theory.

Figure 10. Response of *indg* to a *dlyie* Shock and a *sirt* Shock

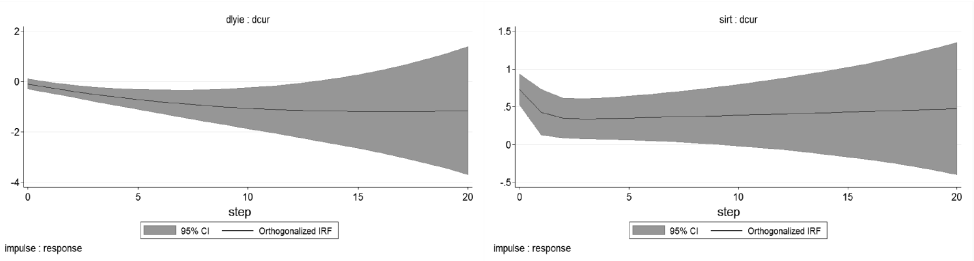


Source: Authors' Computation.

Figure 10 indicates that industrial production is not significantly affected by positive shocks in bond yield difference. IRFs show that changes in call money/interbank rates may influence industrial production and, therefore, short-term interest rates may be used as a policy tool to promote economic growth. More specifically, increasing short-term interest rates may lead to deterioration of real economic activity in line with theoretical expectations. Our assertion is also supported by the finding that changes in short-term interest rates positively affect current account balance due to decrease in domestic production and demand for imports. On the

other hand, bond yield differences may cause an increase in current account deficit according to the IRFs. This finding may be interpreted as meaning lower increases in bond yield difference lead to an increase in capital inflows to the bond market, which, in turn, facilitates the financing of current account deficits. Therefore, we can imply that changes in monetary policy stances may have a significant impact on total factor productivity or consumer preference shocks, which may influence expenditure decisions, and, thus, current account balance.

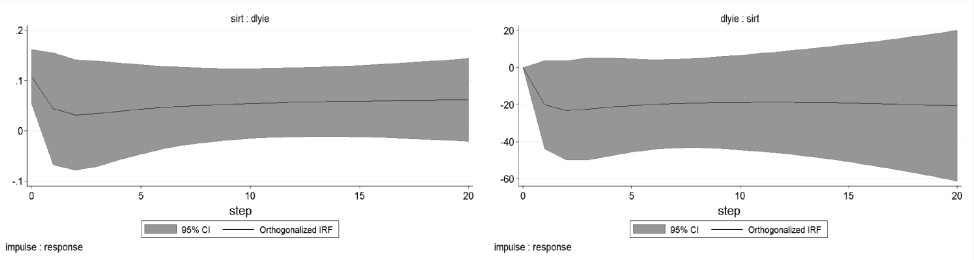
Figure 11. Response of *dcur* to a *dlyie* Shock and a *sirt* Shock



Source: Authors' Computation.

IRFs particularly stress the fact that interest assets with different maturities may have opposite impacts on macroeconomic variables. Thus, it is critically important to determine the effects of short-term interest rates on long-term interest rates, because monetary policy authorities aim to control long-term interest rates with their policy interest rate. As shown in Figure 12, increases in call money/interbank rate do not have any statistically significant impact on the 10-year government bond yield spread. It can be asserted that central banks of the OECD countries we have investigated cannot control long-term interest rates. It may also be interpreted that negative consequences of the rise in long-term interest rates cannot be eliminated by policy interest rate. On the other hand, bond yield difference does not have any impact on the interbank money market and monetary policy stance in said OECD countries. IRFs show that there is no relationship between short- and long-term interest rates; consequently, we propose that the monetary policy authorities of the 12 OECD countries should develop new tools and policies to control long-term interest rates.

Figure 12. Response of *dlyie* to a *sirt* Shock and Vice-Versa



Source: Authors' Computation.

4.2.2 Results of Variance Decomposition Analysis

VDCs based on our PVAR model are employed to determine the degree of significance of each variable included in the model. For this reason, sources of variation in real exchange rates may be useful in determining the consistency of purchasing power parity (PPP) in the countries under investigation. By performing VDC analysis, we can also draw implications about real exchange rate misalignments in the ensuing periods. According to our variance error decomposition analysis, deviations in real exchange rates may explain approximately 25% of the variation in themselves up to the 20th quarter. Although it is indicated that real exchange rates may have a considerable role when examining variations *per se* over the 20-quarter period, the total contribution of other variables is relatively higher, not supporting the consistency of PPP.

Table 2. VDCs of *drexch*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	0	0	0	0	1	0	0
4	0.002439	3.37E-05	0.083881	0.001292	0.697336	0.184354	0.030664
8	0.004805	0.000296	0.077871	0.002286	0.52711	0.267327	0.120305
12	0.006143	0.000632	0.063153	0.002665	0.423709	0.262585	0.241113
16	0.006728	0.000796	0.049262	0.002681	0.340504	0.229236	0.370793
20	0.006782	0.000748	0.037523	0.002495	0.270753	0.189806	0.491893

Source: Authors' Computation.

Table 2 shows that changes in current account balance are the major source of fluctuations in real exchange rates, revealing the importance of changes in current account balance for real exchange rates. Accordingly, it may be inferred that current account balance may impact the dynamics of currency markets due to changing the need for funds to balance current account. In addition, the money markets of

all of the countries in the study and the U.S. may affect the value of real exchange rates and the foreign competiveness of the countries under investigation. Similarly, we have found that the spread between bonds yields accounts for nearly 30% of the variation in real exchange rates up to the 20th quarter. Therefore, it may be argued that variations in real exchange rates and real exchange rate misalignments may stem from external and internal economic factors. More precisely, it may be inferred that the dynamics of bond markets in the OECD countries and the Federal Reserve's possible monetary policy change in terms of raising interest rates can become crucial factors.

Table 3. VDCs of *dcur*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	0	0	0	0	0	0.990672	0.009328
4	0.046537	0.00011	0.003336	0.000397	0.002551	0.936076	0.010993
8	0.244851	0.001872	0.004131	0.056228	0.003156	0.671289	0.018473
12	0.381341	0.005691	0.029729	0.138736	0.002956	0.391608	0.049939
16	0.432356	0.013172	0.071038	0.128606	0.002655	0.208789	0.143384
20	0.486443	0.023188	0.082544	0.094582	0.002389	0.140236	0.170618

Source: Authors' Computation.

Table 3 shows that shocks to the industrial production growth rate play the greatest role in explaining variations in current account balance up to the ensuing 20th quarter. Along with supply shocks, this result suggests that the dynamics of domestic economic agents' expenditures is a critical source of changes in current account balance for ensuing periods, as also referred by Aizenman and Sun (2010) and Lane and Pels (2012). Thus, the role of investment-specific and technology shocks may be regarded as important issues when analysing current account balance in all the countries we have examined. Based on our variance decomposition analysis, we can assert that currency markets may have an important role along with industrial production growth in the analysis of changes in current account balance, in line with Freund (2005) and De Haan *et al.* (2008). The VDCs indicate that deviations in real exchange rates can account for approximately 15% of the variation in current account balance up to the ensuing 20th quarter. This finding also implies that foreign price changes may be crucial for domestic variables and, more specifically, for current account balance in the countries we have investigated. According to the VDCs, it may be revealed that changes in real exchange rates can be expenditure switching. Our assertion is also supported by our finding that domestic inflation can explain nearly 8% of the variation in current account balance up to the ensuing 20th quarter.

The VDCs suggest that monetary policy decisions, and, therefore, the flow of funds across money markets have a considerable impact on current account balance, since call money/interbank rate and the spread of government bonds between countries under investigation and the U.S. account for approximately 10% of the variation in current account balance (deviation of the original series from its equilibrium value) over 20 quarters. Accordingly, we find support that supply, demand and nominal shocks arising from external and internal economic developments are important for the variations of current account balance in all of the countries investigated. We infer that the effects of monetary policy shocks on current account balance can be studied within the DSGE modelling framework, along with other shocks, to analyse current account imbalances. Furthermore, the VDCs indicate that current account balance can explain nearly 15% of the variation *per se* up to the ensuing 20th quarter, revealing its significance for the conclusion of foreign trade agreements, existing trade connections, and markets for foreign trade flows.

Table 4. VDCs of *sirt*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	0	0	0	0.888307	0	0.05718	0.054513
4	0.000161	0.000251	7.44E-05	0.663867	0.022148	0.067111	0.246388
8	0.000386	0.000842	0.000245	0.398644	0.065349	0.067119	0.467415
12	0.000555	0.001079	0.000278	0.252624	0.075129	0.060282	0.610053
16	0.000754	0.001115	0.00025	0.167552	0.07208	0.05377	0.704479
20	0.001016	0.001067	0.000207	0.114464	0.066218	0.048465	0.768563

Source: Authors' Computation.

As shown in *Table 4*, call money/interbank rate plays the greatest role in explaining variations *per se* in ensuing periods. This finding exposes that the dynamics of the interbank money market is critically important in explaining variations in short-term interest rates. In this respect, it may be inferred that factors affecting short-term borrowing requirements of banks and the liquidity of the interbank money market should be analysed in detail. According to the VDCs, we can also interpret that the bond market may have a considerable impact on the interbank money market up to the ensuing 20th quarter. It can, therefore, be proposed that monetary policy authorities in the OECD countries we have investigated should also determine possible impact of long-term interest rates on short-term interest rates, when attempting to achieve their targets. Herein, external imbalance can become a crucial factor for variations in short-term interest rates, because VDCs indicate that current account balance may account for nearly 10% of the variation of the call money/interbank rate up to the ensuing 20th quarter.

Table 5. VDCs of *dlyie*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	0.998671	3.75E-07	0.000233	0	0	0	0.001096
4	0.817059	0.0787558	0.014422	0.0012808	0.0268479	0.0302345	0.0314
8	0.561064	0.0602731	0.023583	0.0079883	0.0771834	0.0912144	0.178694
12	0.372323	0.087302	0.024242	0.020294	0.1488685	0.1086679	0.238303
16	0.270034	0.1019371	0.024242	0.0343977	0.2875056	0.0913705	0.190513
20	0.233593	0.0680835	0.018634	0.0410566	0.4493363	0.0681651	0.121131

Source: Authors' Computation.

Table 5 shows that changes in industrial production growth rate make a major contribution to variations in bond yield spreads between the countries under investigation and the U.S., explaining nearly 25% of the variation. Thus, we may infer that determining the effects of factors influencing aggregate demand is important, since this is also the case with technology shocks, in terms of analysing fluctuations in interest rates. Along with the level of real economic activity, our VDCs indicate that currency markets may affect the spread between bond yields, since we find that real exchange rates (deviation of the original series from its equilibrium value) account for nearly 5% of variation in bond yields up to the ensuing 20th quarter. Accordingly, we can also assert that changes in the level of foreign competiveness may cause considerable changes in the economic situation, which monetary policy authorities should consider in all countries analysed. We have also found that current account balance is another crucial variable in terms of analysing variations in bond yield spread, since the volume of current account balance can be a determinant of the level of capital needed and of financial account. On the other hand, we may argue that foreign and domestic prices may indirectly lead to changes in the dynamics of the bond market in all 12 countries, according to the VDCs. *Table 5* indicates that variations in government bond yield spread are mainly driven by their own shocks up to the ensuing 20th quarter in said countries. However, VDCs imply that short-term interest rates cannot be an efficient tool for controlling long-term interest rates, because variations in bond yield spread account for nearly %4 of variation in call money/interbank rate up to the ensuing 20th quarter. We can, therefore, infer that the previous dynamics leading to the flow of funds between the countries under investigation and the U.S. may well influence the dynamics of the flow of funds in future periods.

Table 6. VDCs of *brog*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	0.00E+00	7.38E-01	5.70E-06	0	8.65E-07	0.00151	0.260483
4	7.90E-03	1.70E-01	5.73E-05	3.62E-02	2.47E-01	0.112838	0.426005
8	1.20E-02	4.22E-02	0.000298	1.21E-02	5.20E-01	0.228302	0.1851
12	1.12E-02	2.39E-02	0.001289	1.25E-02	5.82E-01	0.283303	0.085808
16	1.04E-02	2.39E-02	0.002406	3.37E-02	5.38E-01	0.296253	0.095341
20	1.17E-02	3.13E-02	0.003309	4.80E-02	4.99E-01	0.290619	0.116072

Source: Authors' Computation.

Broad money can be regarded as a crucial variable reflecting changes in economic situations. More precisely, the total volume of money supply in an economy highly interacts with various macroeconomic variables. The total volume of credit is also influenced by changes in the balance of payments, since net domestic assets are related to net foreign assets when the liberalisation and financial integration process is considered. In this respect, our VDCs show that current account balance and bond yield spread explain approximately 60% of variation in real broad money growth, verifying the significance of net foreign assets for monetary aggregates in the countries analysed. We can, therefore, assert that the foreign competiveness level and monetary policy stance of the countries investigated and the U.S. are factors influencing variations in credit volume. On the other hand, there can also be interactions among currency markets and money markets in the countries under investigation, since we find that deviations in real exchange rates account for nearly 30% of variation in broad money. Accordingly, we suggest that the central banks of all 12 countries should incorporate the role of financial markets in their monetary policy formulation and money demand equations. The VDCs also imply that foreign price dynamics may be transmitted to domestic prices in these countries through changes in credit volume and aggregate demand in future periods. We, therefore, suggest that this mechanism should be taken into consideration when determining monetary policy.

Table 7. VDCs of *indg*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	6.83E-01	0.002615	2.25E-03	2.71E-03	0	0.257703	0.051722
4	5.75E-01	2.00E-03	3.69E-03	1.36E-01	6.11E-03	0.060743	0.216457
8	4.82E-01	0.005757	6.88E-03	1.11E-01	5.75E-02	0.113099	0.223764
12	4.58E-01	0.008082	1.49E-02	6.34E-02	9.62E-02	0.213301	0.146117
16	5.01E-01	0.00946	2.52E-02	7.96E-02	9.15E-02	0.200706	0.092534
20	5.93E-01	0.010305	3.37E-02	5.66E-02	7.44E-02	0.144218	0.087777

Source: Authors' Computation.

From *Table 7* it becomes apparent that the industrial production growth rate is influenced by its own past dynamics, since it accounts for nearly 60% of the variation *per se* up to the ensuing 20th quarter. If follows that we can assert that supply shocks, namely, technology shocks, are critically important when analysing fluctuations in business cycles in all countries in the study. On the other hand, we can also suggest that dynamics of the balance of payments play a considerable role in variations of real economic activity due to the role of current account balance and bond yield spread in explaining variations in industrial production growth rate. In this respect, determining domestic and foreign monetary policy implementation is an important issue regarding real business cycles for all countries investigated, as is the role of foreign trade agreements. The VDCs also indicate that domestic and foreign price and currency market dynamics can impact industrial production growth rate in all countries in the study. More precisely, we find that deviations in real exchange rates account for nearly 15% of variation in industrial production growth. Monetary policy decisions and the dynamics of bond markets may also prove important factors when explaining variations in industrial production growth, reflecting the role of money markets in real economic activity in the OECD countries under investigation. We can, therefore, assert that the general equilibrium modelling frameworks employed by the central banks of these countries should consider economic and financial factors as a major source of business cycle fluctuations, as also argued by Mishkin (2011) and Chauvet *et al.* (2015), although other variables in our empirical model are not major determinants of economic growth.

Table 8. VDCs of *infl*

Forecast Horizon	Shocks						
	indg	*infl*	*brog*	*sirt*	*dlyie*	*drexch*	*dcur*
1	0.019559	0.008833	1.70E-04	2.61E-03	1.12E-03	5.40E-01	0.427708
4	0.005405	0.190071	9.50E-03	4.52E-02	1.89E-03	4.02E-01	0.345934
8	0.004346	0.28234	6.46E-03	2.12E-01	1.53E-03	2.63E-01	0.230324
12	0.004683	0.287746	5.32E-03	2.27E-01	2.66E-03	2.39E-01	0.233591
16	0.004815	0.268857	4.91E-03	2.27E-01	5.93E-03	2.34E-01	0.254488
20	0.004696	0.260833	6.76E-03	2.41E-01	9.89E-03	2.27E-01	0.249821

Source: Authors' Computation.

Our VDC analysis also supports this assertion by indicating that inflation explains nearly 25% of the variation *per se*. Nevertheless, we can infer the importance of inflation expectations and pricing behaviours of economic agents in the countries under investigation. In terms of shaping inflation expectations, and, therefore, influencing inflation in future periods, real value of the currencies of all 12 countries may be regarded as a crucial factor, since we have found that deviations in real exchange rates account for approximately 20% of variation in inflation in the ensuing 20th quarter. We can, therefore, suggest that currency markets may have

a considerable impact on inflation in the countries under study. The VDCs also reveal that current account balance and call money/interbank rate can influence the supply and demand dynamics in said countries through changes in net foreign assets of their central banks. Therefore, the central banks of these countries should incorporate the financial sector and financial frictions in their general equilibrium frameworks.

5. Conclusions

In a framework of PVAR modelling with quarterly data, we have estimated VDCs and IRFs to determine interactions between variables. Our VDCs show that real exchange rates can be accepted as crucial sources of fluctuation in external and internal economic factors. Variations in real exchange rates may be expenditure switching and may lead to current account imbalances via changes to the level of foreign competiveness of Australia, Brazil, Canada, the Czech Republic, Iceland, Israel, Korea, New Zealand, Norway, South Africa, Sweden, and the United Kingdom. The VDCs also show that the real value of the currencies of the countries under investigation may affect domestic consumption and investment decisions of economic agents in these countries. It follows that it can also be asserted that real exchange rates may impact supply and demand dynamics in the goods market and lead to inflation in all 12 countries. The IRFs show that appreciation in real exchange rates leads to increased current account deficits, implying that the capital account size in these countries could eventually be influenced by deviations in real exchange rates.

The IRFs also reveal that appreciation in real exchange rates may increase bond yield spreads between the countries we study and the U.S, possibly due to an increased need for foreign funds to finance current account deficits in said countries. We can, therefore, infer that the real value of the currencies of Australia, Brazil, Canada, the Czech Republic, Iceland, Israel, Korea, New Zealand, Norway, South Africa, Sweden, and the United Kingdom against the U.S. dollar may have considerable impact on bond markets of these countries and the U.S., in contrast to the IFE and UIRP. However, IRFs showed that changes in real exchange rates do not have any statistically significant impact on call money/interbank rate. This finding indicates that the role of real exchange rates cannot be incorporated into monetary policy decisions in said OECD countries when implementing an inflation targeting regime. This implication is also supported by the finding of the IRFs that deviations in real exchange rates do not lead to statistically significant impact on industrial production growth and inflation. More specifically, these findings reveal that appreciation/depreciation of real exchange rates in said countries may lead to considerable changes in foreign trade, which, in turn, may negatively influence domestic producers and aggregate supply in all 12 countries. It can, therefore, be asserted that the price elasticity of foreign trade in these countries is relatively higher.

On the other hand, it can be assumed that current account balance is influenced by changes in real income and vice versa. The VCDs imply that positive shocks to current account balance may have considerable impact on the economic situation. The IRFs indicate that improvements in current account balance can lead to a negative economic outlook by negatively influencing industrial production growth. In this respect, we can interpret that the positive effect of decrease in final imported goods on real economic activity will be relatively lower than the negative effect of decrease in imports of relatively high efficiency intermediate and capital goods, affecting total factor productivity and industrial production growth. The IRFs also suggest that improvements in current account balance may lead to possible increase in net foreign reserves; however, this factor does not lead to appreciation of home currency, which, in turn, may negatively affect current account balance in the long term. Although net domestic assets are related to net foreign assets, IRFs imply that improvements in current account balance can lead to a fall in capital account, and thus, growth rate of broad money. Accordingly, IRFs also reveal that improvements in current account balance can also be recognised as a factor causing a fall in the flow of funds in domestic markets, which, in turn, increases short-term interest rates and long-term interest rates in the 12 countries in our study with respect to the U.S.

According to our empirical study, bond yield spreads can be accepted as another crucial variable that influences net foreign and net domestic assets. VDCs indicate that bond yield spread can lead to variations in real exchange rates, current account balances, broad money, industrial production growth, and inflation. Thus, we can infer that monetary and fiscal policy changes in these countries and in the U.S. may affect the flow of funds across said countries. However, the IFRs imply that contractionary economic policy in Australia, Brazil, Canada, the Czech Republic, Iceland, Israel, Korea, New Zealand, Norway, South Africa, Sweden, and the United Kingdom does not promote the flow of funds into their money markets, which, in turn, decreases broad money. According to the IRFs, it can be asserted that increases in short-term interest rates may negatively affect expectations in the OECD countries, which, in turn, cause capital outflows, depreciation of home currencies against the US dollar and a fall in imports, contrary to the concept of overshooting. This finding reveals that short-term interest rates can be used as an efficient monetary policy tool to eliminate real exchange misalignments in the short-term. On the other hand, bond yield spread has the opposite impact on real exchange rates, according to the IRFs. More precisely, increases in bond yield spread may lead to appreciation of home currencies in the OECD countries studied, due to the flow of funds. This assertion is supported by the finding of IRFs indicating that bond yield differences may result in a rise in current account deficit. Bond yield differences may cause increase in capital inflows to the bond market, which, in turn, facilitates the financing of current account deficits. IRFs show that increases in call money/inter-

bank rate do not have any statistically significant impact on the 10-year government bond yield spread. In this respect, it is suggested that monetary policy authorities of the 12 OECD countries should develop new tools and policies to control long-term interest rates. Consequently, for further research, an open-economy DSGE modelling framework should be adopted by policymakers and researchers to clarify the channels through which external and internal economic changes may impact macroeconomic variables in sample countries with the inclusion of exchange rates, domestic expenditure behaviours, foreign output, and inflation shocks, foreign and domestic monetary policy shocks, terms of trade shocks, and fiscal policy changes.

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HOW DOES COMPETITION AFFECT BANK STABILITY AFTER THE GLOBAL CRISES IN THE CASE OF THE ALBANIAN BANKING SYSTEM?

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Abstract
This paper addresses the dynamic relationship between competition and bank stability in the Albanian banking system during the period 2008 - 2015. For this reason, we estimate a new composite individual bank stability indicator that relies on bank balance sheet data. Then, we construct a proxy for bank competition as referred to by the Boone indicator. We also calculated the Lerner index and the efficiency adjusted Lerner Index, as well as the profit elasticity index and the Herfindahl–Hirschman Index. The main results provide strong supportive evidence for the "competition–stability" view – namely, that lower degree of market power sets banks to less overall risk exposure; results also show that increasing concentration has greater impact on bank fragility. Similarly, bank stability is positively linked to macroeconomic conditions and capital ratio and inversely proportionate to operational efficiency. We also used a quadratic term of the competition indicator to capture a possible non-linear relationship between competition and stability, but found no supportive evidence.

JEL Classification: C26, E32, E43, G21, H63
Key Words: Bank Fragility, Competition, Boone and Lerner indicator, Panel Data, GMM

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1. Introduction

The international process of banking liberalisation, triggered by excessive bank risk taking, has gone hand in hand with increased occurrence of systemic banking crises, culminating in the Global Financial Crises (henceforth, GFC) of 2007-2009 (Beck, *et al.* (2013). This has yet again heightened interest in the relationship between competition, market structure and financial stability. However, no scientific consensus has been reached as to whether bank competition mitigates or exacerbates financial stability, since predications emerging from theoretical models and empirical studies are ambiguous and, so far, also inconclusive (Kasman and Carvallo, 2014). The traditional view argues that fiercer competition in the banking sector would give banks proper incentives to behave prudently and would, therefore, lead to a more efficient system, which favours bank stability (Boyd and De Nicolo 2005, Beck *et al*. 2006, Schaeck *et al*. 2009 and Schaeck and Cihak 2014). However, others have challenged this view arguing, instead, that more intense bank competition reduces market power and profit margins, which essentially lowers the franchise value of banks. As a result, this will encourage banks to take greater risks so as to make up for the loss of declined profit (franchise value), which may also lead them to take on more risky investment approaches, eventually increasing the probability of bank crisis (Keeley 1990, Allen and Gale 2004, Boyd *et al*. 2006, Agorakia *et al*. 2011, Leroy and Lucotte 2017). On top of these mainstream views, Martinez-Miera and Repullo (2010) argue that there is a U-shaped relationship, since lower degree of bank concentration may reduce borrowers' probability of default (risk-shifting effect), as well as interest payments from performing loans, which serve as a buffer covering loan losses.

This similarly inconclusive debate is particularly critical for Albania, as the Albanian financial system mainly consists of the operation of the banking sector, where a large number of banks operate in a specific, small, open economy, and the equity market is remarkably underdeveloped. For example, by the end of 2015, the ratio of financial system assets to GDP reached 99.2%, with the banking sector owning 91.4% of financial system assets (90.6% of GDP), while stock market capitalisation was the lowest in South-Eastern Europe. On the one hand, financial developments and innovations in the banking sector have been the main driving force behind economic prospects, while improving market and macroeconomic conditions, as well as increasing competition has motivated larger foreign banks in more developed countries, mostly in the Eurozone, operating at relatively lower margins, to extend cross-border operations into potentially new and more profitable markets, such as that of Albania. On the other hand, such patterns also become a rising concern about increased competition in the banking sector, often criticised for being "overbanked". Therefore, bank stability may be triggered by excessive bank risk-taking due to further competition, which may shift focus towards increasing

profits, while ceasing to monitor and assess risk properly. Still, the GFC did not affect the Albanian economy as strongly as it affected other countries in South-Eastern Europe. At the same time, banks showed apparent resilience during this period and, similarly, they emerged from the GFC in a relatively stable state. However, among other challenging issues, problems of banks being "too-big-to-fail have also emerged: firstly in terms of market share, since the 6 largest banks hold nearly 80% of the market, and, secondly, due to a ratio of nearly 16.2% for the whole market and 22.2% for large banks; in other words, the Herfindahl–Hirschman Index (HHI) suggests that the Albanian banking sector is "moderately concentrated". Similarly, evidence (See also Graph 1 in Appendix A) shows that there is a relatively close relationship between the degree of market power and the extent to which banks are exposed to greater instability, implying that competition precedes bank fragility. Therefore, the effect of the regulatory framework on competition and banks' risk-taking incentives as well as, ultimately, bank stability make this a particularly interesting environment in which to study the competition-stability nexus.

Against this background, existing literature provides a fairly comprehensive review on the competition-stability nexus, but there is still one question concerning these cases that needs to be answered empirically, since there is no evidence on the nature of this nexus in the case of a small-opened emerging economy, namely Albania, and, in particular, after the GFC. Therefore, the main question addressed in this paper focuses on how competition affects bank stability after the GFC. The paper makes use of a sample with quarterly data for 16 banks operating in the Albanian financial sector over the period 2008–2015. The empirical estimation approach follows a five-step procedure. First, we constructed a composite individual bank stability indicator, as explained by Shijaku (2016a). Second, we calculated a competition indicator, as suggested by Boone (2008). Then, empirical estimation was based on a dynamic (AB 1-step) General Method of Moments (GMM). Finally, we deepened our empirical analysis either by splitting the sample with regards to large and small banks or by checking for any non-linearity relationship between competition and stability in the case of the Albanian banking sector. Finally, we also used other alternative measures of competition, which include the use of the Lerner index and the efficiency-adjusted Lerner index, as well as the use of the profit elasticity index and the Herfindahl–Hirschman Index.

This paper complements and extends existing literature on this issue in several aspects. First, to the best of our knowledge, this is the first study to empirically investigate the competition-stability nexus focusing only on the period after the GFC, which may highlight the impact of the global turmoil on individual bank risk exposure. Second, it avoids any pitfall, as described by Uhde and Heimeshoff (2009), related to data issues and ensures comparability across both dependent and independent variables, since it focuses only on a single country. Besides, we do not

make use of data from the Bankscope database, but, rather, we use data taken from the Bank of Albania, which provides the most accurate and reliable banking dataset. Third, this paper uses neither real episodes of banking crises nor a binary approach as a proxy for instability moments. Furthermore, it does not use the Z-score or credit risk as an in-variant measure of bank risk-taking behaviour and distance to solvency, concerning that Fu *et al.* (2014) provide some arguments against being used as means of bank stability proxies. By contrast, rather than focusing only on one aspect of bank risk exposure, this paper proceeds by using, instead, a proxy that includes a wide set of consolidated balance sheet data with regards to different aspects of bank stability conditions; at the same time, it benefits through the use of the principal component analysis approach. Hence, we believe that our proxy stands out to be a much better approach to directly capture any possibility of outright bank defaults or/and instability episodes. This approach is also advantageous due to the fact that it avoids any pitfalls of using the binary approach to crises episodes. To the best of our knowledge, no previous study has employed such a bank stability indicator as the dependent variable to investigate the competition-stability nexus and we believe this is an important step forward toward better understanding the underlying mechanisms. Besides, we also use another alternative competition indicator, as proposed by Boone (2008), which also incorporates the concept of efficiency structure based on bank behaviour. Finally, we provide appropriate evidence, by fragmentising this sector according to the size of the banks, and looking into whether certain institutions show different competition behaviour than others.

Empirical findings provide strong evidence supporting the "competition-stability" view that greater degree of competition further improves bank stability conditions. This implies that there is no trade-off between competition and bank stability in the banking sector in Albania. A number of robustness checks also confirm our main findings that support the "competition-stability" view. Results further indicate that greater concentration has a negative impact on bank stability. We find no evidence of a non-linear relationship in the competition-stability nexus. Similarly, there is no such evidence even when we split the sample to account for small banks and large banks. Furthermore, we find that the positive relationship in the competition-stability nexus is stronger for small banks rather than for large banks. Finally, bank stability is also found to be crucially sensitive to macroeconomic conditions, improving bank operation efficiency and capital structure.

The remainder of the paper is structured as follows: Section 2 summarises the literature review. Section 3 presents the methodology with regards to model specification and data. Main results are presented in Section 4. Section 5 expresses the conclusions of our work.

2. Literature review

The issue of the competition-stability nexus still remains ambiguous and unresolved, despite a large body of theoretical and empirical literature (Kasman and Carvallo 2014) that explains the reasons for and the channels through which competition had affected bank stability, long before the GFC started.

2.1 Theoretical literature

From a theoretical perspective, there are two major streams with diametrically opposing views. On the one hand, it has been a widely-held belief that intense competition, *ceteris paribus*, worsens stability due to risk-taking on the asset side, as the numerous episodes of crises, including that of 2007-2009, show. Two of the channels through which competition might affect stability conditions are: (i) potential exacerbation of the coordination problem of depositors/investors on the liability side and fostering runs and/or panics, which may be of a systemic nature or events unrelated to fundamentals, such as bad news on bank assets; (ii) increasing incentives to take higher risk, either on the liability or the asset side, which increases the probability of default [Dushku (2016)]. Recently, these views have been reconciled by introducing asymmetric information and linking the probability of a run to the strength of fundamentals (Goldsein and Pauzner (2005) and Rochet and Vives (2004)). On the other hand, there are also those who believe that competition may be beneficial for a bank's portfolio risk, since it is expected to produce the same effects as competition might have in other sectors, namely, to improve efficiency and foster innovation [Hay and Liu, (1997)], thus leading to a wider variety of products, lower prices, wider access to finance and better service [OECD, (2010)].

The proponents of the competition-fragility view[1] argue that borrowers are heterogeneous and banks perform tests to sort them out, and an increase in the number of competing banks may worsen the quality of tests. The idea of a negative relationship between the two has been pervasive in relevant literature since the 1990s. As found by Keeley (1990), it is, in fact, the decline of banks' margins and charter values that might magnify problems between banks and depositors, thus inducing the former to take on new risks, which may, in part, be shifted to depositors and, ultimately, to the government, dramatically increasing their failure probabilities (Matutes and Vives, 2000). The idea is that increasing competition would lead to lower interest rates on loans. This would lower margins of their loans and would erode the banks' net present value of future profits to zero. Without the potential of making

1. See, among others, Keeley (1990) Matutes and Vives (2000); Hellmann, Murdock, and Stiglitz (2000); Allen and Gale (2004); Beck, Asli Demirgüç-Kunt, and Levine (2006); Evrensel, (2008); Wagner (2010); and De Haan and Poghosyan, (2012).

future profits banks would acquire more risk and relax their investment selection requirements. In return, this would give them an incentive to expand or/and rely on new risky investment policies, including high-risk and high-yield investments, in an attempt to maintain the former level of profits. This behaviour dominates in more competitive markets, thus contributing to the destabilising effect on both asset and liability incentives. However, from another point of view, with regards to the assets side, lower interest rates would increase return on investment for borrowers, which would encourage them to expand more effort to succeed, thus off-shoring for the diminishing margins through higher lending and, as such, reducing the risk of the bank to default [Cartletti and Hartman, (2002)]. On the liability side, runs and systemic crises could occur either as a consequence of a co-ordination failure among depositors or as a rational response by depositors to a bank's impending insolvency, as well as due to the extent to which competition might affect the operation of the interbank market. In other words, banks with surplus liquidity and market power in the interbank market might face a choice with opposite effects: (i) refuse to finance inefficient banks increasing the probability of default or helping troubled banks in need of liquidity in order to prevent contagion [Carletti and Hartmann (2002), OECD (2010)].

Those who support the competition-stability view[2] argue that competition may be beneficial for a bank's portfolio risk. The idea behind the so-called "charter value" or the possible positive margin effect hypothesis is that banks with some market power tend to enjoy high returns and, thus, face high opportunity cost of going bankrupt [Berger, *et al.* (2009)]. Therefore, they tend to behave more prudently in regard to risk-taking by holding more equity capital and a less risky portfolio and by rejecting those risky investments that could affect their stability and, thereby, jeopardise future profits. For example, Boot and Thakor (2000) suggest that, because large banks tend to engage in credit rationing, they have fewer but higher quality credit investments, which enhance their financial soundness. Besides, market power in the banking sector could lead to higher quality loan portfolios, improved capital allocation and enhanced profits level [Boyd *et al.* (2004), Amidu and Wolfe, (2013)], which may boost a higher "capital buffer" to protect them from adverse external economic and liquidity shocks and moral hazard (risk shifting) with a negative impact on the stability of the banking system (Beck *et al.* 2006, Berger and Bouwman 2013, Fiordelisi and Mare 2014).

2. See, among others, Boot, *et al.* (2000), Bond and De Nicolò (2005), Berger, *et al.* (2009); De Nicolò and Lucchetta (2009); Beck, *et al.* (2006); Berger and Bouwman (2013); Marques-Ibanez, *et al.*, (2014).

Finally, different from the two mainstream views above, Martinez-Miera and Repullo (2010) modify the model in Body and De Nicolo (2005), assuming that a U-shaped relationship exists. They show evidence that, at first, the probability of bank default goes down, but then goes up, after a certain point, as bank competition increases, which is also supported by the findings of Berger *et al*. (2009), Jeona and Limb (2013), Jiménez *et al*. (2013), Liu *et al*. (2013), Samantas (2013).

2.2 Empirical Literature

In line with appropriate theoretical views, many recent studies have tried to empirically analyse the nexus between competition and stability in the banking system. Several authors have tested the competition-stability nexus by focusing on competition indicators based on the structure-conduct-paradigm (Beck *et al*. 2006, Boyd *et al*. 2006, de Haan and Poghosyan 2012a, de Haan and Poghosyan 2012b, Mirzaei *et al*. 2012, Câpraru and Andrieş 2015, Fernández *et al*. 2016, Pawlowska 2016) and the relative market-power hypothesis (Hesse and Čihák 2007, Levy Yeyati and Micco 2007, Uhde and Heimeshoff 2009, Wagner 2010, Fiordelisi and Mare 2014, Pawlowska 2016), but have found mixed evidence. For instance, Boyd and De Nicoló (2005) show that, in a concentrated market, banks tend toward more risk-taking and increasing concentration leads to higher loan rates charged to borrowers. Boyd *et al*. (2006) use a cross-sectional sample of about 2,500 U.S. banks in 2003 and a panel data set of about 2,600 banks in 134 non-industrialised countries for 1993-2004. Authors find that banks' probability of failure increases with market concentration, even though as Berger *et al*. (2009) suggest their conclusions are drawn using some form of concentration indicators, which might be insufficient measures to properly proxy any market structure. Bushman *et al*. (2016) use a new survey approach of competition, which captures managers' current perceptions of competitive pressures deriving from all different sources, including potential entrants, non-bank competitors and labour markets. The authors provide strong evidence that greater competition increases both individual bank risk and banks' contribution to system-wide risk. They also show that higher competition is associated with lower underwriting standards, less timely loan loss recognition and a shift towards non-interest revenue. Leroy and Lucotte (2017) use the Z-score and systemic dimensions of risk and the Lerner index, as in Ahmed and Mallick (2017), to analyse the relationship between competition and bank risk across a large sample of European listed banks over the period 2004-2013. Results suggest that competition encourages bank risk-taking and then increases individual bank fragility. This result can be explained by the fact that weak competition tends to increase correlation in the risk-taking behaviour of banks. Other papers that confirm the competition-fragility view include Beck *et al*. (2013), Jiménez *et al*. (2013), Soedarmonoa *et al*. (2013), Fu *et al*. (2014), Weiß *et al*. (2014).

By contrast, Beck *et al.* (2006) and De Nicolò *et al.* (2009) found that crises are less likely in economies with more concentrated banking systems. Another empirical study by Schaeck *et al.* (2009) uses the Panzar and Rosse H-Statistics as an alternative measure of competition in 38 countries, during the period 1980-2003, and conclude that more competitive banking systems are less prone to systemic crises and that time to crisis is longer in a competitive environment. Jiménez *et al.* (2013) use a unique dataset for the Spanish banking system and report that standard measures of market concentration do not affect the NPL ratio; however, they found evidence in favour of the franchise value paradigm when using the Lerner index. Amidu and Wolfe (2013) investigate how the degree of competition affects diversification and stability using a sample of 978 banks in 55 emerging and developing countries over the period 2000-2007. The core finding is that competition increases stability as diversification across and within both interest and non-interest income generating activities of banks increase. Their analysis identifies revenue diversification as a channel through which competition affects bank insolvency risk in emerging countries. Other recent empirical papers that validate "competition-stability" view include Jiménez *et al.* (2010), Nguyen *et al.* (2012), Liu and Molyneux (2012), Amidu, (2013), Jeona and Limb (2013), Schaeck and Cihak (2014).

In addition, there are also other papers that validate both views. Berger *et al.* (2009) empirically analyse the link between credit risk (NPL ratio), bank stability (Z-score index) and capital ratio (capital ratio) and several measures of market power (Lerner and HHI), using bank level data from Bankscope on 8235 banks in 23 developed countries. Their results, consistent with the traditional "competition-fragility" view, suggest that banks with a higher degree of market power also have lower overall risk exposure. However, the data also provide some support for one element of the competition-stability view, namely, that market power increases loan risk, which may, in part, be offset by higher capital ratios.

The empirical papers mentioned above produce cross-country evidence. However, a few studies focus on a single banking sector. For example Zhao *et al.* (2010) examine the degree to which deregulatory measures aimed at promoting competition lead to higher risk-taking in the Indian banking system. The authors show evidence that improved competition through deregulation does not lead to efficiency gains but, rather, encourages further risk-taking. Fungacova and Weill (2013) analyse this issue based on a large sample of Russian banks over the period 2001-2007 and, in line with prior literature, they also employ the Lerner index as a measure of bank competition. Results clearly support the view that tighter bank competition enhances the occurrence of bank failures. Kasman and Kasman (2015) analyse the relationship between competition (proxies by the efficiency-adjusted Lerner) and bank stability (proxies by Z-Score and NPL ratio) on the Turkish banking system industry. The main results indicate that competition is negatively related to the NPL ratio, but positively related to the Z-Score. At the same time, only few papers

are loosely related to the research question we raise in the case of Albania. The most relevant work is by Dushku (2016)[3] who investigates the link between competition (measured by Lerner Index) and bank risk-taking (measured by Z-Score) for 15 banks operating in the Albanian banking system during the period 2004–2014. The author finds a positive link between competition and bank risk and shows that the nexus between total (plus foreign) credit risk and competition is non-linear.

Similar to the theoretical debate, empirical findings are also challenging. For example, Carbó *et al*. (2009) found that existing indicators of competition (i.e. Lerner index, the H-Statistics) lead to different conclusions concerning the degree of competition as they tend to measure different things[4]. Therefore, it is obviously that the biggest obstacle and the conclusions of extant empirical research vary widely and heavily depend on the indicators chosen for measuring the degree of bank competition risk as well as on the data used [Bushman *et al*. (2016)]. Therefore, one key challenge that explains such mixed results is related to the inappropriate measure used to properly identify bank competition and bank stability [Pawlowska (2016)]. In terms of the bank risk measure, the measure available is even more limited, while the biggest concern is that most measures make no distinction as to which aspect of risks they effectively approximate.

This paper complements and extends existing literature on this issue because it makes use of superior indicators to measure the state of bank competition and banks stability. Most existing empirical studies investigating this relationship at the microeconomic level focus either on credit risk alone, using some form of credit risk measure, such as the NPL ratios, or resort upon bank risk indicators constructed from balance sheet information, such as the Z-Score. In fact, while the Z-score can be interpreted as the number of standard deviations by which a bank is removed from insolvency, the NPL ratio focuses only on credit risk, but leaves out concerns with regards to liquidity and capital risk or other sorts of risks linked to the market within which banks operate. Hence, neither of them is a perfect substitute calculation to account for actual bank distress or the probability of default, which are, without doubt, the most appropriate concepts for defining bank risk (Fu *et al*. 2014, Kick and Prieto 2015). One concern, as Beck *et al*. (2013) place in their empirical analysis, is that both Z-Score and Lerner include profitability in the numerator and any positive relationship between the two might, thus, be mechanical rather than economically meaningful. In addition, we neither focused on real episodes of banking crises nor did we use a binary approach as a proxy for insta-

3. The note (2006) applies the Panzar-Rosse methodology to measure the competition degree in the Albanian banking system during the period 1999-2006. The author finds that Albanian banks operate in monopolistic competition conditions.
4. See also Bikker *et al*. (2012).

bility episodes, both of which may either provide insufficient data for estimation purposes or be based on a threshold level and, therefore, may be easily criticised or produce false signals of instability moments. By contrast, we extend empirical findings by including, instead, a more sophisticated proxy for bank stability based on a wide range of information that includes different aspect of bank risk exposure rather than focusing only on credit risk or profitability; at the same time our work benefits through the use of the principal component analysis approach. To the best of our knowledge, no previous study has employed such a bank stability indicator as the dependent variable to investigate the competition-bank stability nexus and we believe this is an important step forward towards better understanding the underlying mechanisms. Besides, we use a new measure of competition based on the reallocation of profits from inefficient banks to efficient ones, as proposed by Boone, (2008), which has been used in recent studies[5].

3. Methodology Approach

3.1 Dependant variable

Empirical literature provides a good description of how one might attempt to build a composite indicator of stability, but, obviously, this paper follows the Uniform Financial Rating System approach, introduced by the US regulation in 1979, referred to as CAELS rating (Capital adequacy, Asset quality, Earnings, Liquidity and Sensitivity to market risk (See Shijaku (2016a)[6]. First, using statistical methods, all indicators included in each of these categories are normalised into a common scale with a mean value of zero and standard deviation of one[7]. The formula is as follows:

$$Z_t = \left(\frac{X_t - \bar{\bar{\mu}}}{\bar{\sigma}} \right) \tag{1}$$

where, X_t represents the value of indicators X during period t; μ is the mean value and σ the standard deviation. Second, all normalised values of the set of correlated indicators used within one category are then converted into a single uncorrelated index by means of the statistical procedure, namely the principal component analysis (PCA) approach, which is yet again standardised based on the procedure in Equation (1). Then, the estimated sub-indices are transformed between the values

5. See also Van Leuvensteijn *et al.* 2011, Van Leuvensteijn *et al.* 2013, Kasman and Carvallo 2014, Marques-Ibanez *et al.* (2014), Schaeck and Čihák 2014, Duyguna *et al.* 2015, Kasman and Kasman 2015).
6. This approach is also used by the International Monetary Fund Compilation Guide 2006 on Financial Soundness Indicators, but also other authors, such as, Altman (1986), Sere-Ejembi *et al.* (2014) and Cleary and Hebb (2016).
7. Normalising the values avoids introducing aggregation distortions arising from differences in the mean values of indicators.

[0, 1] using exponential transformation [1 / (1 + exp(-Z*)]. Finally, our bank stability index (*CAELS*) is derived as a sum of the estimated exponentially transformed sub-indices, as follows:

$$BSI_{t,w} = \omega_1 \sum_{i=1}^{n} Z^*_{t,C} + \omega_2 \sum_{i=1}^{n} Z^*_{t,A} + \omega_3 \sum_{i=1}^{n} Z^*_{t,E} + \omega_4 \sum_{i=1}^{n} Z^*_{t,L} + \omega_5 \sum_{i=1}^{n} Z^*_{t,S} \quad (2)$$

$$\sum_{*=a,b,c,d,e} \omega^* = 1 \quad (3)$$

Where, *n* is the number of indicators in each sub-index; '*C*' relates to capital adequacy; '*A*' represents a proxy to asset quality; 'E' represents a proxy to earnings; '*L*' represents a proxy to liquidity efficiency categories; and '*S*' is related to the sensitivity of market risk. Z* is the exponentially transformed simple average of the normalised values of each indicator included into the sub-index of the individual bank stability index. Then, the estimated index is a relative measurement, where an increase in the value of the index for any particular dimension indicates a lower risk in this dimension for the period when compared with other periods.

The advantage of this approach is fourfold. First, *CAELS* represents a useful "complement" to on-side examination, rather than a substitute [Betz *et al.* (2014)]. Thereby, it creates an internal comprehensive monthly-based supervisory "thermometer" measurement to evaluate bank stability in real time and on a uniform basis, which, in return, can be used to identify those institutions that require special supervisory attention and concern with regards to both present and future banking sector conditions. Second, as suggested by ECB (2007), *CAELS* reflects more accurately the Albanian financial structure, since it attaches more weight to the banking sector, which includes the most prominent agents in the financial markets, while it takes advantage of a broad range of bank level data. Third, the PCA approach highlights the most common factor identifying patterns in the data without much loss of information, which, at the same time, resolves any issue of endogeneity between the left-hand side and the right-hand side variables. Fourth, it does not assume the probability form of the binary approach, which might expose it either to limitations of an insufficient number of episodes or to the vulnerability of the methodology employed to calculate the threshold level. The latter might even provide false banking distress signals. Rather, it consists of a simpler approach that is easier to explain and implement. Most importantly, it allows analysing the state of the bank as it develops and it is also applicable in cross-section comparisons.

3.2 Measuring competition: The Boone indicator

The literature review offers several methods for estimating the degree of competition within a specific sector, since this indicator cannot be directly measured. Some of the methods fall under the so-called Structural-Conduct-Performance (SCP) approach, which frequently includes measures of the market share and concentration ratio, numbers of banks or the Herfindhal-Hirschmann Index (HHI). The other methods are influenced by the New Empirical Industrial Organisation literature, and have been primarily developed from the non-structural models of Iwata (1974), Breshnahan (1982), Panzar and Rose (1987) and Lerner (1934) index or the price-to-cost margin (PCM) approach[8]. In addition to these already popular measures, an alternative measure of competition, as proposed by Boone (2008), measures the impact of efficiency on performance in terms of profit. The idea of this profit-elasticity index, which is also referred to as the Boone indicator (β), lies in the assumption that banks with superior efficiency, i.e. banks with lower marginal costs, gain more benefits in terms of profit as a result of market share reallocation from a less efficient to a more efficient bank and this effect becomes stronger in a highly competitive market structure. This means that, in a more competitive market, banks sacrifice more for being in a cost disadvantage position. To put it differently, banks are punished more harshly in terms of profits for cost inefficiency. Therefore, the stronger this effect is, the higher β will be in absolute value, which is also an indication of greater degree of competitiveness in that particular market. In the empirical application, the simplest equation to identify the Boone indicator, for bank *i* at time *t*, is defined as follows:

$$ln(\pi_{it}) = \alpha + \sum_{l=1\ldots T}^{L} \beta ln(MC_{l,it}) + \sum_{k=1}^{K} \omega \lambda_{k,it} + \varepsilon_{it} \quad (4)$$

Where, π and MC denote the profit and the marginal cost for banks (proxy efficiency), respectively; α is the bank fixed-effect; λ is a set of control variables associated with coefficient ω; ln is the log-linearised transformation of the variables; and ε is an idiosyncratic shock. The market equilibrium condition is E=0. The E-statistic is $\sum_{l=1}^{L} \beta$, which gives the profit elasticity, that is, the percentage change in profits of bank *i* as a result of a percentage change in the cost of this bank. Theoretically, this indicator is expected to have a negative value, i.e. the increase in costs reduces profit, which can be interpreted as a reduction in the capacity of the bank to affect its losses due to an increase in competition. For this reason, we would expect that more efficient banks may choose to translate lower costs either

8. The Lerner index has been widely used in recent research including Berger *et al.* (2009), Cipollini and Fiordelisi (2012); Fu *et al.* (2014). Dushku (2015) calculates it in the case of Albania by considering the difference between price and marginal cost as a percentage of prices.

into higher profits or into lower output prices in order to gain market share. As a consequence, when using this measure for analysing competition in the banking sector, some researcher[9] transform the formula of the Boone indicator and replace the value of profit with a bank market share value, as follows:

$$ln(MS_{it}) = \alpha + \sum_{l=1...T}^{L} \beta ln(MC_{l,it}) + \sum_{k=1}^{K} \omega \lambda_{k,it} + \varepsilon_{it} \quad (5)$$

Where, MS is the market share of bank *i* at time *t*. In addition, as in the case of the Lerner index, the calculation of the Boone indicator is also based on the estimation of marginal costs, which, based on Fiordelisi and Mare (2014) and Dushku (2015), are estimated based on a trans-log cost function (TCF), as follows:

$$lnTC_{it} = \alpha_0 + \alpha_1 lnQ_{it} + 0.5\alpha_2 (lnQ_{it})^2 + \sum_{j=1}^{3} \beta_j lnP_{it_j}$$

$$+ \sum_{j=1}^{3}\sum_{k=1}^{3} \theta_{jk} lnP_{it_j} * lnP_{it_k} + \sum_{j=1}^{3} \gamma_j lnQ_{it} * lnP_{it_j} \quad (6)$$

$$+ \tau_1 Trend + 0.5\tau_2 (Trend)^2 + \tau_3 Trend * lnQ + CRISIS + \varepsilon_{it}$$

Where, TC is the total costs of bank *i* at time *t*, Q is the bank output, P is a vector of input prices, namely labour price (P_1), price of borrowed funds (P_2) and capital price (P_3), $Trend$ is a time trend capturing the dynamics of the cost-function (efficiency) over time, $CRISIS$ is a dummy variable to account for the effect of the GFC, and α, β, θ, γ and τ are coefficients to be estimated. ε_{it} is a two-component error term computed as follows:

$$\varepsilon_{it} = \mu_{it} + \omega_{it} \quad (7)$$

Where, ω_{it} is a two-side error term, and μ_{it} is a one-sided disturbance term representing inefficiency. Then, from Equation (6), assuming that input prices are homogeneous, the marginal cost can be derived as follows:

$$MC_{it} = \frac{\delta TC_{i,t}}{\delta Q_{i,t}} = \frac{TC_{i,t}}{Q_{i,t}} \left[\hat{\alpha}_1 + \hat{\alpha}_2 lnQ_{it} + \sum_{j=1}^{3} \hat{\gamma}_j lnP_{it_j} + \hat{\tau} Trend \right] \quad (8)$$

9. Van Leuvensteijn *et al.* (2011), Tabak *et al.* (2012), Van Leuvensteijn *et al.* (2013).

The cost function must be homogeneous of degree one in input prices, which imposes some restrictions on parameter estimates. Linear homogeneity means that the percentage increase in all three input prices raises the value of the cost by the same proportion. This property implies that the value of these three input prices included in the cost function represents the total cost. The linear homogeneity in the property of input prices requires that the following restrictions on parameter estimates hold:

$$\sum_{j=1}^{3} \theta_j = 1 \tag{9.1}$$

$$\sum_{j=1}^{3} \beta_j = 0 \tag{9.2}$$

$$\sum_{j=1}^{3} \sum_{k=1}^{3} \theta_{jk} = 0 \tag{9.3}$$

For the purpose of our research we estimated the Boone indicator using both Equation (4) and Equation (5). However, the former is operationally impossible due to the negative net income generated by some of the banks operating in the Albanian banking system in 2008-2010. To overcome this problem, the bank profit value was replaced by the volume of net interest profit. Then, Equation (4) and Equation (5) were often run using the Ordinary Least Square (OLS) approach with random effects.

3.3 The Empirical Approach

The empirical model specification draws on the extensive review of previous studies, but it also departs from Shijaku (2016a) and Shijaku (2016b) to consider the link between competition and bank stability instead of market size. The model is specified as follows:

$$CAELS_{i,t} = \alpha + \beta_1 * X'_{i,t} + \varepsilon_{i,t} \tag{10}$$

where, $CAELS_{i,t}$ is our stability indicator of bank i at time t, with i = 1, ..., *N* and t = 1, ..., T, expressed as a function of a set of explanatory variables ($X'_{i,t}$) grouped into three main categories: (1) $Banking'_{i,t}$ is a set of bank-specific explanatory variables, namely operational efficiency and leverage ratio; $Market'_{i,t}$ is an industry explanatory variable proxy by the Lerner index; $Macroeconomics'_{i,t}$ is a set of control variables that account for the state of the economy, which consists of two variables, namely, output and primary sovereignty risk. α is a constant term. β is

a vector of coefficients to be estimated. $\varepsilon_{i,t}$ is an error term that is assumed to be identically and independently distributed with a mean value of 0 and variance $\sigma_u^2 A = \pi r^2$.

One potential problem with Equation [10] is the fact that, as a partially specified model, it puts together a variety of variables and, so, it nests a conditional restriction with a variety of unconditional ones leading to over identification problems. Under these circumstances, Maximum Likelihood estimators need to identify the moments whose squares are minimised in order to satisfy only the subset of correct restrictions. To correct this issue, the estimation approach strictly follows the methodology as in Shijaku (2016b), which, based on the dynamic General Method of Moments (GMM), weighs differences (AB-1-step) as proposed by Arellano and Bond (1991) and Arellano and Bover, (1995). Han and Phillips (2010) suggest GMM is constructed to be capable of achieving partial identification of stochastic evolution and to be robust for the remaining un-modelled components. In practical terms, GMM is also a virtuous approach to deal with potential endogeneity and dynamic panel data problems in model estimation [Anderson and Hsiao (1981)]. Furthermore, the GMM weighted differences first step (AB-1-step) approach would also resolve un-ward (down-ward bias in standard errors (t-statistics), due to its dependence on estimated values (as it uses estimated residuals from an one-step estimator), which might lead to unrealistic asymptotic statistical inference [Judson and Owen, (1999); Bond and Windmeijer (2002); Ansari and Goyal (2014)], particularly in the case of a data sample with a relatively small cross-sectional aspect [Arellano and Bond (1991)]. The instrument variable is based on past information of $X'_{i,t}$, and, to limit the number of instruments, we restrict ourselves to 4, i.e. the lag range used in generating the instruments as suggested by Roodman (2006). Then, the Sergan and Hansen test is used for over-identifying restrictions based on the sample analogy of the moment conditions adopted in the estimation process, thereby determining the validity of instrument variables (i.e. tests of lack of serial correlation and consistency of instrument variables).

3.4 Data

Sample data for this study consist of quarterly data gathered and complied by the Bank of Albania taken from balance sheet and income statement items of 16 banks operating in Albania. The strength of the dataset is its sample coverage and reliability of information. It covers all banks operating in Albania in the last two decades. The sample consists of 960 quarterly sets of data for 16 banks operating in Albania, since 2001 Q01.

Variables used to calculate the competition indicator are as a follows: *TC* is the sum of personnel expenses, other administrative expenses and other operating expenses. The bank's single output, *Q*, is a proxy for total bank assets. P_1 is calculated as the

ratio of personnel expenses over total assets. P_2 is the ratio of other administrative expenses plus other operating expenses over total fixed assets. P_3 is the ratio of interest expenditure over the sum of total deposits. $CRISIS$ is a dummy variable that takes the value of 1 during the period 2008 Q03–2010 Q04, and 0 otherwise. All variables are log-linearised, besides the *CRISIS*.

The empirical study focuses on the period 2008 Q02–2015 Q03, as the second half of 2008 marks the beginning of the pass-through effects of GFC on the Albanian economy[10]. That includes a total panel of balanced observations with 448 observations and 28 periods. The variables used for empirical analysis are approximated as follows. The bank-specific variables and the stability indicator are individually estimated for each bank. *CAELS* is transformed into an index, taking the average performance during the year 2010 as the base year. *EFFICIENCY* is the gross expenditure to gross income ratio. *LEVERAGE* presents the equity to asset ratio of individual banks. *BOONE* is a non-structural competition index variable, as explained above. It is also transformed into an index, taking the average performance during the year 2010 as the base year and enters the model as log-transformed. These bank-specific variables and the stability indicator are individually estimated for each bank. The macroeconomic variables are aggregated indicators that represent the state of the economy. *GDP* represents gross domestic production. It is transformed in real terms by deflating with the Consumer Price Index (CPI). *PSRISK* represents the spread between domestic 12 months' T-Bills and the German 12 months' T-Bills. They are transformed in real terms by subtracting the respective domestic and German annual inflation rate. All data represent end-period values. They are log-transformed, besides the *PSRISK* and *CRISIS*. Furthermore, the dataset developed for this paper has several sources. Data on *GDP* are taken from the Albanian Institute of Statistics. Data on domestic *T-Bills* rates are taken from the Ministry of Finance. Data on German 12 months' *T-Bills* rates and German *CPI* are taken from Bloomberg. The rest of the data are taken from the Bank of Albania.

Finally, prior to empirical estimation, all data were subjected to a unit root test procedure in an effort to understand their properties and also to ensure that their order of integration fulfils the criteria of our empirical estimation approach. The latter is a pre-required condition so as to generate consistent and unbiased results. Therefore, the unit root test approach includes the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) Fisher Chi-square tests. The reason is twofold: First, these tests are built on the same null hypothesis that panel variables are stationary. Second, they are mostly used for unbalanced panel models, such as our sample.

10. The Albanian economy was not directly affected by the GFC, but the spill-over effects through financial and trade linkages were immediately transmitted from 2008 Q04, which, at the same time, provides a justification why we chose the empirical estimation from this period.

Results are presented in Table 2 in the Appendix. Findings imply that some of the variables included in our specified model are integrated of order zero I(0). This means that they are stationary. Therefore, they enter the model at level. This set of variables includes *EFFICIENCY* and *LEVERAGE*. The other variables, namely *CAELS*, *GDP, PSRISK* and *BOONE* are found to be integrated in order one, I(1). This means they pose non-stationary properties. Therefore, they enter the model as first difference, since it will transform them into a stationary stance[11].

4. Empirical Results

4.1 Main results

This section reports the main results from the model, as specified in Equation [10], which are reported in Table 4 in Appendix A. We estimate 6 regressions. In each regression we use the same measure of competition, but with some methodological changes. First, column [1] reports the results of a linear relationship between competition and stability including all banks operating in Albania. Second, column [2] presents results with regards to a possible non-linearity relationship. Then, column [3] and column [4] show the results as presented previously, but with regards to a sample consisting of only large banks. Similarly, column [5] and [6] provide results with regards to only small banks. All these models are estimated yet again based on the AB-1-step GMM approach, as previously explained. At the bottom of the table, we report specification test results for the GMM estimation. First, AR(1) and AR(2) are the Arellano-Bond tests for first and second order autocorrelation of residuals. One should reject the null hypothesis of no first order serial correlation and not reject the null hypothesis of no second order serial correlation of residuals. Second, the Haussmann test of over-identifying restrictions indicates whether instruments are uncorrelated with the error term. The GMM does not require distributional assumptions on the error term and it is more efficient that the Two Least Two Square approach, since it accounts for heteroscedasticity Hall (2005). Results show that, in our case, requirements are met, as suggested by the p-values of AR(1) and AR(2) tests. In addition, the Sergan and Hansen test suggests that the instruments used in all specifications are appropriate. This means that all GMM equations are properly specified.

Analyses of estimated coefficients, both external and internal variables, suggest that all explanatory variables have the expected signs and are statistically significant at conventional level. They are also compatible with previous studies, as reported

11. These results are robust also in other unit root test approaches, including the Im, Pesaran and Shin W-stat test and Fisher test. Data can be provided upon request.

by Shijaku [(2016a) and (2016b]. For example, the coefficients of the variables linked to macroeconomic patterns bear relatively the same level of significance on bank stability as in previous studies. The coefficient of *GDP* is positive in all regressions, suggesting that increases in economic growth have a positive effect on bank stability. This effect is found to be relatively stronger for small banks. One possible explanation for this is that small banks in Albania are more exposed to individuals and small and medium enterprises, which, in response, are the first to be affected by economic turmoil. The coefficient of primary sovereignty risk, presented by *PSRISK*, is statistically significant and negative in all regressions, as well as for small banks, suggesting that a higher spread ratio worsens bank stability. Evidence shows, however, that the effect is stronger for large banks. This can also be explained by the fact that this group of banks is the main one that finances any domestic government borrowing and holds the main stock of bank lending to the private sector. On the other hand, at the given magnitude of the coefficient, results suggest that the interest rate pass-through effect on bank stability is found to be relatively low. Second, bank-specific factors are also found to impact bank stability. Both *EFFICIENCY* and *LEVERAGE* coefficients are statistically significant, which implies that operational efficiency and capital structure have a crucial impact on bank stability. The magnitude of the coefficients indicates that there is a trade-off between operational efficiency and capital in terms of bank stability. The former has a positive sign, suggesting that bank stability increases through improving operational efficiency and better capital structure. By contrast, we found that capital is relatively more important for small banks when compared to the higher effect of operational efficiency found for large banks.

Table 4 also summarises the results of regressions when capturing the effects of competition through the Boone indicator. As mentioned before, it emphasises the effect of an increase in marginal cost on the decrease in market shares. Results indicate that the coefficient of Boone indicator is significantly positive. This means that increasing competition improves bank stability conditions, given that the higher value of the Boone indicator signifies a higher degree of competition. At the same time, since the Boone indicator is significant, changes of marginal cost have more impact on profits, which means that market share is subject to more competition. Similarly, as competition in the banking sector increases, it is likely to boost the franchise value and encourage banks to lower their overall risk exposure, thus confirming the competition-stability view in the case of Albania. These findings are consistent with the "competition-stability view" of other recent studies (Berger and Bouwman 2013, Fiordelisi and Mare 2014, Schaeck and Cihak 2014), i.e., that greater bank competition is associated with higher bank stability.

Finally, following Jimenez *et al.* (2013, Liu *et al.* (2013), Fu *et al.* (2014), Kasman and Kasman (2015), we also use a quadratic term of the measures of competition to capture a possible non-linear relationship between competition and bank stability.

Results, as reported in Table 4 column [2] in Appendix A, reveal an important consideration, namely, that we did not find any evidence of non-linearity relationship between competition and stability, thus rejecting Martinez-Miera and Reputto (2010) assumption in the case of the Albanian banking system. We do not find such evidence even when we split the sample with regards to small and large banks, as reported in Table 4 column [4] and column [6] in Appendix A[12].

4.2 Robustness checks

In an attempt to further enrich our analysis, and as a complementary proof, we ran a number of robustness checks on our main model, as specified in Equation (10). This included the use of five different alternative measures as proxies for bank competition, which are also used as explanatory variables to get more robust results. For example, column [1] in Table 5 in Appendix A shows the impact of competition as measured by an alternative Boone indicator that also includes bank capital (Equity) in the estimation of the TCF model on bank stability [See also Equations (B.1 and B.2) in Appendix B]. Results are relatively similar to those in the previous sections, re-confirming that a greater degree of bank competition due to increasing operational efficiency would further improve bank stability conditions[13].

On the other hand, we also use as a robustness check the marginal cost estimated from Equation (8) to calculate the Lerner index [*LERNER*][14] and the efficiency-adjusted Lerner index [*LERNER**][15], as well as to estimate the profit elasticity [*PROFITELASTICITY*][16]. These results are respectively reported in columns [2], [3] and [4]. They show that the *LERNER* and *LERNER** are negatively related to *CAELS*. The impact is also significant. As previously mentioned, since the Lerner index is inversely proportional to *CAELS*, it appears that the negative sign for both these competition measures show that increases in the degree of bank pricing power are positively related to individual bank stability. By contrast, the coefficient

12. We used also a cubic term of the measures of competition to capture a possible non-linear relationship between competition and bank stability, bust still found no supportive evidence. Results are provided upon request. However, one important consideration is that as our measures for competition mainly focus on the lending market, it should be kept in mind that these conclusions are quite subject to loan markets.
13. Results (Table 6 in Appendix) are also robust for methodological changes in which we used the GMM White Period 2nd Step approach. The Arellano and Bond test results also require significant AR(1) serial correlation and lack of AR(2) serial correlation (See also Kasman and Kasman, 2015).
14. Following Fiordelisi and Mare (2014) we calculated the Lerner index as $LERNER_{it} = \frac{P_{i,t} - MC_{i,t}}{P_{i,t}}$. The index is a linear, straightforward indicator that takes a value between 0 and 1, where lower value indicates a greater degree of competition.
15. [See also Equations (B.3) in Appendix B for the approach used to estimate this index].
16. [See also Equations (B.4) in Appendix B for the approach used to estimate this index].

of *PROFITELASTICITY* exhibits a positive sign, suggesting that lower elasticity of profit would boost bank stability. These results provide yet again additional strong supportive evidence for the competition-stability view, re-confirming, as previously, that a greater degree of bank competition improves bank stability conditions.

Finally, we also examined the impact of bank concentration on the stability of Albanian banks using the Herfindahl index (also known as Herfindahl–Hirschman Index, or HHI)[17]. The results are reported in Table 5 Column (5) in Appendix A. The negative coefficient for the HHI indicator supports a negative link between market power and bank stability. This suggests that a lower bank concentration ratio leads to a decrease in bank insolvency risk, and, therefore, a higher degree of bank stability. In other words, the less concentrated the banking system is, the more stable the banks are. By contrast, based on the size of respective coefficients, we find that the impact of bank concentration is relatively higher that the extent to which competition affects bank stability. On the one hand, it is very clear that results remain similar to those analysed in previous sections, since in all regressions estimated we find that bank market power is negatively related to bank stability, i.e., there is a positive relationship between a higher degree of competition and stability. These results support both theories -the competition-stability view and the concentration-fragility view- in the case of Albania, showing that banks with lower market power are, on average, more stable. On the other hand, the use of the alternative competitiveness proxy should be treated as a robustness check of the results, which further strengthens our conclusions in terms of competitions.

5. Conclusions

Developments in the banking market leading to the financial crisis of 2008 have once again heightened interest in determinants of bank risk-taking and stability conditions. An increasingly competitive environment caused by the growing internationalisation of financial markets and the emergence of non-bank players in the market for corporate financing have often been seen as contributing to increasing banks' incentives to take risks. This perception of the effects of higher competition on bank risk-taking is confirmed by a wide array of theoretical and empirical banking models.

This paper continues the series of studies performed using the sample data of the Albanian banking sector. The purpose is to fill in the information gap by analysing whether competition improves or reduces banking stability for banks operating in

17. The HHIA is calculated using bank total assets as inputs ($HHIA = \sum_{i=1}^{n} s_i^2$, where s represents the market share of each bank in the total market assets). It can range from 0 to 1.0, moving from a huge number of very small firms to a single monopolistic producer. Increases in the index generally indicate a decrease in competition and an increase of market power, and vice versa.

the Albanian banking system during the period 2008–2015. Although there have been several similar articles published, we are improving on existing literature, while including three crucial dimensions. First, in contrast to other bank-level studies, we use the most direct measure of bank stability available, which is generated from the unique supervisory dataset collected by the Bank of Albania, based on which we analyse the bank competition-stability nexus. Second, we deepen our empirical analysis by splitting the sample with regards to large and small banks. Finally, we also check for a non-linearity relationship between competition and stability in the case of the Albanian banking sector.

In summary, the main results of this paper are that competition improves bank stability and results appear to hold for a wide array of other alternative model specifications, estimation approaches and variable construction. Besides this major finding, we also discovered that concentration is inversely correlated to bank stability, suggesting that a more concentrated banking system is more vulnerable to bank fragility. Overall results suggest that higher pricing power and less concentration could simultaneously lead to higher bank stability, thus bolstering the competition-stability view suggesting that bank competition and bank soundness go hand in hand with each other. Similarly, under a concentration-stability view, greater bank concentration eases market power. This would increase profit margins, and, therefore, would result in higher franchise value. At the same time, we found no evidence of non-linearity relationship between competition and stability in the case of the Albanian banking system. Furthermore, an interesting point is that we found that the relationship between bank competition and bank stability is stronger for small banks than for large banks. Similarly, we did not find any non-linearity relationship between competition and bank stability in the case of small banks or large banks. Finally, in regard to control variables, results confirm previous studies in the case of the Albanian banking sector. First, macroeconomic conditions are relatively important for bank stability. Similarly, bank stability is also conditional to improving the operational efficiency and capital structure of banks.

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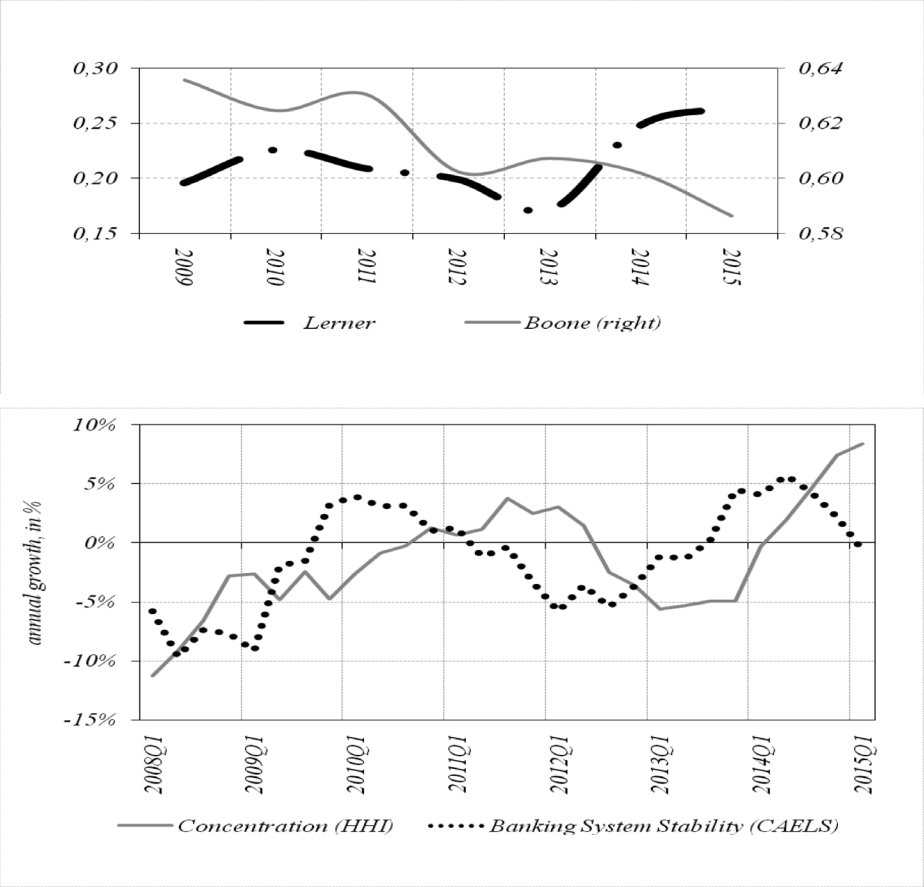
APPENDIX A

Graph 1. Bank competition and bank stability, 2008 -2015



Source: Bank of Albania, Author's calculations.

Table 1. Summary of literature review

Authors (year)	Geographical coverage (Sample time)	Methodology	Main variables		Main results
			Stability	Competition	
Boyd *et al*. (2006)	US bank and 134 non-industrial economies (1993-2004)	OLS with fixed effects, GMM approach	Z-score,	HHI	Banks probability of failure is positively and significantly related to concentration, *ceteris paribus*, loan to asset ratios are negatively and significantly related to concentration, and banks' profits are positively and significantly related to concentration.
Berger *et al*. (2009)	8235 banks in 23 developed countries	GMM approach	Z-score, NPL, ROA	H-Statistics, Lerner, HHI	Consistent with the "competition-fragility" view—banks with a higher degree of market power also have less overall risk exposure. The data also provide some support for one element of the "competition-stability" view—that market power increases loan portfolio risk.
Schaeck *et al*. (2009)	38 developing and developed countries (1980–2003)	Logit models	Duration models with time-varying, covariates and Logit probability model.	Panzar and Rosse H-Statistics, CR3	More competitive banking systems are less prone to systemic crises and time to crisis is longer in a competitive environment.
Jiménez *at al*. (2010)	107 unique banks (commercial and savings banks) in Spanish banking system (1988 to 2003)	GMM First Differences	NPL	C5 and HHI, Lerner	Market concentration does not affect bank risk. Non-linear relationship using standard measures of market concentration in both the loan and deposit markets. When direct measures of market power, such as Lerner indices, are used, empirical results are more supportive of the original franchise value hypothesis, but only in the loan market.
Cipollini and	180 commercial banks	A Probil model	A measure of	HHI	Positive effect of bank concentration on financial

Fiordelisi. (2012)	(within EU-25) (2003-2007)	estimated by GMM	risk-adjusted bank performance as risk indicator		distress.
Liu and Molyneux (2012)	Commercial banks from four South East Asian countries: (1998-2008)	OLS with fixed effects, Dynamic panel GMM	Z-Score	H-Statistics,	Competition does not increase bank risk-taking behaviour. Concentration is inversely related to bank risk.
Amidu and Wolfe (2013)	978 banks in 55 emerging and developing countries (2000–2007)	Three-stage-least-squares (3SLS)	Z-score	H-statistics, Lerner index	Competition-stability view.
Fungacova and Weill (2013)	Russian banks (2001-2007)	Panel logit	Bank failures	Lerner	Competition-fragility view.
Soedarmonoa *et al*. (2013)	636 commercial banks in 11 Asia countries (1994-2009)	OLS with fixed effects, 2SLS	Z-score,	Lerner	Higher degree of competition is associated with higher insolvency risk of banks.
Ansari and Goyal (2014)	22 Sub-Saharan African country, 15 Eastern and Central Europe countries, and 11 Latin America countries, (2000-2007)	Three-stage-least-squares, GLS	Z-score, ROA (ROE)	Lerner, HHI	Increase in bank competition has a significant effect on the overall stability of banks in emerging and developing markets. This relationship holds when risk-adjusted profits are used as the dependent variable.
Fiordelisi *et al*. (2014)	Cooperative banks in Austria, France, Germany, Italy and Spain, (1998-2009)	Granger causality test	Z-score	Lerner index Adjusted-Lerner Index, HHI	Bank market power negatively Granger-causes banks stability. Higher competition increases bank stability. Concentration is negatively related to individual bank soundness.
Kasman and Carvallo. (2014)	272 commercial banks from fifteen Latin American countries (2001-2008)	Granger causality technique	*Z*-score	Lerner indexes, Boone indicators	More competition is conducive to greater financial stability.
Marques-Ibanez *et al*. (2014)	9 EU countries and US (2007-2009)	Probit Model	Binary variable for riskier banks	Boone indicator	More intense competition and greater use of securitisation is correlated with higher levels of realised risk

Schaeck and Cihak (2014)	3,325 European banks in Austria, Belgium, Denmark, France, Italy, Germany, Luxembourg, Netherlands, Switzerland, and the U.K, consisting of savings, cooperatives and commercial banks. (1995- 2005)	OLS with fixed effects, 2TLS	Z-score	Boone indicator, HHI	Boone indicator captures competition patterns. Competition is stability-enhancing, and the stability-enhancing effect of competition is greater for healthy banks than for fragile ones.
Câpraru and Andrieş (2015).	923 banks from 27 EU countries (2001-2009)	GMM	Z-Score	CR5, HHI	The results validate both stability and fragility views depending on the group of countries and the pre-crisis/crisis period.
Kasman and Kasman (2015)	Turkish banking industry (2002–2012)	GMM approach	Z-score, NPL ratio	HHI, Boone indicator	Competition is negatively related to the NPL ratio but positively related to the Z-score.
Kick and Prieto (2015)	5035 banks (1994-2010)	A two-step IV-probit model	Z-score	HHI Lerner Index Boone indicator	Using Lerner index as a competition measure indicates that market power tends to reduce default probability (riskiness of banks). The Boone indicator shows that increased competition lowers bank risk-taking.
Bushman *et al*. (2016)		OLS (Probit Model)	Text-based measure of competition, survey approach, Z-score	Lerner Index	Evidence that greater competition increases both individual bank risk and a bank's contribution to system-wide risk.
Dushku (2016)	Albanian banking system (2004-2014)	Robust Least Square (Panel)	NPL ratio, Z-Score	Lerner index	Higher market power associated with lower risk. After the crisis the relationship between total credit risk and competition is non-linear.
Pawlowska (2016)	EU-27 (2006-2010)	One Step GMM approach	NPL	CR5, HHI, Lerner	Absence of strong evidence for a relationship between competition and risk-taking behaviour by EU banks.

Table 2. Panel Unit Root Test

Variable	ADF - Fisher Chi-square			PP - Fisher Chi-square		
	Intercept	Intercept and Trend	None	Intercept	Intercept and Trend	None
ΔCAELS	[0.0000]	[0.0000]	[0.0000]	[0.0018]	[0.0000]	[0.0000]
ΔGDP	[0.0000]	[0.0000]	[0.0000]	[1.0000]	[0.0000]	[0.0000]
ΔPSRISK	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[1.0000]	[0.0000]
ΔBOONE	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[1.0000]	[0.0000]
EFFICIENCY	[0.0000]	[0.0000]	[0.9649]	[0.0000]	[0.0000]	[0.8965]
LEVERAGE	[0.0000[	[0.0007]	[0.0001]	[0.0000]	[0.0006]	[0.0010]
Note: Δ is a first difference operator. Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.						

Source: Author's calculations.

Table 3. Correlation Analysis: Ordinary

Sample: 2008Q2 2015Q3 Included observations: 480 Balanced sample (list-wise missing value deletion)						
	CAELS	GDP	PSRISK	BOONE	EFFICIENCY	LEVERAGE
CAELS	1	0.103	-0.070	0.047	-0.103	0.012
GDP	0.103	1	-0.016	0.061	-0.036	0.007
PSRISK	-0.070	-0.016	1	-0.039	-0.031	0.045
BOONE	0.047	0.061	-0.039	1	-0.068	-0.005
EFFICIENCY	-0.103	-0.036	-0.031	-0.068	1	0.366
LEVERAGE	0.012	0.007	0.045	-0.005	0.366	1

Source: Author's calculations.

Table 4. Empirical Results based on the GMM approach

Model Estimation	Banking System		Large Banks		Small Banks	
	[1]	[2]	[3]	[4]	[5]	[6]
ΔGDP	0.9449	0.9494	0.3924	0.3632	1.1628	0.8821
	[*0.03*]	[*0.05*]	[*0.32*]	[*0.41*]	[*0.04*]	[*0.09*]
ΔPSRISK	-0.0549	-0.0549	-0.0574	-0.0572	-0.0522	-0.0611
	[*0.06*]	[*0.05*]	[*0.07*]	[*0.07*]	[*0.12*]	[*0.27*]
ΔBOONE	0.2037	0.1996	0.0415	0.0488	0.2987	0.8184
	[0.03]	[*0.19*]	[*0.27*]	[*0.15*]	[*0.21*]	[*0.04*]
ΔBOONE^2		-0.0313		0.0677		13.70
		[*0.96*]		[*0.72*]		[*0.25*]
EFFICIENCY	-0.4119	-0.4118	-0.3976	-0.3910	-0.3201	-0.250
	[*0.08*]	[*0.08*]	[*0.13*]	[*0.14*]	[*0.23*]	[*0.33*]
LEVERAGE	0.5661	0.5674	0.0637	0.0514	0.3762	0.4989
	[*0.02*]	[*0.02*]	[*0.68*]	[*0.75*]	[*0.04*]	[*0.03*]
CRISIS			-0.0687	-0.0679	0.0290	0.040
			[*0.35*]	[*0.36*]	[*0.67*]	[*0.67*]
Cross-sections	16	16	6	6	10	10
Instrument rank	20	20	20	20	20	20
No. of observations:	448	448	162	162	270	270
J-statistic	18.4	18.3	13.2	13.1	18.7	12.2
Probability (J-statistic)	0.24	0.19	0.51	0.44	0.17	0.51
The Table shows bank-level GMM regression statistics on empirical results. Haussmann tests (J-Statistics and the Probability of J-Statistics) investigate the validity of the instruments used, and rejection of the null-hypothesis implies that instruments are valid, since they are not correlated with the error term. The Probability appears in parentheses [ ] below estimated coefficients.						

Source: Author's calculations.

Table 5. Empirical Results based on GMM approach

Model Estimation	Banking System				
	[1]	[2]	[3]	[4]	[5]
ΔGDP	0.9805	1.0282	1.0895	0.8313	1.2343
	[*0.026*]	[*0.019*]	[*0.028*]	[*0.000*]	[*0.02*]
ΔPSRISK	-0.0548	-0.0267	-0.0451	-0.0348	-0.0267
	[*0.059*]	[*0.057*]	[*0.197*]	[*0.000*]	[*0.08*]
ΔBOONE*	0.0679				
	[*0.100*]				
LERNER		-0.0694			
		[*0.797*]			
LERNER*			-0.0337		
			[*0.651*]		
PROFITELASTICITY				0.0407	
				[*0.472*]	
HHI					-0.8172
					[*0.25*]
EFFICIENCY	-0.4065	-0.3540	-0.4444	-0.5050	-0.4173
	[*0.097*]	[*0.188*]	[*0.079*]	[*0.000*]	[*0.09*]
LEVERAGE	0.5324	0.3656	0.6289	0.0613	0.6238
	[*0.026*]	[*0.232*]	[*0.010*]	[*0.527*]	[*0.02*]
Cross-sections	16	16	16	16	16
Instrument rank	20	20	20	20	20
J-statistic	17.6	18.4	15.8	12.0	18.5
Probability of J-statistic	0.28	0.19	0.33	0.29	0.19
No. of observations:	448	493	434	480	480

Table shows bank-level GMM regressions statistics on the empirical results of the estimations using alternative measures of bank competition. Haussmann tests (J-Statistics and the Probability of J-Statistics) investigates the validity of the instruments used, and rejection of the null-hypothesis implies that instruments are valid as they are not correlated with the error term. The Probability appears in parentheses [ ] below estimated coefficients.

Source: Author's calculations.

Table 6. Empirical Results based on GMM approach

Model Estimation	Banking System				
	[1]	[2]	[3]	[4]	[5]
ΔGDP	0.8169	0.5475	0.7000	0.7092	0.9319
	[*0.00*]	[*0.00*]	[*0.00*]	[*0.00*]	[*0.00*]
ΔPSRISK	-0.0534	-0.0301	-0.0312	-0.0543	-0.0279
	[*0.00*]	[*0.00*]	[*0.00*]	[*0.00*]	[*0.00*]
ΔBOONE*	0.0581				
	[*0.00*]				
LERNER		-0.2042			
		[*0.08*]			
LERNER*			-0.0312		
			[*0.09*]		
PROFITELASTICITY				0.0304	
				[*0.42*]	
HHI					-0.9244
					[*0.00*]
EFFICIENCY	-0.2962	-0.1351	-0.3839	-0.2946	-0.2252
	[*0.07*]	[*0.16*]	[*0.00*]	[*0.05*]	[*0.09*]
LEVERAGE	0.3114	0.2042	0.4864	0.0522	0.4215
	[*0.06*]	[*0.09*]	[*0.00*]	[*0.63*]	[*0.00*]
Cross-sections	16	16	16	16	16
Instrument rank	20	20	20	20	20
No. of observations:	480	480	480	480	480
J-statistic	12.0	12.0	12.0	12.0	12.0
Probability of J-statistic	0.29	0.29	0.29	0.29	0.29
AR(1) [p-value]	0.07	0.00	0.00	0.00	0.59
AR(2) [p-value]	0.45	0.11	0.14	0.21	0.53

The Table shows bank-level GMM regression statistics on empirical results of estimations using, alternatively, the White Period 2nd Step Approach. Haussmann tests (J-Statistics and the Probability of J-Statistics) investigate the validity of the instruments used, and rejection of the null-hypothesis implies that instruments are valid, since they are not correlated with the error term. The Arellano and Bond test results also require significant AR(1) serial correlation and lack of AR(2) serial correlation (See also Kasman and Kasman, 2015). The Probability appears in parentheses [ ] below estimated coefficients.

Source: Author's calculations.

APPENDIX B

As a robustness test, we estimate an alternative measure of the marginal cost in the Boone indictor formula[19] following Leon (2014), and re-specify Equation (3) to also include an additional control variable, namely, bank capital. The specified model is expressed as follows:

$$lnTC_{it} = \alpha_0 + \alpha_1 lnQ_{it} + 0.5\alpha_2 (lnQ_{it})^2 + \sum_{j=1}^{3} \beta_j lnP_{it_j}$$
$$+ \sum_{j=1}^{3}\sum_{k=1}^{3} \delta_{jk} lnP_{it_j} * lnP_{it_k} + \sum_{j=1}^{3} \gamma_j lnQ_{it} * lnP_{it_j} \quad \text{(B.1)}$$
$$+ \tau_1 Trend + 0.5\tau_2 (Trend)^2 + \tau_3 Trend * lnQ$$
$$\omega_1 lnE_{it} + 0.5\omega_2 (lnE_{it})^2 + \omega_3 lnE_{it} * lnQ + CRISIS + \varepsilon_{it}$$

where, E_{it} is total equity of bank i at time t. This model is estimated on the basis of the OLS approach. Then, assuming that input prices are still homogeneous, Equation (4) is re-expressed as follows:

$$MC_{it} = \frac{TC_{i,t}}{Q_{i,t}} \left[\hat{\alpha}_1 + \hat{\alpha}_2 lnQ_{it} + \sum_{j=1}^{3} \hat{\gamma}_j lnP_{it_j} + \omega_3 lnE_{it} + \tau_3 Trend \right] \quad \text{(B.2)}$$

The most important finding, as reported in Table 5 in Appendix, is that the correlation between marginal costs, calculated on the basis of different approaches, is of a relatively high level, which is also statistically significant. This means that changing methodology and augmenting the TCF model does not change the results and that the banking sector in Albania exhibits competitive patterns. Following Clerides *et al.* (2015) and Kasman and Kasman (2015), we estimated the efficiency adjusted Lerner index at the bank level, as follows:

$$Efficiency - Adjusted\ LERNER_{it} = \frac{\pi_{i,t} + TC_{i,t} - MC_{i,t} * Q_{i,t}}{\pi_{i,t} + TC_{i,t}} \quad \text{(B.3)}$$

where, $\pi_{i,t}$ is the profit of bank *i* at time *t*, and the rest are as previously defined. Similar to the conventional Lerner index, the Adjusted Lerner index also ranges from 0 to 1, with larger values implying greater market power. Then, Clerides *et al.* (2015) measure profit elasticity, deriving from the efficiency adjusted Lerner index, by solving for π in equation (B.3) and differentiating with respect to MC, as follows:

$$Profit\ Elasticity_{it} = \frac{Q_{i,t} * MC_{i,t}}{Q_{i,t} * MC_{i,t} - TC_{i,t} * (1 - Adjusted\ LERNER_{it})} \quad \text{(B.4)}$$

Hence, the efficiency adjusted Lerner index and the profit elasticity are two closely related concepts.

18. Results are provided upon request.

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GENDER DIFFERENCES IN FINANCIAL INCLUSION: CENTRAL AND SOUTH EASTERN EUROPE

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Abstract
The paper analyses the gender dimension of financial inclusion in Central and South Eastern Europe (CESEE). The gender dimension is analysed for different age groups: the young, those in their most active working age and older generations. Results show that financial inclusion varies across countries and age groups, but, in general, males are more financially included than females, as measured by having an account with a financial institution. The largest positive contributor to the gender gap is employment, implying that labour market exclusion is related to financial exclusion. While having secondary education also explains the existence of the gap, tertiary education acts towards the reduction of the gap in the case of young population.

JEL Classification: F65, G21, O16
Keywords: Financial Inclusion, Gender Differences, CESEE

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1. Introduction

The rising inequalities in post-transition economies have many dimensions, which subsequently appear in the focus of research studies. Many changes in transition economies result in improved macroeconomic indicators, with heterogeneous impact on the microeconomic level. One of the examples is related to the development of the financial system. Claessens and Perotti (2007) suggest that financial development can be correlated with increased inequalities in societies. This could be particularly observed in transition, when different political and regulatory changes asymmetrically influence access to finance for various population subgroups, as a result of other processes brought about by the transformation of economies and societies. The financial development of transition economies has been substantial (Bonin and Wachtel, 2002), supported by large foreign direct investments in the banking sector (Giannetti and Ongena, 2009; Haselmann, Pistor, and Vig, 2010; Ongena, Popov, and Udell, 2013; Claeys and Hainz, 2014). The question is whether the effects have been evenly distributed among the population and which subgroups might be more exposed to adverse effects. The importance of this question has been previously acknowledged in relevant literature. For example, it has been established that households without formal income sources and assets that could be used as collateral in financing find themselves at a disadvantageous position in the emerging Europe financial markets dominated by foreign banks (Beck and Brown, 2015).

Previous contributions have established important differences across transition economies at the household level, but predictors as to whether a household will have a banking account are similar (Beck and Brown, 2011). The aim of this paper is to analyse financial inclusion in Central and South East European (CESEE) countries focusing on gender differences in the financial inclusion of different age groups. Our results complement previous aggregate findings that identified both age and gender as important financial inclusion factors (EBRD, 2016). The relevance of the empirical analysis can be supported with many arguments. It is complementary to the policy advocacy of increased financial literacy (Brown and Sticks, 2014), frequently found to be even worse for young people (Lusardi, Mitchell, and Curto 2010). It is also complementary to discussions about the ageing society (Bloom, Canning and Fink, 2010; Catalano and Pezzolla, 2016). Finally, it is complementary to the gender gap discussion related to differences in social mobility and access to formal employment, but also to gender differences in qualifications and wages (Lewis and Lockheed, 2008; Breen *et al.*, 2009; Dorius and Firebaugh, 2010), which increased during the transition period.

Micro data from the latest World Bank Global Financial Inclusion Database (2014) have been used in empirical analysis. Consequently, the scope of the analysis is limited by the questions asked within that Survey. However, this approach enables comparability between analysed countries, which is frequently an obstacle encountered in empirical studies focusing on transition economies.

The paper adopts the following structure. The next section briefly summarises relevant literature. Section 3 describes data and gives preliminary results on gender and age differences concerning financial inclusion in different countries. Section 4 explains the empirical strategy used and presents estimation results, while discussion of the results is presented in section 5. The last section concludes the paper.

2. Brief literature review

Financial development is one of the factors impacting inequalities in societies, including the inequality of financial inclusion of individuals. However, empirical findings are not unambiguous in determining whether financial development increases or decreases inequality. One strand of the literature suggests that financial development is related to increased inequalities in societies (e.g. Claessens and Perotti 2007). On the other hand, Beck, Demirgüç-Kunt and Levine (2007) argue that financial development disproportionately helps the poorer part of society. With greater financial development, the income of the poor tends to grow faster than the average GDP per capita, which, in turn, lowers income inequality.

In addition to the impact on micro-level outcomes, financial inclusion can have macro-level policy implications. Financial inclusion can have important consequences for monetary policy, since it influences and reflects changing behaviour of affected consumers and entrepreneurs (Mehrotra and Yetmen, 2015). As Johnston and Murdoch (2008) argue, unequal access to finance might lead to misallocations because disadvantaged population subgroups demand small-size financing, which, due to relatively high unit costs, is not deemed profitable by lending institutions. Under these circumstances, financial exclusion deepens with time and the structure of savings and borrowing agents changes, consequently affecting the financial stability of the country.

Due to these issues, the problem of financial inclusion and access to financial services came into the focus of research and has been found to vary significantly among different countries (Demirgüç-Kunt and Klapper, 2012). In order to measure financial inclusion, three dimensions have been proposed in the literature - outreach, usage and quality of financial services (Amidžić, Massara, and Mialou 2014). The outreach can be represented by assessing the differences in regional availability of services, claiming that, due to the absence of adequate financing, certain segments of society remain at a disadvantageous position. Another example is when there are preconditions in order to use certain services, such as Internet access or a specific level of digital literacy. In both examples, financial exclusion is due to involuntary reasons. Policy recommendations to remedy this problem are straightforward and suggest increased network/education efforts in certain areas in order to enable access for disadvantaged population.

The financial exclusion related to using financial services might be voluntary (when individuals can have access to services, but chose not to use them) or involuntary. The difference can be assessed by investigating the reasons why individuals do not use financial services. Policy actions also depend on the nature of the answers provided, but, in most cases, awareness- raising campaigns can lead to increased participation of excluded population. The quality of services provided is the most difficult factor to assess and it is also difficult to specify policy measures aimed at addressing the (perceived) quality gap beyond general recommendations that there should be no discriminating against consumers. Regardless of this proclaimed equality, even the perceptions of the gap influence behaviour of economic agents and can have long-run effects on the development of the entire economy.

A particular concern when considering financial exclusion is how it affects different population groups and, in particular, the young. The recent global economic crisis has increased the level of uncertainty among young populations, resulting in their increased inability to acquire financial independence from their families (Robb 2011; Shim *et al.* 2013). But, it is not only the young population at a disadvantageous position. Agarwal *et al.* (2009) showed that both young and elderly people are facing adverse financial conditions in the market, i.e. financial institutions charge higher fees and interest rates, as they perceive older people to be more risky than prime-age population. The expected consequences of financial exclusion of the young and the old are different. It could be argued that young persons have the possibility to improve their financial inclusion in the course of their lifetime. However, the probability to catch up is disproportionate due to the fact that financial markets are developing swiftly and constantly offering an increasing number of differentiated products. If financial exclusion of the young is supported by their disproportionately high financial illiteracy, then the outlook for increased financial inclusion in the future is not optimistic. The financial exclusion of the elderly is important in the context of demographic ageing. If the share of elderly population is high and increasing in an economy, the possibilities of their following developments in the financial sector in more advanced economies are limited. The ability of the elderly population to keep up with the developments of the financial system's new products could be further constrained due to the increased likelihood that they are technologically at a disadvantage as well.

Equal access to financial services is particularly important when the gender dimension is included. Even though many gender inequality issues (such as wage, employment and income gap) are relatively well documented, the gender gap in equal access to finance is a topic that, due to lack of data, has only recently gained in importance. The existence of a gender gap in financial inclusion is mostly confirmed, especially in developing countries. Demirgüç-Kunt, Klapper and Singer (2013) show that, in the case of developing countries, women are more often excluded from the use of financial services and that the consequences of their financial

exclusion are related to inequality in terms of income, education and employment status. Presbitero, Rabellotti and Piras (2014) analyse female involvement in a firm's ownership and management and find that those firms in which females are predominantly included are more likely to be credit rationed. Muravyev, Schäfer and Talavera (2009) reached a similar conclusion. Hence, we explore the gender gap for the young, the working population and the older population in transition economies in order to provide deeper insight in the structure of the gap.

3. Data and preliminary evidence

Data used in the analysis include survey data from the World Bank Global Financial Inclusion (GFI) Database. The latest GFI Survey was conducted in 2014. We are using data for 19 Central and South East European countries[1], with a total of 19,016 observations. The Survey data also provide weights, consisting of base sampling weights and post-stratification weights (Demirgüç-Kunt *et al.*, 2015). However, results in the empirical section rely on unweighted data[2]. We have opted for this approach because our aim is not to produce national level averages (for which the survey weights are intended); instead, we focus our analysis on specific sub-samples of the Survey in order to get additional insights. Survey weights designed for the overall sample might not be appropriate for the discussion of national averages of sub-samples.

There are three separate age groups analysed in the paper: younger, the so-called (prime) working age and older. These labels do not follow usual conventions in the labour market analysis, in order to allow for more evenly distributed individuals across each sub-sample. The young sample covers individuals aged 15-24; working age population covers the period 25-49 and the older population covers all respondents older than 50.

The usage of financial services is initially analysed through indicators depicting the percentage of population using specified service. Examples of services considered in the Survey are: whether a person has an account, whether a person has a debit or credit card, whether a person borrowed or saved. We focus only on data covering individuals having an account, as the most generic indicator. As a preliminary analysis, we test the differences in sample means in each country. Differences in the usage of financial services are already seen in the initial inspection of data. When the entire sample is analysed[3], gender differences are significant, at least at the level of 10

1. Countries covered in the analysis include Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Hungary, Kosovo, Latvia, Lithuania, FYR of Macedonia, Malta, Montenegro, Poland, Romania, Serbia, the Slovak Republic and Slovenia. Although, strictly speaking, Malta and Cyprus do not belong to the group of post-transition economies, these countries joined the European Union in 2004 and share many characteristics with other countries from that group.
2. However, we have also conducted empirical analysis with the weighted data in order to check the sensitivity of our results.
3. Results are not presented here in the interest of saving space, but are available from the authors upon request.

percent in Albania, Bosnia and Herzegovina, Czechia, Kosovo, FYR of Macedonia, Poland and Romania. In all these countries men are significantly more likely to have an account with a financial institution than women. In Table 1 we examine gender differences for different age groups.

As expected, differences are significant in most countries in the case of older population. Significant differences have been found in Albania, Bosnia and Herzegovina, Czechia, Kosovo, FYR of Macedonia, Montenegro, Poland, Romania and the Slovak Republic. In all these countries, it is more likely for a man to have an account with a financial institution than for a woman.

Preliminary analysis of the prime age working population reveals some differences. Men are more likely to have an account with a financial institution in Albania, Bosnia and Herzegovina, Kosovo, FYR Macedonia and Serbia. However, men are less likely to hold an account with a financial institution in Lithuania and the Slovak Republic.

As initially expected, in the case of young population, gender differences are significant in the smallest number of countries – Cyprus and Romania.

Sample averages also show that there are huge differences between countries. In the case of the young population, the lowest share of population with an account is in Albania, while the highest share is in Slovenia. It can also be noticed that average shares are higher for prime age working population than for the young population. Due to these differences, we include country dummy variables in our empirical estimates.

Table 1. Having an account with a financial institution by country (as a percentage of the total number of male and female respondents within a specific country)

	Male	Female	Difference (sign.)
Young population			
Albania	0.33	0.29	0.04
Bulgaria	0.42	0.58	-0.16
Bosnia and Herzegovina	0.41	0.36	0.06
Cyprus	0.81	0.70	0.12*
Czechia	0.73	0.68	0.05
Estonia	0.94	0.93	0.00
Croatia	0.63	0.71	-0.08
Hungary	0.61	0.58	0.03
Kosovo	0.43	0.42	0.01
Lithuania	0.46	0.46	-0.00
Latvia	0.86	0.87	-0.01
FYR of Macedonia	0.58	0.53	0.04
Malta	0.91	0.93	0.03
Montenegro	0.54	0.45	0.09
Poland	0.75	0.67	0.08
Romania	0.68	0.43	0.24*

Serbia	0.76	0.82	-0.05
Slovak Republic	0.43	0.53	-0.09
Slovenia	0.94	0.97	-0.03
Active population			
Albania	0.61	0.45	0.16***
Bulgaria	0.84	0.86	-0.02
Bosnia and Herzegovina	0.76	0.61	0.17***
Cyprus	0.94	0.96	-0.02
Czechia	0.93	0.93	-0.01
Estonia	0.99	0.99	0.00
Croatia	0.93	0.95	-0.02
Hungary	0.88	0.87	0.01
Kosovo	0.66	0.41	0.26***
Lithuania	0.95	0.99	-0.04***
Latvia	0.97	0.98	-0.01
FYR of Macedonia	0.92	0.80	0.12***
Malta	0.99	0.99	0.01
Montenegro	0.73	0.76	-0.02
Poland	0.92	0.87	0.05
Romania	0.71	0.75	-0.04
Serbia	0.92	0.87	0.06*
Slovak Republic	0.88	0.95	-0.07**
Slovenia	0.99	0.99	-0.01
Older population			
Albania	0.39	0.27	0.12**
Bulgaria	0.58	0.53	0.04
Bosnia and Herzegovina	0.57	0.43	0.14***
Cyprus	0.97	0.93	0.01
Czechia	0.82	0.74	0.08**
Estonia	0.98	0.98	0.00
Croatia	0.93	0.91	0.02
Hungary	0.67	0.68	-0.01
Kosovo	0.76	0.38	0.38***
Lithuania	0.82	0.84	-0.01
Latvia	0.86	0.85	0.01
FYR of Macedonia	0.89	0.74	0.15***
Malta	0.98	0.95	0.03
Montenegro	0.66	0.56	0.10**
Poland	0.78	0.67	0.10***
Romania	0.61	0.45	0.52***
Serbia	0.79	0.80	-0.01
Slovak Republic	0.80	0.73	0.07*
Slovenia	0.99	0.98	0.01

Source: authors' estimates based on World Bank Global Financial Inclusion Database (2014)
Notes: *** denotes the significance at 1 percent, ** denotes the significance at 5 percent and * denotes the significance at 10 percent.

4. Empirical strategy and estimation results

Preliminary analysis in the previous section has shown that there are differences between genders and among age groups in having an account with a financial institution. Hence, in this section, we investigate which characteristics are important contributors to the overall gender gap in financial inclusion, measured on the basis of having an account with a financial institution. As well we investigate which characteristics are important contributors to the gender gap in various age groups.

In the search for contributors to the gender gap in financial inclusion, we rely on Fairlie decomposition. Fairlie decomposition is an extension of the widely used Blinder-Oaxaca decompositions for cases when the outcome variable is binary, which is the case in our paper. Fairlie (1999) describes the method to identify and decompose the overall gap between the two subgroups (A and B, where N depicts the relative size of each group) into the contribution of each specific factor considered to be relevant for the existing gap:

$$\bar{Y}^A - \bar{Y}^B = \left[\sum_{i=1}^{N^A} \frac{F\left(X_i^A \hat{\beta}^A\right)}{N^A} - \sum_{i=1}^{N^B} \frac{F\left(X_i^B \hat{\beta}^A\right)}{N^B}\right] + \left[\sum_{i=1}^{N^B} \frac{F\left(X_i^B \hat{\beta}^A\right)}{N^B} - \sum_{i=1}^{N^A} \frac{F\left(X_i^B \hat{\beta}^B\right)}{N^A}\right]$$

The benefits of applying this methodological approach is that we can assess the contribution of each variable to the gap by observing the change in the average probability predicted from replacing one distribution (male) with the other (female), while holding distribution of other variables constant. It has to be emphasised, though, that underlying probit[4] models (presented in Table A2 in the Appendix) rely on the male population sub-sample[5]. In this case, the data in Table 2 provides an estimate of the contribution to the total explanation of the gap resulting from women having the same distribution as men[6].

4. Following Fairlie (2017), we present results of 1000 replications with randomised order of covariates in order to address the issue of path-dependent decomposition. An advantage of relying on the probit model is that it somewhat decreases the problem of unobserved heterogeneity present in cross-sectional data. As Wooldridge (2002) showed, the estimated betas in this context are indeed biased, but ranking of the relative importance of covariates is preserved. It could be, however, the case that there are important variables omitted, which are only important for either men or women. In that case, ranking of the covariates importance would have been different had we included this additional variable in the estimates.
5. As a robustness check, we also performed testing with pooled estimates as well as with female coefficients. Furthermore, all variants (male, female, pooled) were tested with and without sample weights. Results can be obtained from the authors upon request. In general, the sign of the estimated coefficients is the same across different estimations; the same variables turned out to be significant.
6. It could be the case that men have different personality traits than women (on average). Personality traits influence a person's behaviour as an economic agent and also their decision about having an account with a financial institution or not. Unfortunately, data in the Survey were not very rich with information on personality traits, so we were not able to address these points in the empirical analysis.

The methodology relies on defining characteristics which are important for the specific outcome (in our case weather a person has an account with financial institution). Bearing in mind the source of the data, we include following explanatory variables (detailed description of variables can be found in Table A1 in the Appendix):

- Level of education. Empirical research shows that individuals with higher levels of education exhibit not only a higher level of financial inclusion and a higher financial literacy level, but also that those individuals plan expenditure and build up a financial safety net (OECD, 2013; Hung, Parker, Yoong, 2009). Hence, if persons are more educated, they could envisage different ways of gaining financial resources though formal channels, such as financial institutions. Thus, if there are differences in educational attainment between men and women, it could be more likely that a more educated person will be less financially excluded. This notion is included in the specification as dummy variable for the highest obtained educational level of respondent, primary education being a reference.
- Employment status. In the analysis employment status is considered not as a current labour market attachment, but rather as exposure to economic activity during the previous year. If a person had already had more work experience, they might be more likely to find a job, even if currently unemployed or inactive. Furthermore, they might be included more than economically inactive persons (Goodwin *et al.*, 1999). To the extent that men are more likely to be involved in economic activities, this variable can explain the financial inclusion gap. It also has to be emphasised that, in the context of post transition economies, employment does not necessarily imply that a person should have an account, due to the large shadow economy. There is widespread anecdotal evidence reporting cases of cash payment, in kind payment or no payment at all for work done by employees. Employment itself can be formal (but not actually paid, although a contract exists) or informal (and in that case more likely paid in cash).
- Income. Rhine and Greene (2006) confirm that income is an important determinant of financial inclusion. Furthermore, since some countries impose restrictions on females who want to do the same jobs as males, often for higher paying posts (Fleury, 2016), males have more opportunities for having a higher income. Hence, to the extent that men earn comparably more than women and are more likely to be asset-owners, they are also more likely to be more financially included than women. We include this in our model by specifying a dummy variable for each income quintile respondent belongs to, the middle value being a reference.
- Agriculture depicts whether a respondent participated in the sales of agricultural products produced either by himself or his family. The variable aims to capture a specific segment of the population, frequently not accustomed to using financial products. Literature shows that small farmers, in particular, are more likely to

be financially excluded (Dev, 2006). Agricultural activity in the pre-transition period was frequently organised in large state-owned enterprises with individual households being allowed to own only small allotments, in some of the cases big enough only for subsistence agricultural activity. Transition towards being agricultural producers might have been challenging, particularly in more remote areas. This population might be voluntarily financially excluded, due to long-term distrust in financial institutions. Additionally, they might operate within the shadow economy, as it might be more costly to compete in the regular market for agricultural products. However, the questionnaire is focused on obtaining financial resources from agricultural activities through sales. So, regardless of the possibility that a person may operate within the shadow economy for business purposes, they might still have an account with a financial institution for personal reasons. It is to be highly expected that, in such circumstances, men will be designated for taking care of the financial side of a family agricultural business. To the extent that men are more likely to participate in agricultural activities defined as means to get financial resources, this can contribute to the gender bias in financial inclusion.

- Government support depicts whether a person received any kind of government support during the last 12 months. This is an indication of another type of sub-population, accustomed, to a certain extent, to being provided for by government institutions. In that case they might be more accustomed to not seeking financial resources by themselves, but rather to wait for government institutions to find a solution for their (financial) problems, whatever the initial reason they found themselves in this situation might be. Frequently, government support can be obtained only if a person has financial account. However, there are also some cases of non-financial support, where one's relation to financial inclusion is not straightforward. It could also be the case that men are more likely to be designated as recipients in cases when support is provided for the whole family. To the extent that there are gender differences in receiving government support, we expect correlation with the gender gap in financial inclusion.
- Country dummy variables. Initial analysis has revealed that there are important differences in financial inclusion indicators among the economies analysed. In order to capture these, we include dummy variables (with Poland, as the largest country in the sample, being the reference) in our specification.

Analysis is first performed on the overall sample, additionally including a dummy variable referring to age, the working age group being the reference. Subsequent analysis refers to separate estimates covering the younger population, the working age population and the older population.

Table 2. Factors explaining the gender gap in the financial inclusion of different age groups

	Entire sample	Young sample	Working age sample	Older sample
Male	0.79	0.61	0.87	0.78
Female	0.75	0.59	0.84	0.71
Difference	-0.04	-0.01	-0.03	-0.07
Total contribution (% of difference)	72.79	105.07	78.60	67.17
% of total contribution				
Young	-13.89***			
Older	0.76			
Secondary ed.	44.83***	76.99***	33.69***	42.24***
Tertiary ed.	1.30	-83.89***	-17.03	15.11***
Empl	56.45***	118.89***	71.68***	28.44***
Income_1q	1.49**	6.71	10.76**	-1.56*
Income_2q	1.86**	-2.06	5.70*	0.56
Income_4q	0.15	3.39	-0.70	-0.31
Income_5q	5.91***	5.52	-1.04	8.12***
Agriculture	0.17	-0.87	-0.23	0.54
Gov_support	-0.57***	-40.75***	-9.62**	0.68
Albania	4.89***	45.99**	7.48**	-2.22*
Hungary	-0.23	1.14	-0.52	-0.17
Czechia	-0.20	-8.66	-0.10	0.02
Romania	-1.19*	0.18	-3.66	-0.96
B. and H.	3.31**	14.49	5.97*	-0.24
Bulgaria	4.90***	1.16	-1.58	7.97***
Croatia	2.94**	-1.24	2.16	3.27**
Cyprus	4.25**	12.75	0.75	4.42**
Estonia	-2.51	-6.04	-0.12	-3.79*
Latvia	-1.66	-13.02	1.22	-1.79
Lithuania	-0.01	10.38	0.94	-0.02
FYR of Macedonia	0.51	-6.39	0.21	0.74
Malta	-2.27	5.69	-3.04	-1.44
Montenegro	0.64	0.62	0.84	0.31
Serbia	0.04	-2.97	-0.32	0.44
Slovak R.	-0.72	-11.00	0.50	-0.51
Slovenia	-1.07	3.81	2.15	-0.77
Kosovo	-4.83***	-30.07	-6.10**	0.78

Source: authors' estimates based on World Bank Global Financial Inclusion Database (2014)

Notes: *** denotes the significance at 1 percent, ** denotes the significance at 5 percent and * denotes the significance at 10 percent.

The diagnostics segment of Table A2 in the Appendix reveals the structure of the sample. As previously noted, probit estimates were based on the male sub-sample, while the total number includes both genders. The pseudo R^2 of the probit estimates is relatively high and in all cases all variables are jointly significant.

There are important differences when different age groups are considered, although in all cases, on average, it is more likely that men will have an account with financial institutions rather than women. The financial inclusion gap is the smallest for the youngest and widest for the oldest sub-sample. Chosen variables jointly explain between 67% (for the oldest sub-sample) and 105% (for the youngest sub-sample) of the gap. The result for the youngest sub-sample is somewhat surprising. Bearing in mind that the coefficients of the probit estimates rely on the male sub-sample, this would imply that there are important differences between young males and females and this creates a lucrative venue for future research efforts. Results so far indicate that, had the young females the same observable characteristics as the young males, the gap we are interested in for the purpose of this research would be even wider.

When the total sample is considered, the largest positive contributor to the gap is employment, implying that labour market exclusion is related to financial exclusion. When specific age groups are considered, labour market exclusion is very important for the young population. It could be the case that family responsibilities for women aged 15-29 are related to their distance from the labour market and, subsequently, also the reason why they are less likely to have an account with a financial institution than men of the same age. Although the employment variable is also significant for the older age group, for them the most relevant variable explaining the gap is secondary education. The difference in higher educational attainment at this age explains the existing gap. It is also important for other age groups: the least important for the working age population, but interesting result is that it is also important for explaining the gap in the younger population.

The variable acting towards reduction of the gap in young population is tertiary education. For the older population, tertiary education is still an important contributor in explaining the gap. This shows that in the older age group there are important differences concerning the educational attainment level between men and women. However, these educational differences are not contributing factors to explaining the existence of the gap in young population; quite the contrary. For the young, had the men and women the same level of educational attainment (other characteristics being equal), the gap would be even wider. Since young women tend to have higher educational attainment, it is important to investigate the drivers for financial inclusion beyond education.

Income variables also provide explanation for the existing gap, but in a very specific way. In the case of working population, lower end of the income distribution is an important covariate explaining gender differences in having an account with

a financial institution. For the older population, a significant explanation is at the higher end of income distribution. Traditional roles in the family seem to be preserved in the older population sub-group with higher income. It also seems that traditional family roles are important for prime-age working population at the lower end of income distribution.

Government support acts towards reducing the gender gap in having an account with a financial institution for young and working population. In both cases, had females in the same proportion been designated the recipients of government support, the gap would have been even wider. These results deserve additional attention in future research. However, based on correlations presented in this paper, it is not clear whether any policy recommendations can be made. Hence, the nature of channelling government support and its impact on financial inclusion of beneficiaries should be more thoroughly investigated.

As initially expected, the country of residence is an important predictor for explaining the gender gap in financial inclusion. Our results indicate that this is even the case when we focus on young population. Thus, if policy recommendations are sought, it would be beneficial to analyse what drives the gender gap in financial inclusion among young population across different countries.

5. Discussion

A well-functioning financial system plays a vital role not only in supporting economic growth (Wachtel, 2001), but also in meeting individuals' financial needs. Even though post-transition economies still share many common features, development of their financial systems differs. Most post-transition economies inherited banking systems with structural distortions; however, unlike less-advanced reformers, fast-trackers managed to come up more easily with a relatively strong banking sector (Bonin and Wachtel, 2002). On the other hand, less-advanced reformers are still lagging behind in financial intermediary development, especially in lending ability (Cojocaru *et al.*, 2015). At the same time more developed financial systems are associated with a higher share of individuals having an account. Hence, the more developed financial system, the higher the probability also of females to have an account and to be financially included.

A limited number of studies on financial inclusion determinants focus on the gender difference in financial inclusion. However, most of them confirm the existence of a gender gap in financial inclusion. Demirgüç-Kunt, Klapper and Singer (2013), in a sample of 98 developing countries find evidence of a significant gender gap in financial inclusion, even after controlling for individual characteristics. Muravyev, Schäfer and Talavera (2009), who analyse a sample which mostly includes post-socialist economies in Eastern Europe and Central Asia, acknowledge the discrimination against female entrepreneurs. The gender gap in financial inclusion

is not only present in developing countries. Morsy and Youssef (2015) analyse developed and developing countries and also find that females are more likely to be financially excluded. However, as Muravyev, Schäfer and Talavera (2009) find, in more financially developed economies females are more likely to get loans and to face lower collateral requirements.

Young population is especially vulnerable to financial exclusion. Our results show that contributing factors to the financial inclusion gap of the young population are, among others, employment and education. Unemployment of young population, which is very high in many post-transition countries (Tomić, 2016; International Labour Organization, 2015), is another barrier to financial inclusion. Since entrepreneurship and self-employment are important contributors to the overall employment growth (Botrić and Tomić, 2016) and employment is an important determinant of financial inclusion, promoting entrepreneurship might be a way to increase relationships with financial institutions and, thus, of being financially included. However, we have to bear in mind that it is difficult to start a business in an uncertain environment, especially for a young population that, generally speaking, has not accumulated the wealth needed to start a business. Since our sample covers the still economically fragile period, starting a business might have been an obstacle to a significant number of young persons and, hence, a number of them remained financially excluded during this period.

A similar argument is valid for education. Since better education is associated with finding a job more easily (Wolbers, 2003), higher educational attainment is positively correlated with financial inclusion. Hence, investment in education, especially in education quality, might reduce the financial inclusion gender gap in younger population. The choice to continue education might also be restrained by the financial resources available. To the extent that this decision depends on the resources within a family, it might be the case that a male child is favoured in comparison to a female child. Policies aimed at supporting education, in particular alleviating the financial burden for parents, could decrease the gender gap in financial inclusion.

Financial inclusion can also be related to migration. High unemployment in post-transition countries might cause migration to more developed countries, which are suffering less from unemployment problems, especially youth unemployment. If migrants had the opportunity for self-employment and, thus, were able to generate adequate income, they would not be forced to migrate. Hence, policies targeted to increase self-employment and entrepreneurship might not only increase financial inclusion, but also decrease migration pressures coming from low job opportunities.

6. Conclusions

In this paper we tackled the issue of gender gap in financial inclusion across post-transition economies. Results show that financial inclusion varies across countries, but, in general, males are more financially included than females. Since we were interested in differences in financial inclusion for different age groups, we conducted the analysis on the entire sample and separately on the young, the prime-age active and the older-than-50 sub-samples. Our results indicated that the financial inclusion gender gap for the youngest population is the smallest.

We investigated several characteristics which were deemed important for explaining the gender gap: education, employment, income, government support, and whether a person is engaged in agricultural activity. When the entire sample is considered, the largest positive contributor to the gap is employment, implying that labour market exclusion is related to financial exclusion. Furthermore, we found that, while having secondary education explains the existence of the gap, tertiary education acts towards reducing the gap in the case of young population.

We found that traditional roles in the family (i.e. men being more financially included) are distributed differently across the family income spectrum. In the case of older population, traditional roles seem to be important for the higher end of income distribution, while for the working age population they seem to be evident at the lower end of the distribution.

Since having a financial account is a prominent issue for the financial inclusion of females, this problem might be mitigated, besides investing in formal education, by awareness-raising campaigns, which would bring financial services closer to women and, thus, decrease gender differences. Additionally, changes in legislation in some of the countries in our sample, which would remove restrictions on females working at the same jobs as males in some sectors, might increase the employability of females and, thus, their financial inclusion.

Given that our results indicate the smallest financial inclusion gap for the youngest population, and that they might adapt more easily to new situations, future research might broaden analyses with the types of financial exclusion of the younger population, as well as with the reasons behind it, which might give rise to the creation of policy measures designed to increase youth financial inclusion.

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Appendix

Table A1. Definition of variables

Variable	Definition
Fin_account	= 1, if respondent has an account with financial institution
Male	= 1, if respondent is male
Young	= 1, respondent is older than 15 and younger than (or equal to) 24
Working	= 1, if respondent is older than 25 and younger than (or equal to) 49
Older	= 1, if respondent is older than 50
Primary ed.	= 1, if respondents' highest completed education level is primary
Secondary ed.	= 1, if respondents' highest completed education level is secondary
Tertiary ed.	= 1, if respondents' highest completed education level is tertiary
Empl	= 1, if respondent received any money for doing work in the past 12 months
Income_1q	= 1, if respondents' household belongs to the 1st income quintile in the country
Income_2q	= 1, if respondents' household belongs to the 2nd income quintile in the country
Income_3q	= 1, if respondents' household belongs to the 3rd income quintile in the country
Income_4q	= 1, if respondents' household belongs to the 4th income quintile in the country
Income_5q	= 1, if respondents' household belongs to the 5th income quintile in the country
Agriculture	= 1, if respondent personally received money from the sale of his or family's agricultural products during the last 12 months
Gov_support	= 1, if respondent personally received any financial support from the government during the last 12 months
Country	= 1, if respondent is from a specific country

Table A2. Probit estimates for Fairlie decomposition

	Whole sample	Young sample	Working sample	Older sample
Constant	0.12 (0.11)	-0.51* (0.29)	0.20 (0.21)	0.01 (0.12)
Young	-0.56*** (0.06)			
Older	-0.03 (0.05)			
Secondary ed.	0.58*** (0.05)	0.65*** (0.10)	0.71*** (0.10)	0.58*** (0.06)
Tertiary ed.	1.05*** (0.07)	1.35*** (0.24)	1.34*** (0.14)	0.89*** (0.10)
Empl	0.90*** (0.05)	0.83*** (0.10)	0.88*** (0.07)	0.88*** (0.07)
Income_1q	-0.33*** (0.06)	-0.20 (0.14)	-0.46*** (0.11)	-0.34*** (0.09)
Income_2q	-0.14** (0.06)	-0.09 (0.15)	-0.27** (0.12)	-0.06 (0.08)
Income_4q	0.07 (0.06)	0.20 (0.15)	-0.07 (0.12)	0.11 (0.08)
Income_5q	0.23*** (0.06)	0.18 (0.14)	-0.03 (0.11)	0.45*** (0.08)
Agriculture	0.01 (0.06)	-0.02 (0.16)	-0.02 (0.11)	0.04 (0.09)
Gov_support	0.34*** (0.05)	0.75*** (0.15)	0.29*** (0.11)	0.27*** (0.07)
Albania	-0.79*** (0.11)	-0.77*** (0.29)	-0.51** (0.21)	-1.00*** (0.15)
Hungary	-0.32*** (0.11)	-0.21 (0.33)	-0.18 (0.22)	-0.40*** (0.14)
Czechia	0.05 (0.12)	0.37 (0.33)	0.04 (0.23)	-0.02 (0.16)
Romania	-0.48*** (0.11)	0.07 (0.35)	-0.67*** (0.21)	-0.47*** (0.13)
B. and H.	-0.52*** (0.11)	-0.64** (0.30)	-0.42* (0.21)	-0.57*** (0.14)
Bulgaria	-0.55*** (0.11)	-0.46 (0.33)	-0.46** (0.22)	-0.58*** (0.14)
Croatia	0.30** (0.12)	-0.08 (0.28)	0.24 (0.23)	0.77*** (0.20)
Cyprus	0.62*** (0.12)	0.44 (0.30)	0.25 (0.24)	0.98*** (0.19)
Estonia	1.41*** (0.21)	1.34*** (0.48)	1.35*** (0.48)	1.51*** (0.28)
Latvia	0.41*** (0.13)	0.69** (0.35)	0.57** (0.29)	0.31* (0.17)
Lithuania	-0.05 (0.12)	-0.39 (0.30)	0.20 (0.25)	0.03 (0.17)
FYR of Macedonia	0.17 (0.12)	-0.31 (0.30)	0.09 (0.23)	0.43*** (0.16)
Malta	1.19*** (0.18)	0.61 (0.40)	1.29*** (0.43)	1.43*** (0.26)
Montenegro	-0.52*** (0.11)	-0.16 (0.30)	-0.71*** (0.20)	-0.50*** (0.15)
Serbia	0.16 (0.12)	0.48 (0.32)	0.05 (0.23)	0.10 (0.15)
Slovak R.	-0.23** (0.11)	-0.42 (0.31)	-0.29 (0.22)	-0.11 (0.15)
Slovenia	1.57*** (0.21)	1.30*** (0.48)	1.14*** (0.36)	1.96*** (0.37)
Kosovo	-0.37*** (0.10)	-0.40 (0.27)	-0.68*** (0.19)	0.14 (0.17)
Diagnostics				
N – probit	8087	1128	3234	3725
N – decomposition	19016	2364	7590	9062
LR chi2	2462.87***	398.92***	749.10***	1100.37***
Pseudo R2	29.76	26.36	30.70	27.77

Source: authors' estimates based on World Bank Global Financial Inclusion Database (2014)

SEEJE

Book Review

Strategie in volatilen Märkten
Wettbewerbsvorteile durch Unternehmungsdiversifikation

by James D. Madden
Duncker und Humblot GmbH, Berlin, 2017

reviewed by Grigoris Zarotiadis*

Competition is the Holy Grail of the orthodox school; not any kind of competition, but the perfect one among competitors who seek to optimise their very personal welfare. Yet, neither competition is perfect, nor is it merely to maximise the individual benefits of competitors.

James D. Madden contributes to this everlasting discussion, with his PhD dissertation "*Strategie in volatilen Märkten*" (Strategy in volatile Markets); he provides a comprehensive theoretical study (with empirical backing) on diversification, one of the major aspects of socioeconomic reality that removes perfectness from actual competition.

The author does not hide his preference for the (neo-) classical school – Friedrich A. von Hayek is his main inspiration and the source for the introducing citations chosen in the main chapters of his thesis. Nevertheless, Madden is a business economist; therefore, he succeeds in anticipating that beyond the necessary micro-foundation of theoretical macroeconomic neoclassical equilibria there lies the reality of the daily struggle to sustain a business in the framework of aggressive, often destructive, imperfect competition. This becomes obvious from the very beginning of the book, when the author sets the basic hypothesis of his analysis: "*on the one hand, businesses depend on new knowledge in order to adjust successfully to changing general conditions; yet, on the other hand, they do not have the time they would probably need to develop this new knowledge… business diversification is a way to efficiently solve this problem*" (page 7 of the book).

* Grigoris Zarotiadis, School of Economics, Aristotle University of Thessaloniki, Greece

The organisation of the book is quite straightforward. In his introductory chapter, the author determines his main question(s) and provides a logical diagram (page 25) that clearly describes the methodological structure of the ensuing pages.

Madden starts from the main linkage in relevant literature: from the point of view of each specific entrepreneur the decision to diversify results from uncertainty. It is the lack of perfect information that motivates producers to differentiate the commodities supplied, either in the procedure of producing them, or in their very specific characteristics themselves.

Here, it is necessary to clarify two issues with respect to this starting hypothesis set by the author: first, it is a microeconomic argument that searches for individual incentives, although, macro-economically speaking, diversification refers to the fact that today's societal needs expand not only quantitatively but also qualitatively. Second, it is a clearly neoclassical way of anticipating the motives for diversification, as they result from denying one of the most crucial 'orthodox' assumptions, namely, perfectness of information.

Heterodox analysts see in the decision to diversify one of the thinkable choices for the energetic, aggressive (in that sense) competitors to maintain and expand their spectrum of monopolistic power. It becomes obvious that the uncertainty argument (the starting point of Madden in his PhD thesis) refers, on the contrary, to passive competitors, who simply try to optimise their position in the framework of an overlying, untouchable competitive environment.

Next, in the contents of the book, the author proceeds with the second chapter presenting a thorough review of standard relevant literature regarding the decision to diversify. Beyond presenting theoretical justifications in a comprehensive way, he also includes in his examination an empirical meta-analysis to reach combinatory conclusions on the assessment of existing theoretical arguments. Overall, Madden concludes that existing empirical contributions provide, at best, a weak association between diversification and business success, whereas the causality of this relationship is even more dubious. For him this is an indication for the need of further, more sophisticated theoretical contributions. Thereby, he justifies the introduction of new arguments resulting from the non-standard assumptions of limited rationality, opportunistic behaviour and uncertainty, which is actually the theoretical path he chooses to follow.

In the following two chapters (C and D in the book) Madden goes deeper into a detailed analysis of the two main ways of modelling the decision to diversify, as well as the direction of diversification: first the theory that starts from transaction costs and, second, the one that focuses on the most efficient use of resources.

According to the author, neither transaction costs nor the resources based considerations are capable of providing convincing justification for our main question. Madden sees the reason for this weakness in the simplistic, I would also say obsessive, use of neoclassical and standard industrial economics hypotheses.

Based upon this recognition, the author proceeds to combine the tradition of transaction costs and resources modelling in a model where dynamic know-how and technology are included. In chapters E and F of the book, he presents his approach in detail, starting from the basic conceptions and moving on to the final presentation of the comprehensive model. The proposed framework goes beyond the standard assumption of homogenous technologies shared by all competitors and, consequently, provides alternative solutions for explaining the phenomenon of diversification in an environment of uncertainty. Madden summarises his contribution in 6 theoretical hypotheses that describe the way in which process and/or behavioural uncertainty induce businesses to develop-market, cooperative or hierarchical forms of diversification.

Concluding, the monograph reviewed constitutes a useful tool for any scholar who wants to deal with competition theory, especially concerning diversification issues. This happens because, first, the author provides a constructive review of relevant literature along with a practical categorisation of alternative arguments, and, secondly, because Madden presents an innovative, combinatory model that can form the basis for future theoretical advancements, as well as for relevant empirical research.

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