CONFERENCE FULL-PAPER PROCEEDINGS BOOK

3RD INTERNATIONAL CONFERENCE on Applied Economics and Finance (ICOAEF 2017)

6 - 7 December, 2017

Cyprus Science University

North Cyprus

Welcome to ICOAEF 2017

3rd International Conference on Applied Economics and Finance (ICOAEF 2017) is the third event in the series. We are proud to organise and host this event by the Cyprus Science University. ICOAEF 2017 provided an opportunity for all those interested in the Applied Economics and Finance to discuss their research and to exchange ideas. We received papers from all the following fields: Applied Macroeconomics, Applied Microeconomics, Applied International Economics, Applied Energy Economics, Applied Financial Economics, Applied Agricultural Economics, Applied Labour and Demographic Economics, Applied Health Economics, Applied Education Economics, Applied International Trade, Econometrics, Applied Statistics, Capital Markets, Corporate Finance, Quantitative Methods, Mathematical Finance, Operations Research, Risk Management.

This year, we were together with about 140 young and experienced researchers, Ph.D. students, post-doctoral researchers, academicians, and professionals from business, government and non-governmental institutions from over 20 different countries and enjoy about 140 presentations. ICOAEF 2017 attracting such a high number of particiapts is a good indicator of the success and means the conference serving its purpose and offer a good opportunity for scholarly exchange and networking.

We thank Cyprus Science University, again, for hosting ICOAEF 2017. We also thank the Central Bank of the Republic of Turkey, Enerji Piyasaları İşletme A.Ş, Young Businessman Assosiation of Turkey, and the Central Bank of the Turkish Republic of Northern Cyprus for their support and contribution to the Conference.

Ilhan Bora, PhD
ICOAEF2017, Co-organizor
Business Faculty
Cyprus Science University
Girne, North Cyprus

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Cyprus Science University
Merit Park Hotel (5*), Kyrenia, North Cyprus
www.icoaef.com

Program

Opening Speech :
Hall 1: 9.30-9.45, 06.12.2017

1. Prof. Dr. Ahmet Bülend Göksel (Rector, Cyprus Science University, North Cyprus)

Keynote Speakers
Hall 1: 9.45-11.00, 06.12.2017

1. Marc Willinger (University of Montpellier, France)
2. Aziz Turhan (Vice President, BDDK, Turkey)
3. Ali Yücelen (President, Young Businessmen Association of Turkey, Turkey)
4. Mustafa Akmaz (General Manager, Pension Monitoring Center, Turkey)

Break Time: 11.00-11.15

Special Session: EPIAS
Hall 1: 11.15-11.11.45, 06.12.2017

1. Eren Aksoy (EPIAS, Turkey)
   Chair: Talat Ulusever (Acting President, Capital Market of Boards of Turkey, Turkey)

Special Workshop on Applied Economics
Hall 1 : 11.45-12.45, 06.12.2017

- **A Wavelet-Based Approach of Testing for Granger Causality**
  1. Pejman Bahramian (Head of Economics Department, Girne American University, North Cyprus)

Sessions

Applied Economics
Hall 1 : 14.00-15.00, 06.12.2017

Income and Consumption Convergence Across Turkish Regions: Dynamic Panel Quantile Regression Approach
Murat Güven (Istanbul Technical University, Turkey)
Bülent Güloğlu (Istanbul Technical University, Turkey)
Fuat Erdal (Ibn Haldun University, Turkey)

Comparative Analysis of the Impact of Fixed and Flexible Exchange Rates on Economic Growth of Nigeria: A VECM Approach

Behiye Cavusoglu, (Near East University, North Cyprus)
Aliyu Shuaibu, (Near East University, North Cyprus)

Has the efficiency of foreign exchange markets in India evolved over time?
R.P. Datta (Indian Institute of Foreign Trade, India)
Ranajoy Bhattacharyya (Indian Institute of Foreign Trade, India)

Feldstein – Horioka Puzzle Re-Examination: ECOWAS Case (1986-2015)
Fatih Mangır (Selcuk University, Turkey)
Haldun Soydal (Selcuk University, Turkey)
Abdoul-Kader Sıdı Gandou(Selcuk University, Turkey)

Türkiye Ekonomisi
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Türk Bankacılık Sektörünün Gelişiminin Analizi (2005-2016 Dönemi)
Serpil Cula (Başkent University, Turkey)
Adalet Hazar (Başkent University, Turkey)
Şenol Babuşçu (Başkent University, Turkey)

Türkiye'de BeklenenYaşam Süresinin Modellenmesi
Ayhan Aydın (Adnan Menderes Üniversitesi, Türkiye)
Serpil Aydın (19 Mayıs Üniversitesi, Türkiye)
Osman Peker (Adnan Menderes Üniversitesi, Türkiye)

Tekrarlı Yarı-Yapılandırılmış Görüşmelerde "Doyma NoktasıYanılsaması" Sorunsalı Üzerine Bir Tartışma
Mehmet Eryılmaz (University of Uludağ, Turkey)

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Hicran Kasa (Türk Hava Kurum Üniversitesi, Türkiye)
Esra Uygun (Gaziosmanpaşa Üniversitesi, Türkiye)

Finansal Kiralama (Leasing) ve Ekonomi için Önemi: Riskler, Avantajlar
Deniz Şişman (Gelişim Üniversitesi, Türkiye)
Mehmet Şişman (Marmara Üniversitesi, Türkiye)

Applied Finance II
Hall 3 : 14.00-15.00, 06.12.2017

Managerial Entrenchment Hypothesis and Dividend Payout Policy
Raheel Gohar (College of Business Administration, Al Yamamah University, Kingdom of Saudi Arabia)
Ayesha Rashid Loan (COMSATS, Pakistan)

A Markov Autoregressive Dynamic Causality Analysis For World Equity Markets In Crisis Period
Mesut Türkay (Undersecretariat of Treasury, Turkey)
Alper Özün (University of Greenwich, School of Business, London, UK)

Effects Of Exchange Rates On Corporate Profits: A Tobit Analysis
Nazlı Karamollaoğlu (MEF University, Turkey)

Low Price Anomaly And Capital Market Trends - Case of Warsaw Stock Exchange
Magdalena Jasiniak (University of Lodz, Poland)

A Test For Joint Market Efficiency From An Investor's Perspective
Lakshmi Viswanathan (Institute for Financial Management and Research, India)
S.Maheswaran (Institute for Financial Management and Research, India)

Energy Economics-I
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Evaluation of Wind Energy Potential and Economic Analysis of Wind Energy Turbine Using Present Value Cost Method at Famagusta, Rizokarpaso, Kyrenia, Morphou, Nicosia and Ercan in Cyprus: Case Study
Youssef Kassem (Near East University, North Cyprus)
Hüseyin Çamur (Near East University, North Cyprus)
Abdelrahman Alghazali (Near East University, North Cyprus)

Parametric and Non-Parametric Models to Estimate Households and Businesses' Willingness to Pay for reliable electricity supply in Nepal
Naghmeh Niroomand (Cambridge Resources International)
Glenn P. Jenkins (Eastern Mediterranean University, North Cyprus) and (Queen's University, Canada)

Energy Consumption, Economic Growth And Co_2 Emissions: Evidence From Turkey
Ayhan Kapusuzoglu (Ankara Yildirim Beyazit University, Turkey)
Nildag Basak Ceylan (Ankara Yildirim Beyazit University, Turkey)

The Efficiency of Commodities Markets: Energy, Precious Metals, and Base Metals
Efe Çağlar Çağlı (Dokuz Eylul University, Turkey)
F.Dilvin Taşkın(Yasar University, Turkey)
Pınar Evrim Mandacı (Dokuz Eylul University, Turkey)

Strategic Dynamic Climate Policy: The role of CCS
Tunç Durmaz (Yıldız Teknik Üniversitesi, Türkiye)

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Multidisciplinary-I
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Kenan Kayan (Kocaeli University, Turkey)

Estimation of the Static Corporate Sustainability Interactions Model
Mehmet Ali Soytas (Ozyegin University, Turkey)

Who Cares About The Cyprus Problem? A Socio-Demographic Analysis In Northern Cyprus
Selim Jürgen Ergun (Middle East Technical University – Northern Cyprus Campus, North Cyprus)

M. Fernanda Rivas (Middle East Technical University – Northern Cyprus Campus, North Cyprus)

Cooperation and Optimism In A Social Dilemma
Olusegun A. Oyediran (University of Castilla-La Mancha, Spain)
M. Fernanda Rivas (Middle East Technical University – Northern Cyprus Campus, North Cyprus)
Mark Coulson (Middlesex University, UK)
David Kernohan (Middlesex University, UK)

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"Belirsizlik" ve "Beklentilerin" Rasyonellik Üzerindeki Etkileri: Davranışsal İktisat Açısından Bir Değerlendirme
Sema Yılmaz Genç (Kocaeli University, Turkey)

Yapay Zekanın Ekonomi Üzerindeki Olası Etkisi
Selçuk Koç (Kocaeli University, Turkey)
Sema Yılmaz Genç (Kocaeli University, Turkey)
Mehmet Çağrı Gözen (Kocaeli University, Turkey)

FİNTECH: Finansal Sektör Açısından Mitler ve Gerçekler
Murat Güleç (Banking Regulation and Supervision Agency, Turkey)

Küresel Ekonomik Sistemde Kripto Paraların Büyümeye Etkisi"
Ayhan Aydın (Adnan Menderes Üniversitesi, Türkiye)
Osman Peker(Adnan Menderes Üniversitesi, Türkiye)

2000'li Yıllarda Bölgesel Kalkınmada Sınır Ticaretinin Önemi
Figen Büyükakın (Kocaeli University, Turkey)

Applied Economics-III
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Evaluation Of The Change Of Public Purchasing Policy Understanding In Turkey
Elif Ayşe Şahin Ipek (İzmir Kâtip Çelebi University, Turkey)
Yaprak Karadağ (İzmir Kâtip Çelebi University, Turkey)
Bernur Açıkgöz (İzmir Kâtip Çelebi University, Turkey)

Real Exchange Rate And Economic Growth: A Reconsideration Using Periodic Overlapping And Periodic Non-Overlapping Data
Mehdi Seraj (Eastern Mediterranean University, North Cyprus)
Seyi Saint Akadiri (Eastern Mediterranean University, North Cyprus)

The Relationship Between Budget Defict And Current Defict: The Case Of Turkey (1980-2016)
Hakan Acet (University of Selcuk, Turkey)
Mustafa Tek (University of Selcuk, Turkey)
Bedriye Tunçsiper (İzmir Democracy University, Türkiye)
Orhan Kasap (University of Selcuk, Turkey)

Tourism Economics II
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Abdullah Karaman (Selcuk University, Turkey)
Kürşad Sayin (Selcuk University, Turkey)

Sales Promotion Tools In Small Hotel Businesses And Their Importance: An Application
Kürşad Sayin (Selcuk University, Turkey)
Abdullah Karaman (Selcuk University, Turkey)

Does Tourism Revenue Contribute Economic Growth In Turkey?
Ayhan Kapusuzoglu (Ankara Yildirim Beyazit University, Turkey)
Nildag Basak Ceylan (Ankara Yildirim Beyazit University, Turkey)

Stock Market Development And Economic Growth: Evidence From A Set Of Emerging Market Countries
Ayhan Kapusuzoglu (Ankara Yildirim Beyazit University, Turkey)
Nildag Basak Ceylan (Ankara Yildirim Beyazit University, Turkey)

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Yasemin Özerkek (Marmara University, Turkey)
Zeynep Deniz Dervişen(Kadir Has University, Turkey)

The Relationship of Real Wages, Inflation And Labor Productivity for Turkey
Filiz Eryılmaz (University of Uludağ, Turkey)
Hasan Bakır (University of Uludağ, Turkey)

Relationship Of Human Capital With Economic Growth In Turkey: ARDL Bound Testing Approach
Sevilay Konya (Selcuk University, Turkey)
Gülbahar Kabaloğlu (Selcuk University, Turkey)
Mücahide Küçüksucu Konya Necmettin Erbakan University, Turkey)
Zeynep Karaçor (Selcuk University, Turkey)

Digital Economy and Effects on Economic Development
Esra Kabaklarlı (Selcuk University, Turkey)
Duygu Baysal Kurt (Selcuk University, Turkey)
Yasemin Telli Üçler (Konya NecmettinErbakan University, Turkey)

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Üniversite-Sanayi İşbirliğinin Potansiyel Bir Öncülü Olarak Üniversite İmajı Üzerine Bir Tartışma
Mehmet Eryılmaz (University of Uludağ, Turkey)

Stratejik Yönetimin Işletmeye Olan Katkısı Ve Önemi
Leyla Şenol (Kocaeli University, Turkey)

Kamusal Dürtme: Kamu Politikalarinda Seçim Mimarisi
Cevat Tosun (Hitit Üniversitesi, Türkiye)
Emre Özyerden (Hitit Üniversitesi, Türkiye)

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Ayhan Orhan (Kocaeli University, Turkey)

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Rojhat Genc (Kocaeli University, Turkey)
Abdullah Eker (Dicle University, Turkey)

Multidisciplinary II
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Centrality Measures In Network Analysis: Learning From The VCG Mechanism
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Pierfrancesco Reverberi (La Sapienza - Università di Roma, Italy)

The Analysis of the Relationship Between Hope Level and Sociodemographic Characteristics
Selay Giray (Marmara University, Turkey)

An Assessment On Effects Of Using Renewable Energy Resources In Turkey
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Abdullah Eker (Dicle University, Turkey)

An Analysis For The Relationship Between Trade Openness And Economic Growth: Evidence For Ten African Countries
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Esra Kabaklarlı (Selçuk University)
Fatih Ayhan (Bandırma Onyedi Eylül University)

Macro And Micro Determinants Of Trade In Services: The Case Of British Service Traders
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Fikret Dülger (Çukurova Üniversitesi, Türkiye)
Burhan Biçer (Osmaniye Korkut Ata Üniversitesi, Türkiye)

TMCB Altın Rezervinin Holt - Winters Üstel Düzleme Yöntemi ve Yapay Sinir Ağları ile İncelenmesi
Hasan Aykut Karaboğa (Yıldız Teknik Üniversitesi, Türkiye)
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İbrahim Demir (Yıldız Teknik Üniversitesi, Türkiye)

AB Ülkelerinde Kutuplaşma Teorisinin Ekonomik Mali Göstergelerle İncelemesi
Doç Dr. Deniz Aytaç (Hitit Üniversitesi, Türkiye)
Araş. Gör.Necmi Ocak(Hitit Üniversitesi, Türkiye)

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Berna Serener (European University of Lefke, North Cyprus)

Islamic Finance, In The Light Of Institutional Framework, For Macroeconomic Resilience And Multipolar World
Mughees Shaukat (College of Banking and Financial Studies under the Central bank of Oman, Oman)

On The Mind And Spirit Of Islamic Framework For Economic Justice
Mughees Shaukat (College of Banking and Financial Studies under the Central bank of Oman, Oman)
Bushra Shafiq (Islamic Banking Department, State Bank of Pakistan)

Health Economics
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Seyit Mumin Cilasun (Atılım University, Turkey)

Evaluation of Turkish Public University Hospitals
Nehir Balcı (Dokuz Eylül University, Turkey)
Gülüzar KURT GÜMÜŞ(Dokuz Eylül University, Turkey)

The Effect of Decentralization Policies on Hospital Performance: A Case Study for Turkish Public Hospital Reform
Emre Atılgan (Trakya University, Turkey)

Decentralization or Deconcentration in Health Sector? What Did Turkey Need to Do and What Happened?
Hakan Yaş (Trakya University, Turkey)
Emre ATILGAN (Trakya University, Turkey)

Financial Performance Analysis with Topsis Technique: A Case Study of Public University Hospitals In Turkey
Nehir Balcı (9 Eylül Unıversity, Turkey)

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Politik Risk Faktörlerinin Doğrudan Yabancı Yatırım Kararları Üzerine Etkisine Ilişkin Bir Analiz
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Fatih Mangır (Selçuk Üniversitesi, Türkiye)

Vergi Gelirleri Ile Ekonomik Büyüme Arasındaki Ilişkinin Ekonometrik Analizi (Seçilmiş OECD Ülkeleri Ve Türkiye)
Esra Uygun (Gaziosmanpaşa Üniversitesi, Türkiye)
Hicran Kasa (Türk Hava Kurumu Üniversitesi, Türkiye)

2011-2013 Döneminde Gerçekleştirilen Halka Arzların Işlem Görülen Pazarlar Itibariyla Fiyat Analizi, Düşük Fiyatlamanin Nedenleri Ve Uzun Dönem Performansi Etkileyen Unsurlar
Mehmet Özer (Sermaye Piyasası Kurulu, Türkiye)

Türkiye'de Genç İşsizliğin Değerlendirilmesi: Demografik Fırsat Penceresi Risk mi? Fırsat mı?
Şeyma Şahin (Bandırma Onyedi Eylül Üniversitesi, Türkiye)
Merve Çiloğlu Yörübulut (Bandırma Onyedi Eylül Üniversitesi, Türkiye)
Muhammet Kutlu (Atatürk Üniversitesi, Turkey)

Applied Economics-II
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Yılmaz Toktaş (Amasya University, Turkey)
Ali Altıner (Recep Tayyip Erdoğan University, Turkey)

Testing Unit Root of Main Macro-Economic Variables of Turkish Central Bank
Erkan Kara (NecmettinErbakan University, Turkey)
Fatih Azman (Necmettin Erbakan University, Turkey)
Mahmut Baydaş (Necmettin Erbakan University, Turkey)
Oğuzhan Kodalak (Necmettin Erbakan University, Turkey)

Fiscal Policy Sustainability in the Southern Africa: Implications for the Proposed Monetary Union
Ntokozo Patrick Nzimande (University of KwaZulu-Natal, South Africa)
Harold Ngalawa (University of KwaZulu-Natal, South Africa)

Non-Ruin Probabilities with Phase-Type Claims
Altan Tuncel (Kırıkkale University, Turkey)
Fatih Tank (Ankara University, Turkey)

Balance of Payments, Balance of Trades, FDI, Exchange Rate, and GDP: Empirical evidence from Canada
Mohammad Rajabi (Eastern Mediterranean University, North Cyprus)
Rasool Dehghanzadeh Shahabad (Eastern Mediterranean University, North Cyprus)
Mohammadreza Allahverdian (Eastern Mediterranean University, North Cyprus)
Naser Elahinia (Eastern Mediterranean University, North Cyprus)

Monetary Policy I
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Fatih Yılmaz (Central Bank of Republic of Turkey, Turkey)

Brexit And Its Impacts On The United Kingdom And The EU
Hüseyin Özdeşer(Near East University, North Cyprus)

Back To Normal?
Lakshmi Viswanathan (Institute for Financial Management and Research, India)
S.Maheswaran (Institute for Financial Management and Research, India)

Banking Efficiency In The Eurozone
Onur Akkaya (Kilis 7 Aralık University, Turkey)

The Reaction of Turkish Central Bank to the Monetary Policy of the Federal Reserve Bank
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Özcan Özkan (Kilis Yedi Aralik University, Turkey)

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Labor Economics
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Analytical Investigation Of Labor Market Interactions In Turkey
Orhan Çoban (Selcuk University, Turkey)
Duygu Baysal Kurt (Selcuk University, Turkey)
Emre Sinan (Selcuk University, Turkey)
Ayşe Çoban (Selcuk University, Turkey)

The Relationship Between Job Demands, Exhaustion, And Turnover Intention: A Test Of Moderated Mediation Model
Mehmet Ferhat Ozbek (Gümüşhane University, Turkey)

Domestic Violence and Female's Labor Market Conditions in Turkey: An Analysis of Cross-Sectional Data
Hakan Ulucan (Pamukkale University)

Unemployment Hysteresis in Turkey: Stationarity Tests with Fourier Functions
İpek Tekin (Cukurova University, Turkey)

Economic Development
Hall 2 : 10.30-11.30, 07.12.2017

Financial Development And Income Distribution Inequality In The Euro Area
Donatella Baiardi (Università di Parma, Italy)
Claudio Morana (Università di Milano-Bicocca , Italy) and (CeRP-Collegio Carlo Alberto, Italy)

Validity Of Thirlwall's Law For BRICT Countries: Panel Data Analysis
Filiz Erataş Sönmez (Celal Bayar University, Turkey)
Yagmur Sağlam (Sinop University, Turkey)

The Significance of Non-Cash Turnover In Economic Growth
Radosław Pastusiak (University of Lodz, Poland)
Magdalena Jasiniak (University of Lodz, Poland)

An Analysis Of Electricity Generation And Economic Growth in Malaysia
Farah Roslan (University of Aberdeen, United Kingdom)

Relationship Between Foreign Direct Investment, Domestic Investment and Economic Growth in India
Farid Irani (Eastern Mediterranean University, North Cyprus)

Applied Economics and Finance I
Hall 3 : 10.30-11.30, 07.12.2017

Portfolio Optimization By General Semi-Variance Approach For Risk Measurement Using Gaussian Kernel Estimation
Ahmad Darestani Farahani
Hossein Soleimani Amiri

A Risk Scenario Analysis for the Turkish Economy
Bilal Bagis (Bingol University, Turkey)

Determinants of the Turkish Foreign Aid: A Quantitative Analysis
Abdurrahman Korkmaz (İzmir Kâtip Çelebi University, Turkey)
Hüseyin Zengin (İzmir Kâtip Çelebi University, Turkey)

The Effect of Social Transfers on Income Inequality and Poverty
Egemen İpek (Gümüşhane University, Turkey)

The Effects of Institutions on Economic Growth: The Evidence from Turkey
Emin Ertürk (University of Uludağ, Turkey)
Filiz Eryılmaz (University of Uludağ, Turkey)

Applied Finance
Hall 4 : 10.30-11.30, 07.12.2017

Convergence in Financial Measures: Theory and Evidence
Ünal Seven (Central Bank of the Republic of Turkey, Turkey)
HakanYetkiner (Izmir University of Economics, Turkey)

Profit and Cost Functions Analysis for The Swedish Financial System
OnurAkkaya (7 Aralık Kilis University, Turkey)

Parasocial Breakup And Demand For Stocks By Domestic Investor In The Bist
Ibrahim Bozkurt (Cankiri Karatekin University, Turkey)
Mercan Hatipoglu (Cankiri Karatekin University, Turkey)

Bank-Specific and Country Risk Determinants of Bank Profitability: The Case of Ukraine
Seyed Alireza Athari (Girne American University, North Cyprus)

Oksana Kindrat (Girne American University, North Cyprus)

Does Corporate Governance News Influence Investor Reaction? Evidence from the Banking Industry
Doriana Cucinelli (University of Milan-Bicocca, Italy)
Daniele Previtali (Luiss Guido Carli, Italy)
Maria Gaia Soana(University of Parma, Italy)

Break-time 11.30-12.00, 07.12.2017

Applied Banking
Hall 1 : 12.00-13.00, 07.12.2017

Can Asset Growth Predict Expected Stock Returns In Borsa Istanbul?
Asil Azimli (Dokuz Eylul University, Turkey)
Pınar Evrim Mandacı (Dokuz Eylul University,Turkey)

Facing The Contagious Credit Ratings: Is it True Or A Myth?
Gul Şerife Huyugüzel Kışla (Ege University, Turkey)

Credit Risk Assessment for Real Sector Firms
Mehmet Selman Çolak (**Central Bank** of the Republic of **Turkey, Turkey)**

Role of Internal Audit in Enterprise Risk Management: Evidence from a Signaling Game Analysis
Halis Kiral (Social Sciences University of Ankara, Turkey)
Hakan Karabacak (Turkish Ministry of Finance, Turkey)

Uygulamalı Ekonomi ve Finans II
Hall 2 : 12.00-13.00, 07.12.2017

Orta Gelir Seviyesindeki Seçilmiş Ülke/Ülke Grupları Açısından Yakınsama Ve Iraksama
Selçuk Çağrı Esener (Bandırma Onyedi Eylül Üniversitesi, Türkiye)
Burak Darıcı (Bandırma Onyedi Eylül Üniversitesi, Türkiye)
Şeyma Şahin (Bandırma Onyedi Eylül Üniversitesi, Türkiye)

Finansal Piyasalarda Uzun Dönemli Bağımlılık ve Etkin Piyasalar Hipotezi
Mercan Hatipoglu (Cankiri Karatekin University, Turkey)
Ibrahim Bozkurt (Cankiri Karatekin University, Turkey)

Türkiye'de Emek Piyasası Etkileşimlerinin Analitik Bir Incelemesi
Orhan Çoban (Selçuk Üniversitesi, Türkiye)
Duygu Baysal Kurt (Selçuk Üniversitesi, Türkiye)
Emre Sinan (Selçuk Üniversitesi, Türkiye)
Ayşe Çoban (Selçuk Üniversitesi, Türkiye)

Yaşam Sürelerinin Aktüeryal Analizlerde Kullanımı
Fatih Tank (Ankara Üniversitesi, Türkiye)
Altan Tunçel (Kırıkkale Üniversitesi, Türkiye)
Taylan Matkap (Anadolu Sigorta, Türkiye)

Finansal ve Ticari Küreselleşmenin Beşeri Sermaye Üzerindeki Etkileri
Mina Mahjoub Laleh (Çukurova Üniversitesi, Türkiye)

Uygulamalı Ekonometri
Hall 3 : 12.00-13.00, 07.12.2017

Türkiye Ekonomisinde Cari işlemler Dengesi ve Ekonomik Büyüme Arasındaki Ilişki
Bedriye Tunçsiper (İzmir Demokrasi Üniversitesi, Türkiye**)**

Ar-Ge İnovasyon Finansmani Oecd Ülkeleri: Panel Veri Analizi
Hüseyin Tuğberk Tıraş

Elektrik Dağıtım Bölgelerinin Etkinliğinin Network Veri Zarflama Analizi ile Değerlendirilmesi
Serpil Aydın (Ondokuz Mayıs Üniversitesi, Türkiye)
Talat Şenel(Ondokuz Mayıs Üniversitesi, Türkiye)

Enerji Yoğunluğu Açisindan Firma Heterojenliği
Fikret Dülger(Çukurova Üniversitesi,,Türkiye)
Almıla Burgaç Çil(Çukurova Üniversitesi,Türkiye)

Inovasyon Ve Ekonomik Büyüme: Üst Ve Üst-Orta Gelirli Ülkeler Örneği
Gülçin Güreşci (9 Eylül Üniversitesi, Türkiye)
Esra Ballı (Çukurova Üniversitesi, Türkiye)

Lunch-time 13.00-14.00, 07.12.2017

Turizm Ekonomisi
Hall 1 : 14.00-15.00, 07.12.2017

Turizm Sektöründe Personel Güçlendirme ve Güç Mesafesinin İşten Ayrılma Niyeti Üzerindeki Etkisi: Bir Uygulama
Özer Yılmaz (Bandırma Onyedi Eylül Üniversitesi, Türkiye)
Kemal Eroğluer (Bakım Okulu ve Eğitim Merkezi, Balıkesir, Türkiye)
Cansen Can Akgül (Bandırma Onyedi Eylül Üniversitesi, Türkiye)

Harmonik Regresyon Analizini Zaman Serisiyle Karşılaştırma: 2017 Yılı Için Yurtdışını Ziyaret Eden Türk Vatandaş Sayısının Tahmini
Pelin Akin (OndokuzMayıs University,Turkey)
Yüksel Terzi(OndokuzMayıs University, Turkey)

Türkiye'de; Termal Sağlık Turizmi Kapsamında Uygulanan Yeni Stratejilerin Değerlendirilmesi
Volkan Akgül (BandırmaOnyediEylülUniversity, Turkey)
Cansen Can Akgül (Bandırma Onyedi Eylül University, Turkey)
Didem Ayhan (T.C. Sağlık Bakanlığı)

Türkiye'deki Doğum Tercihlerinin Mali Boyutu
Cevat Tosun (Hitit University, Turkey)
Buğra Burak Duman(Hitit University, Turkey)

Farklı Mevsimlerde Farklı Turizm Politikaları: Türkiye örneği
Abdurrahman Korkmaz (İzmir Kâtip Çelebi University, Turkey)
Sabriye Celik UGUZ(Balıkesir University, Turkey)
Ferhat TOPBAŞ(İzmir Democracy University, Turkey)

Ekonomik Kalkınma
Hall 2 : 14.00-15.00, 07.12.2017

Orta Gelir Tuzağı ve Türkiye
Mahmut Sami Duran (Selcuk University, Turkey)
Kıvılcım Metin Özcan (Ankara University of Social Sciences, Turkey)

Göçmen Girişimciler ve Ekonomik Kalkınma İlişkisi Üzerine Türkiye Özelinde Bir Tartışma
Mehmet Eryılmaz (University of Uludağ, Turkey)

Kurumsal Risk Yönetimi ve Yükseköğretim Örgütleri
Mehmet Eryılmaz (University of Uludağ, Turkey)

Türkiye'de Kredi Garanti Fonu Tedbirleri ve Büyüme Etkileri Üzerine Bir Analiz
Burçhan Sakarya
Alper Hekimoğlu

Business Cycle and Crises
Hall 3 : 14.00-15.00, 07.12.2017

Early Warning Indicators of Turkish Crisis in 2000 and 2001
Filiz Eryılmaz (University of Uludağ, Turkey)

The Political Business Cycles Theories: Evidence from Money Supply
Filiz Eryılmaz (University of Uludağ, Turkey)

The European Union's Monetary Policy Experience after 2008 Global Economic Crises
Filiz Eryılmaz (University of Uludağ, Turkey)
Derya Yılmaz (University of Uludağ, Turkey)
Emin Ertürk (University of Uludağ, Turkey)

The Macroeconomic Effects of Sovereign Risk Premium Shock: A Case Study for Turkey
Nimet Varlık(Kırıkkale University, Turkey)
Fulya Gebeşoğlu(Çankaya University, Turkey)
Serdar Varlık(Hitit University, Turkey)

Multidisciplinary-IV
Hall 4 : 14.00-15.00, 07.12.2017

Determinants Of Corporate Dividend Policy In Poland
Justyna Rój (The Poznań University of Economics, Poland)

The Economics of CCS: A Survey of The Recent Literature
Tunç Durmaz (Yildiz Technical University, Turkey)

Presenting an Ideal Production Planning Model in Multi-Product Supply Chain
Ali Alikhani (Islamic Azad University, IRAN)
Maryam Shoar (Islamic Azad University, IRAN)
Maral Mirzaei Moradi (Islamic Azad University, IRAN)

Military Coups And Financial Markets
Uğur Emek (Başkent University, Turkey)

Cyberloafing
Adnan Celik (Selcuk University, Turkey)
Fatma Gul Karacelebi (Selcuk University, Turkey)

Break-time 15.00-15.30

Turkish Economics
Hall 1 : 15.30-16.30, 07.12.2017

The Role of Institutions in Determining Saving Rates: Case Study from Turkey
Husnu Tekin (Istanbul University, Turkey)

Bayesian Analysis of Political Effects of Events on Financial Markets: A Case Study from Turkey
Hasan Aykut Karaboga(Yıldız Technical University, Turkey)
Ersin Sener(Yıldız Technical University, Turkey)
Ibrahim Demir (Yıldız Technical University, Turkey)

Expectations And Household Expenditure: Case Of Turkey
Egemen İpek(Gümüşhane University, Turkey)
Haydar Akyazı (Karadeniz Technical University, Turkey)

Current Account Dynamics: A Study On Turkey With FAVAR Approach
Bige Küçükefe (Namık Kemal University, Turkey)
Dündar Murat Demiröz (İstanbul University, Turkey)

How to Deliver Free Coal To The Poor Families? Turkey Case
Ergül Halisçelik (Undersecretariat of Treasury, Turkey)

Applied Economics-IV
Hall 2 : 15.30-16.30, 07.12.2017

The Identification Of FDI Determinants In Selected Country
Veronika Linhartová, (University of Pardubice, Czech Republic)

Political Connections: Evidence from Insider Trading around TARP
Ozlem AKIN
Nicholas S.
Coleman Christian Fons-Rosen Jose-Luis Peydr

Convergence in Crime Rate across OECD Countries
Ezgi Adıyaman (Izmir University of Economics, Turkey)
Hakan Yetkiner (Izmir University of Economics, Turkey)

An Investigation for the Relationship between Foreign Trade and Employment for Turkish Economy
Fatih Ayhan (Bandirma Onyedi Eylul University, Turkey)

Existence of Contagion from Three Angles: Volatility, Timing and Return Denomination
Dogus Emin (Social Sciences University of Ankara, Turkey)

Uygulamalı Ekonomi ve Finans III
Hall 3 : 15.30-16.30, 07.12.2017

Dış Yardımlar Ve Verimlilik Artışı: KKTC Ekonomisi Için Ampirik Bir Inceleme
Ömer Tuğsal Doruk(Kıbrıs Amerikan Üniversitesi, Türkiye)
Ahmet Kardaşlar (Çukurova Üniversites, Türkiye)
Yusuf Can Şahintürk(Deniz Bank , Türkiye)

Doğrudan Yabancı Yatırımların Çevre Kirliliği Üzerine Etkisi: Üst-Orta Gelir Grubu Ülkeleri Için Ekonometrik Bir Analiz
Faruk MİKE (Hakkari Üniversitesi , Türkiye)
Ahmet Kardaşlar (Çukurova Üniversitesi, Türkiye)

Sağlık Harcamalarının Ekonomik Büyüme Üzerindeki Etkisi: Avrupa Ve Merkez Asya Ülkeleri Örneği
Barış YILDIZ (Gümüşhane Üniversitesi, Türkiye)
Gizem AKBULUT (Gümüşhane Üniversitesi, Türkiye)

Tüketici Teorisinde Yeni Yaklaşım: Açıklanmış Tercihler
Özlem İpek (Gümüşhane Üniversitesi, Türkiye)
Haydar Akyazı (Karadeniz TeknikÜniversitesi, Türkiye)

Applied Economics and Finance II
Hall 4 : 15.30-16.30, 07.12.2017

The effect of Bank-Specific determinants and minority Shareholders' Protection on the Dividend Policy: Evidence from Nigerian Banks
Seyed Alireza Athari (Girne American University, North Cyprus)
Irina Belaya (Girne American University, North Cyprus)

The Effect of Exchange Rate on Economic Growth: The Case of Turkey
Bilal Khan (Girne American University, North Cyprus)

The Effect of Country Risk and Tourism Revenue on Economic Growth: The Case of Balkan Countries
Arsen Rakhmatulin (Girne American University, North Cyprus)

The Impact of Fear and Greed on Stock Market Investment Decisions in USA
Seyed Alireza Athari (Girne American University, North Cyprus)
Sanjay Kumar (Girne American University, North Cyprus)

ORTA GELİR SEVİYESİNDEKİ SEÇİLMİŞ ÜLKE/ÜLKE GRUPLARI AÇISINDAN YAKINSAMA VE IRAKSAMA

Selçuk Çağrı ESENER[*]
Burak DARICI[**]
Şeyma ŞAHİN[***]

ÖZET

Ülkeler arası kişi başı gelir farklılıklarının zaman içinde azalıp azalmayacağı konusu Adam Smith'ten bu yana iktisatçıların önemle üzerinde durduğu konulardan birini oluşturmaktadır. Özellikle küreselleşme ve liberalizasyon eğilimleri bu konudaki değerlendirmelerin önemini arttırmıştır. Konunun kavramsal çerçevesi ve unsurları ile ilgili literatürdeki tartışmaların mevcudiyeti ise bu konunun iktisat literatürü için ne kadar önemli olduğunu ortaya koyacak türdendir. Bu amaçla, 1970-2015 dönemi için seçili ülke/ülke gruplarına ait kişi başı GSYİH büyüme oranları beşer yıllık dönemler halinde incelenmiştir. Bu çalışmada, ülke/ülke gruplarının gelişmiş ülke gruplarına yakınsayıp yakınsamadığı ve seçili ülke/ülke grupları arasında gelir farklılıklarında azalma olup olmadığı araştırılmıştır. Çalışmadan elde edilen sonuçlara göre, seçili ülke/ülke gruplarının gelişmiş ülke gruplarına yakınsama veya ıraksama gösterip göstermediği yorumlanacaktır. Ayrıca seçili ülke/ülke grupları arasındaki gelir farklılığının durumu gösterilecektir.

Türkiye açısından sonuçlara bakıldığında, kişi başına gelir düzeyinde hem yakınsamayı hem de ıraksamayı işaret eden çeşitli bulgulara rastlanmıştır. Türkiye ve gelişmiş ülkelerle olan ilişki önemli ölçüde yakınsama yönlü bir eğilimi işaret eder iken orta gelir seviyesindeki gelişmekte olan ülkelerle olan tekil ilişki de bir ıraksama görüntüsü ortaya çıkmaktadır. Dolayısıyla, bu ülkelerin kişi başına gelirleri 1970'lerden bu yana Türkiye'ye kıyasla daha fazla artış göstermiştir. Bu bir nevi ıraksama olarak algılanabilirse de bir ülkenin gelişmişlik seviyesi arttıkça ilk sıçrayışlara kıyasla daha küçük büyümeler gerçekleştireceği düşünülebilir. Nitekim günümüzde gelişmiş veya G7 ülkeleri büyüme değerleri Türkiye'ye kıyasla daha düşük düzeylerdedir. Benzer gelişmişlikteki seçilmiş ülkelerle yapılan kıyasta ise Türkiye'nin görece iyi bir ivmeye sahip olduğu da çalışmanın öne çıkan önemli bir sonucudur.

Anahtar Kelimeler: Ekonomik Büyüme**,** Yakınsama, Iraksama, Orta Gelir Seviyesi Ülkeler, Türkiye Ekonomisi

CONVERGENCE AND DIVERGENCE REGARDING TO THE SELECTED MIDDLE-INCOME COUNTRY / COUNTRY GROUPS

ABSTRACT

The issue, whether inter-country per capita income differences would diminish or not over time, has been one of the topics that economists have emphasized since Adam Smith. In particular, trends in globalization and liberalization have increased the significance of the studies. The existence of the discussions in the bibliographic conceptual framework and factors related to the subject show how important this subject is for the economic literature. For this purpose, per capita GDP growth

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rates for selected country / country groups, for the period between 1970 and 2015, were studied over five-year periods. In this study, it is analyzed whether the country / country groups converged to the advanced country groups or not and also whether there is a decrease or not in the income differences between the selected country / country groups. According to the results obtained from the study, It will be interpreted that the selected country / country groups show convergence or divergence to the developed country groups. Moreover the situation of inter-country/country groups income disparity will be demonstrated.

When we examine the results in terms of Turkey, it is observed several findings indicating both convergence and divergence in income per capita level. While the relationship between Turkey and developed countries indicates a significant convergence tendency, a divergent image emerges in the singular relationship with developing countries at the middle-income level. Therefore, the per capita incomes of these countries have increased more than in Turkey since the 1970s. Although this can be considered as a kind of divergence, it can also be thought that as development level increases, a country grows smaller than the first bounces. Indeed, nowadays, advanced or G7 countries have lower growth rates than Turkey. Another significant result of the study is that Turkey has a relatively good momentum in comparison with selected similar development-level countries

Keywords: Economic Growth, Convergence, Divergence, Middle Income Level Countries, Turkish Economy

1.GİRİŞ

Ekonomik büyümeye ve onun kökenlerine artan ilgi çeşitli teorilerin geliştirilmesine kaynaklık etmiştir. Salt üretim faktörleriyle açıklanan ekonomik büyümenin teknolojik gelişmeleri bertaraf etmesi neo-klasik büyüme teorisyenlerince kısmen giderilerek teknoloji modele dışsal olarak dahil edilmiştir. Neo-klasiklerin öngördüğü ve ekonomik büyümenin kaynaklarını açıkladığı yakınsama teorisindeki eksiklikler, ekonomik büyümenin kaynaklarını açıklama noktasında içsel büyüme modellerinin gelişimine zemin hazırlamıştır. Yeni büyüme modellerinde teknoloji içsel olarak modele dahil edilmiş ve teknolojinin yanı sıra beşeri sermayenin de ekonomik büyüme üzerinde etkisinin olduğu gündeme getirilmiştir. *Ayrıca neo-klasiklerin yakınsama öngörüsünün şiddetle eleştirisi yapılarak ıraksama sürecinin üzerinde durulmuştur*. Dolayısıyla yakınsama ve ıraksama kavramlarının tanımlanması, ilgili konuyu ele alırken üzerinde durulması gereken önemli bir husustur.

Neo-Klasik büyüme modelinin en önemli öngörülerinden biri yakınsama hipotezi, gelişmekte olan ülkelerin gelişmiş ülkelere kıyasla daha hızlı büyüyecekleri ve uzun dönemde kişi başı gelirlerindeki farkların azalarak birbirlerine yaklaşacağını öngörmektedir. Yakalama süreci de denilen bu öngörüye göre, bir ülkede kişi başına düşen gelirin başlangıç değeri ile gelirdeki büyüme hızı arasında negatif yönlü bir ilişki vardır (Nahar &Inder,2002: 2011). Sermayenin serbest dolaşımına dayanan ve sermayenin marjinal verimliliğinin düşük olduğu gelişmiş ülkelerden, sermayenin marjinal verimliliğinin yüksek olduğu gelişmekte olan ülkelere yapılan yatırımların teknoloji transferi ile harmanlanması durumunda büyüme farklılıklarının ortadan kalkacağı (Piketty,2015:74) ve teknoloji transferi ile birlikte yapılan yönetimsel avantajlarında bu sürece pozitif katkı yaptığı vurgulanmaktadır (Akıncı vd., 2016:3). Diğer bir ifadeyle bu öngörüde, görece geri kalmış ülkelerde ilave bir birim sermayenin yaratacağı verimin gelişmiş ülkelerden daha yüksek olması varsayımından hareket edilerek işçi başına sermaye stoku düşük ülkelerde ekonomik büyümenin daha hızlı olacağı ve böylece büyüme farklılıklarının uzun dönemde azalacağı kabul edilmiştir. Uzun dönemde ise bu sürecin gerçekleşmesi için iktisat politikalarına ihtiyaç duyulmadığı öngörünün diğer bir önemli vurgusudur (Berber, 2011:144). Sonuç olarak bu modele göre, ‘’belli koşullar veri iken geri iken geride kalmak, başlangıçtaki liderden daha hızlı büyüme kabiliyeti ve üretkenliği yaratır’’ (Ceylan, 2010: 50). 1950’li yıllarda Solow tarafından literatüre

kazandırılan bu model uzun dönemli ekonomik büyümenin kavramlaştırılması noktasında önemli bir etkiye sahip olmuştur. Ancak bu anlayışın gelişmekte olan ülkelerin ekonomik büyümeleri yönünde oluşturduğu iyimser beklenti, analitik ve kuramsal çerçevesinin dayandığı varsayımlar öngörünün geçerliliği noktasında sorgulanmasına neden olmuştur. *Nitekim hem literatürdeki hem de tarihsel süreçteki eğilimler bu yönde bir kalıtımsallığın olduğunu mutlak anlamda doğrulamamaktadır*.

Yakınsama hipotezinin en sistematik eleştirisi ise, 1990'lı yıllarda P.Romer ve R.Lucas tarafından yapılmıştır. Geliştirdikleri içsel büyüme teorisi aracılığıyla devlet merkezli bir yaklaşım benimseyerek, yakınsamayı sağlayan otomatik bir sirkülasyonun olmadığını aksine neo-klasik büyüme modelinin öngördüğü şekilde gerçekleşen sürecin ıraksamaya yol açacağını savunmuşlardır. Gelişmekte olan ülkelerin söz konusu profilleriyle gelişmiş ülkeleri yakalayabilmesi ancak gerekli önlemleri alması durumunda gerçekleşecektir. Alt yapı ve beşeri sermayeye değer katacak; ekonomi, sağlık, teknoloji ve ar-ge gibi politikalara ağırlık verilmesi durumunda ekonomik büyümenin sağlanabileceğini ve bu amaçla aktif iktisat politikalarına ihtiyaç duyulduğunu ortaya koymuşlardır. Ayrıca bu süreçte teknolojinin önemine vurgu yapılarak teknolojiyi neo-klasiklerin öngördüğü gibi sistemin dışına itmemişler, sistemin bir ürünü haline getirmişlerdir. Özellikle gelişmekte olan ülkeler için kritik bir önem taşıyan bu yaklaşımın ışığında büyümenin temel belirleyicisi, neo-klasiklerin öngördüğü gibi sermaye yetersizliği değil, devlet güdümünde yapılan etkin politikalardır (Demir, 2002:2). Dünya genelinde kişi başına düşen gelirin dağılımına bakıldığında hem yakınsama hem de ıraksama görüntüsü ortaya çıkmaktadır. 1870-1990 yılları arasında en zengin ülkeler ile en yoksul ülkeler arasındaki fark beş kat artmıştır (Pritchett,1997:3-4). Genelde ekonomik, toplumsal ve politik süreçler; özelde ise beşeri sermayenin etkinliğini arttıracak eğitim ve sağlık harcamalarının yetersizliği, beyin göçü ve teknolojik yenilik üretecek nitelikte insan sermayesinin olmaması ülkeler arasında gelir farklılığının artmasına neden olabilmektedir. Ayrıca üretim yapısında yaşanan değişim ve dönüşüm, servetin birikim ve paylaşım süreci, nüfusun yapısı, etkin ve istikrarlı olmayan hükümet politikaları ve bunların etkinliğini arttıracak yasal ve kurumsal çerçevenin olmayışı gelişmiş ülkelerle gelişmekte olan ülkeler arasındaki farkın açılarak gelirlerinin birbirlerinden farklılık göstermesine yol açmaktadır. Üzerinde durulması gereken bir diğer önemli husus ise, dünya genelinde özellikle de 1990 döneminden sonra bir yakınsama trendi olduğudur. Küreselleşme özellikle de uluslararası ticaretin serbestleşmesi büyük kazançlar yaratılmasında en önemli etkiye sahiptir. Uluslararası ticaretin avantajlı hal almasında ise bilgi ve teknolojinin yaygınlaşması etkili olmuştur. Buna ek olarak güçlü hükümet politikalarının da bu sürece pozitif katkı yaptığı söylenebilir.

2. LİTERATÜR

Ülkeler arasında gelir farklılıklarında zamanla bir azalma olup olmadığı konusu iktisadi büyüme literatürünün önemli konularından birini oluşturmaktadır. Yapılan ampirik çalışmaların gerek veri setindeki farklılıklar gerekse uygulamadaki yöntem çeşitliliği bu konunun 1980'lerden günümüze dinamizmini göstermektedir. Nitekim bu alanda yapılan ilk ekonometrik çalışma olarak kabul edilen Baumol (1986)'dan günümüze ülke, bölge ve il bazlı; kişi başı gelir, büyüme oranı, satın alma gücü paritesi gibi değişkenler kullanılarak farklı yöntemlerle yapılmış çalışmalar mevcuttur. Çalışmaların sonuçlarındaki farklılıklar ise bu alanda belirsizliğe neden olabilmektedir. Ancak literatür incelendiğinde genellikle potansiyel olarak ekonomik performansı birbirlerine yakın ülke/ülke gruplarında zamanla gelir farklılıklarının azaldığı, ülkelerin kişi başı gelir düzeyinde birbirlerine yaklaştıkları görülmüştür. Nitekim daha çok benzeşen ülke/ülke gruplarının incelendiği çalışmalar, *Baumol (1986), Li ve Papel (1999), Freeman ve Yerger (2001), Nahar ve Inder (2002), Strazicich vd. (2004), Ceylan (2010), Gögül ve Korap (2014), Yeşilyurt (2014), Sarıbaş (2016), Savacı ve Karşıyakalı (2016),* bu durumu destekler niteliktedir. Ekonomik performans olarak görece az benzeşen ülke/ülke gruplarının incelendiği çalışmalarda ise, *Gauiler vd., (1999), Seyrek (2002), Niroomand (2005), Akıncı ve Yılmaz (2012), Nissan ve Ayala vd., (2013), Çamurdan ve Ceylan (2013), Tüzemen ve Tüzemen (2015), Akıncı ve Sevinç (2016)*, ülkelerin kişi başı gelir düzeyinde birbirlerinden uzaklaşma eğiliminde oldukları sonucuna varılmıştır. Ancak sözü edilen

çıkarımın rehberliğine rağmen söz konusu çıkarımı destekleyici nitelikte olmayan çalışmalar da vardır.

Tablo.1 Yakınsama ve Iraksama Hipotezini Test Eden Çalışmalar ve Temel Bulguları

Çalışma	Ülke/Bölge	Yöntem	Dönem	Temel Bulgular
Baumol (1986)	16 Sanayileşmiş ülke	Yatay kesit regresyon	1870-1979	Çalışmadan elde edilen sonuç, seçili ülkelerin kişi başına gelir bakımından birbirlerine yakınsadığını yönündedir. Özellikle ikinci dünya savaşından sonraki dönemde ise yakınsamanın daha güçlü olduğu tespit edilmiştir.
Li ve Papell (1999)	16 OECD Ülkesi	Zaman Serisi Tekniği	1900-1989	Kişi başı gelir yakınsamasının varlığını araştırmışlardır. Zaman serisine dayalı yapılan birim kök analizleri sonucunda seçili ülkelerin tamamında yakınsamanın geçerli olduğunu sonucuna varılmıştır. Ayrıca 16 ülkenin 14'ünde stokastik yakınsama 10'unda deterministik yakınsama olduğu tespit edilmiştir.
Gauiler vd., (1999)	Avrupa,OECD ve Dünya Ülkeleri	Panel Veri Analizi	1960-1990	Kişi başı gelir yakınsamasının araştırıldığı çalışmada, Avrupa Birliğine üye 15 ülkenin, 27 OECD ülkesinin ve dünya ülkelerini temsilen 86 ülkenin ele alındığı çalışmada, Evans ve Karras testleri uygulanmıştır. Çalışmadan elde edilen sonuca göre, Avrupa ülkelerinde ve OECD ülkelerinde yakınsama vardır ancak dünya ülkelerinin genelinde yakınsama bulunamamıştır.
Freeman ve Yerger (2001),	8 OECD Ülkesi	Yatay Kesit ve Zaman Serisi	1950-1988	Çalışmanın veri aralığını oluşturan 1950-1988 dönemi için yakınsama tespit edilemezken alt dönemler itibariyle yakınsama bulgularına rastlanılmıştır. Çalışma, 1950-1970 ve 1970-1988 dönemi olmak üzere iki alt bölüme ayrılmıştır. 1950-1970 dönemi için yapılan yatay kesit test sonuçlarında yakınsama olduğu, zaman serisi test sonuçlarında ise yakınsama olmadığı tespit edilmiştir. 1970-1988 dönemi için yatay kesit test sonuçlarında yakınsama tespit edilememişken zaman serisi analizinde yakınsama tespit edilmiştir.
Nahar ve Inder (2002)	22 OECD Ülkesi	Zaman Serisi Tekniği	1950-1988	Kişi başı gelir bakımından gelir yakınsamasını test eden çalışmada, zaman serisine dayalı birim kök testlerinden yararlanılmıştır. Analizlerden elde edilen

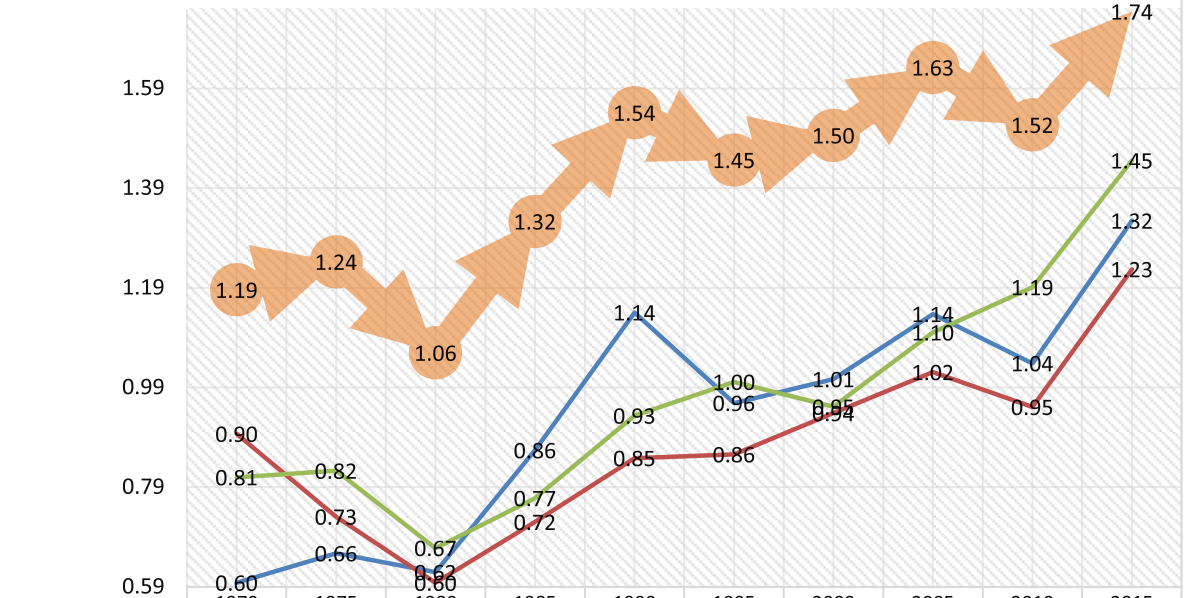
				sonuca göre, kişi başına gelir kriteri bakımından 22 OECD ülkesinde yakınsama olduğudur. Yalnızca Norveç'in OECD ortalamasından uzaklaştığı, yine benzer şekilde Yeni Zelanda'nın da ABD kişi başı gelir seviyesinden uzaklaştığı görülmüştür.
Seyrek (2002)	Dünya Ekonomileri	Varyans Analizi	1962-2000	Çalışmada dünya ülkelerinin hem büyüme oranları hem de kişi başına gelir durumlarını göz önünde bulundurmuştur. Çalışmadan elde edilen bulgular, dünya genelinde büyüme oranları dikkate alındığında çok az bir yakınsamanın olduğu, kişi başına gelir durumları dikkate alındığında ise ıraksamanın olduğu yönündedir. Çalışma alt ülke gruplarına ayrıldığında ise, gelişmiş ülke gruplarında kişi başına gelir kriteri esas alındığında yavaş fakat devamlı bir yakınsama olduğu, büyüme kriterine göre ise ıraksama olduğu, Afrika kıtasında her iki kritere göre de ıraksama olduğu, Batı Avrupa ve Kuzey Amerika ekonomileri için kişi başına gelir kriterine göre başlangıçta ıraksama tespit edilirken sonrasında yakınsama tespit edilmiştir. Doğu Avrupa ve Orta Doğu ülkelerinde ise kişi başına gelir kriterine göre başlangıçta yakınsama tespit edilse de sonra ki dönemlerde hızlı bir ıraksamanın mevcut olduğu, büyüme kriterine göre ise mutlak bir ıraksamanın olduğu sonucuna ulaşılmıştır
Strazicich vd. (2004)	15 OECD	Zaman Serisi Tekniği	1870-1994	Kişi başına gelirin stokastik olarak yakınsayıp yakınsamadığını diğer çalışmalardan farklı olarak LM birim kök testinden faydalanmışlardır. Bu yöntemin kullanılma nedeni, yapısal kırılmaların varlığı altında bile boş hipotezin reddedilme olasılığının olmamasıdır. Analiz sonucunda, seçili ülkelerde stokastik yakınsamanın varlığına dair bulgular elde edilmiştir.
Ceylan (2010)	G-7 Ülkeleri	Zaman Serisi Tekniği	1870-2006	Ele alınan dönem üç ayrı periyotta incelenmiş ve zaman serisi analiz yöntemlerinden ADF birim kök ve Nahar Inder testlerinden faydalanılmıştır. Analizden elde edilen bulgular her iki test içinde yakınsama olgusunun varlığını ortaya koyarken Nahar Inder testinden elde edilen sonuçların daha güçlü bir yakınsama eğilimine sahip olduğu yönündedir.
Akıncı ve Yılmaz (2012)	17 AB Ülkesi	Haldane-Hall	1992-2011	Araştırma sonucunda, altı kurucu ülke ile Avusturya, Finlandiya, İrlanda, Malta, Portekiz arasında yakınsama olduğu,

				Estonya, Kıbrıs, İspanya, Slovakya, Slovenya ve Yunanistan arasında ise ıraksama olduğu sonucuna varılmıştır.
Nissan ve Niroomand (2005)	100 Ülke	Regresyon Analizi	1975-1988	Kişi başı gelir ve insani gelişim endeks kriterlerine göre düşük, orta ve yüksek gelirli 100 ülkenin yakınsama veya ıraksama trendine sahip olup olmadıkları araştırılmıştır. Düşük gelirli ülkeler için insani gelişim endeksi kapsamında çok az bir yakınsama tespit edilirken, kişi başına gelir kapsamında ıraksama dağılımı tespit edilmiştir. Sonuç olarak üç ekonomi grubu arasında gelir açığının genişlediği ancak yaşam kalitesinin birbirine yaklaştığı sonucuna varılmıştır.
Çamurdan ve Ceylan (2013)	25 gelişmekte olan ülke	Zaman Serisi Tekniği	1950-2008	Çalışmada, ülkeler arasında kişi başı gelirin zaman içinde azalıp azalmayacağını test edilmiştir. Analiz yöntemi olarak doğrusal ve doğrusal olmayan zaman serisi yöntemleri kullanılmış olup ADF birim kök, Nahar Inder ve KSS yöntemlerinden yararlanılmıştır. ADF birim kök testi sonucuna göre önemli sayılabilecek yakınsama eğilimi bulunamazken, Nahar Inder test sonucuna göre, modele dahil edilen 25 ülkenin 18'inde ortalamaya doğru yakınsama eğilimi bulunurken, KSS testi sonucuna göre ise, yalnızca Malezya için yakınsama eğilimi olduğu tespit edilmiştir.
Ayala vd., (2013)	17 Latin Amerika Ülkesi-AB	Zaman Serisi Tekniği	1950-2001	17 Latin Amerika ülkesinin kişi başı gelir bakımından ABD'ye yakınsayıp yakınsamadığının araştırıldığı çalışmada elde edilen sonuca göre seçili Latin Amerika ülkelerinin ABD'ne yakınlaşması için 100 yıllık bir süreye ihtiyaç duyduğunu göstermektedir. Ancak yine de seçili ülkelerden ikisinin ABD'ye yakınsama eğilimine sahip olduğu tespit edilmiştir.
Yeşilyurt (2014)	27 OECD	Panel Veri Tekniği	1978-2010	Yıllık gelir yakınsaması ADF birim kök testi aracılığıyla sınanmıştır. Çalışmadan elde edilen bulgular 27 OECD ülkesi için gelir yakınsama olgusunun varlığını ortaya koymaktadır.
Gögül ve Korap (2014)	26 OECD	Panel Veri Tekniği	1970-2012	Kişi başı reel gelir bakımından yakınsama hipotezi araştırıldığı çalışmada yöntem olarak panel birim kök testleri kullanılmıştır. Çalışma sonucunda 26 OECD ülkesinin hem lider ülke olan ABD ekonomisine hem de OECD ortalamasına

				yakınsadığını bulmuşlardır.
Tüzemen ve Tüzemen (2015)	17 Balkan Ülkesi	Panel Veri Tekniği	2000-2013	Çalışmada öncelikle seçili balkan ülkelerinim kişi başı gelir kriteri bakımından birbirlerine yakınsama durumları araştırılmıştır. Ayrıca ülkelerin hem topluca hem de bireysel olarak 2000 yılında en yüksek reel kişi başı GSYİH'ya sahip ülke olan Yunanistan'a yakınsayıp yakınsamadığı da araştırmanın bir diğer inceleme konusudur. Yapılan panel birim kök testi sonucunda ülkeler arasında yakınsama olmadığı, ayrıca Balkan ülkelerinin toplu olarak da Yunanistan'a yakınsamadığı tespit edilmiştir. Ayrıca ülkelerin bireysel olarak Yunanistan'a yakınsayıp yakınsamadığı da ADF birim kök testi aracılığıyla sınanmıştır. Ülkeler bireysel olarak değerlendiğinde Arnavutluk ve Slovenya hariç seçili balkan ülkelerinin Yunanistan'a yakınsama şartını sağladığı belirtilmiştir.
Sarıbaş (2016)	6 farklı ülke grubu	Panel Veri Tekniği	1990-2010	Analiz sonucunda, aynı yapısal özelliklere sahip ülkelerin gelir farklılıklarının zamanla ortadan kalktığı sonucuna ulaşmıştır.
Akıncı ve Sevinç (2016)	Balkan ve AB Kurucu Ülkeleri	Panel Veri Tekniği	1990-2014	Kişi başına gelir yakınsamasının 11 Balkan ve 6 AB kurucu ülkeleri arasındaki geçerliliğini sınamışlardır. Çalışmada, dengesiz panel veri analizlerinden faydalanılmıştır. Yapılan analiz sonucunda, iki ülke grubu arasında ıraksamanın olduğu ortaya koyulmuştur.
Savacı ve Karşıyakalı (2016)	13 AB üyesi ülke ve Türkiye	Panel Veri Tekniği	1960-2013	Carlino ve Mills'in zaman serisi yönteminin kullanıldığı çalışmada ADF birim kök testi sonucuna Türkiye ve Avusturya, Belçika, Danimarka, Finlandiya, Fransa, İtalya, İsveç, Portekiz arasında 1990 döneminden sonra yakınsama olduğu, Türkiye, Yunanistan ve İngiltere arasında ise ıraksama olduğu yönündedir.

3. SEÇİLMİŞ ÜLKE/ÜLKE GRUPLARI AÇISINDAN YAKINSAMA VE IRAKSAMA ANALİZİ

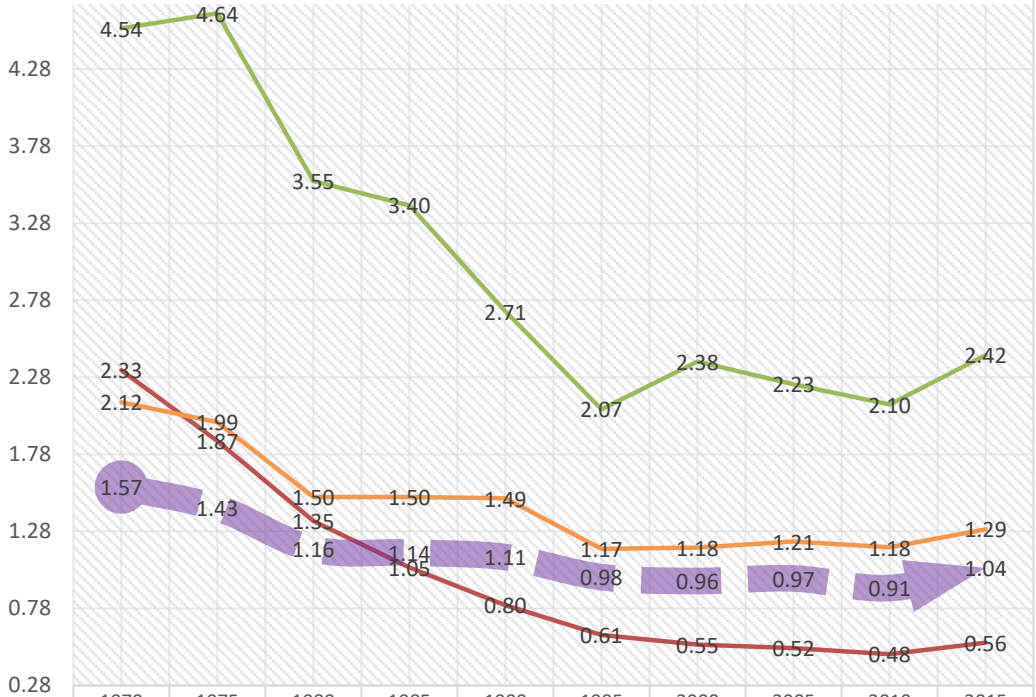
Grafik 1. Türkiye/Latin Amerika Ülkeleri Kişi Başına GSYİH (1970-2015)



	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Tr/Argentina	0.60	0.66	0.62	0.86	1.14	0.96	1.01	1.14	1.04	1.32
Tr/Brazil	0.90	0.73	0.60	0.72	0.85	0.86	0.94	1.02	0.95	1.23
Tr/Mexico	0.81	0.82	0.67	0.77	0.93	1.00	0.95	1.10	1.19	1.45
TR/LATIN	1.19	1.24	1.06	1.32	1.54	1.45	1.50	1.63	1.52	1.74

Grafik 1'de Türkiye ve çeşitli Latin Amerika ülkeleri kişi başına GSYİH değerleriyle karşılaştırılmıştır. Bu ülkeler; Arjantin, Bolivya, Brezilya, Şili, Kolombiya, Guatemala, Honduras, Meksika, Panama, Paraguay, Peru, Uruguay ve ülkelerin genel ortalamasıdır. Adı geçen 12 ülkenin GSYİH ortalaması doğrultusunda genel bir değerlendirme yapıldığında, *uzun dönemde, Türkiye'nin bu ülkelerin ortalamasına kıyasla büyük oranda pozitif ayrıştığı ve bu ülkelere kişi başına GSYİH yönünden ıraksadığı* yorumu yapılabilir. Söz konusu pozitif ivmenin istisnası olan yıllar 1975-1980, 1990-1995 ve 2005-2010 dönem aralıklarıdır. Bu çerçevede 1973 ve 1978 yıllarında yaşanan petrol ve enerji şoklarının neden olduğu olumsuz tablonun, 1994 ekonomik krizinin ve ABD subprime mortgage krizi ile başlayıp kısa süre içinde Avrupa piyasalarına ve dünyaya yayılan Küresel Mali Kriz'in Latin Amerika ülkelerine kıyasla Türkiye'yi daha sert biçimde etkilediği düşünülebilir. Öte yandan, benzer *'farklılaşma'* yorumunu 1999 Marmara Depremi sonrasında iktisadi ve siyasi gelişmeler nedeniyle ülkemizde yaşanan 2000-2001 Krizleri için söylemek mümkün görünmemektedir. Bunun muhtemel nedeni, aynı dönemlerde Latin Amerika'nın lokomotif ülkelerinden Brezilya'da (1999) ve Arjantin'de (2001-2002) de farklı nedenlerle de olsa ortaya çıkan iktisadi krizlerdir.

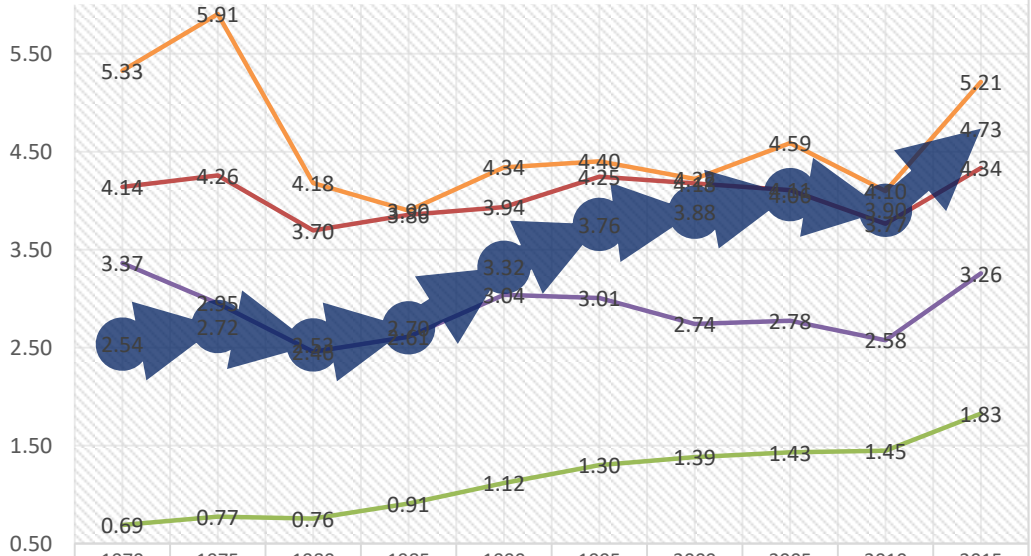
Grafik 2. Türkiye/Asya Ülkeleri Kişi Başına GSYİH (1970-2015)



	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Tr/Korea, Rep.	2.33	1.87	1.35	1.05	0.80	0.61	0.55	0.52	0.48	0.56
Tr/Thailand	4.54	4.64	3.55	3.40	2.71	2.07	2.38	2.23	2.10	2.42
Tr/Malaysia	2.12	1.99	1.50	1.50	1.49	1.17	1.18	1.21	1.18	1.29
TR/ASYA	1.57	1.43	1.16	1.14	1.11	0.98	0.96	0.97	0.91	1.04

Grafik 2'de Türkiye ve çeşitli Asya ülkeleri kişi başına GSYİH değerleriyle karşılaştırılmıştır. Bu ülkeler; Çin, Gürcistan, Hindistan, Endonezya, İsrail, Kore, Malezya, Pakistan, Filipinler, Singapur, Tayland ve bu ülkelerin genel ortalamalarıdır. Adı geçen 11 ülkenin GSYİH ortalaması doğrultusunda genel bir değerlendirme yapıldığında, *uzun dönemde, 1970'lerde bir buçuk kat civarı olan kişi başı gelir farklılığı 1990'lı yıllarla birlikte denk bir noktaya geldiği veya benzeştiği* yönünde yorum yapılabilir. Özellikle gelişmekte olan ülkelerde küreselleşme çabalarının beraberinde getirdiği uluslararası entegrasyon ile ticari ve finansal liberalizasyon adımlarının atılmasıyla *"Asya Kaplanları"* ekonomik anlamda ivme kazanmışlardır. Gerek yoğun ve ucuz insan gücünün gerekse de bölgede uluslararası sermaye hareketlerinin artmasının bunda öncü rol oynadığı düşünülebilir. Elbette tüm ülkeler için farklı alt senaryolar olmakla birlikte Çin ve Hindistan yukarı yönlü bu trendin lokomotifi olmuş ve halen de olmaktadırlar. Türkiye ile kıyaslandığında (en azından 90'lardan bu yana), ele alınan Asya ülkeleriyle benzeşen bir eğilime sahip olunduğu savunulabilir. Küreselleşme literatüründe sıklıkla kendine yer bulan 1997 Güneydoğu Asya Krizi söz konusu yönelimi değiştirememişse de *-ki bunda 1999-2001 döneminde ülkemizdeki iktisadi ve politik bunalımların 'dengeleyici' unsur olduğu düşünülebilir-*, takip eden süreçte yaşanan 2008 Küresel Mali Krizi'nin görece bir dalgalanmaya yol açtığı değerlendirilebilir.

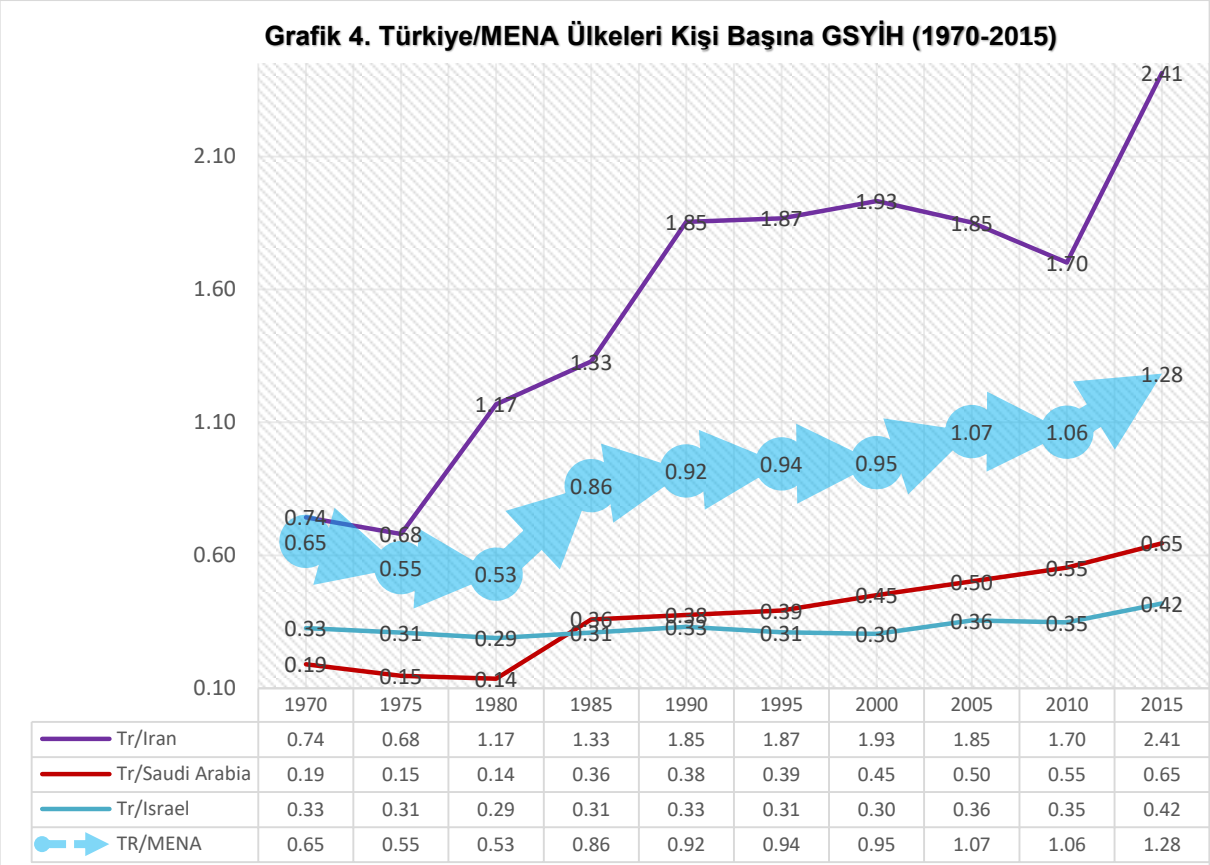
Grafik 3. Türkiye/Afrika Ülkeleri Kişi Başına GSYİH (1970-2015)



	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Tr/Egypt	5.33	5.91	4.18	3.90	4.34	4.40	4.22	4.59	4.10	5.21
Tr/Morocco	4.14	4.26	3.70	3.86	3.94	4.25	4.18	4.11	3.77	4.34
Tr/South Africa	0.69	0.77	0.76	0.91	1.12	1.30	1.39	1.43	1.45	1.83
Tr/Tunisia	3.37	2.95	2.46	2.61	3.04	3.01	2.74	2.78	2.58	3.26
TR/AFRIKA	2.54	2.72	2.53	2.70	3.32	3.76	3.88	4.06	3.90	4.73

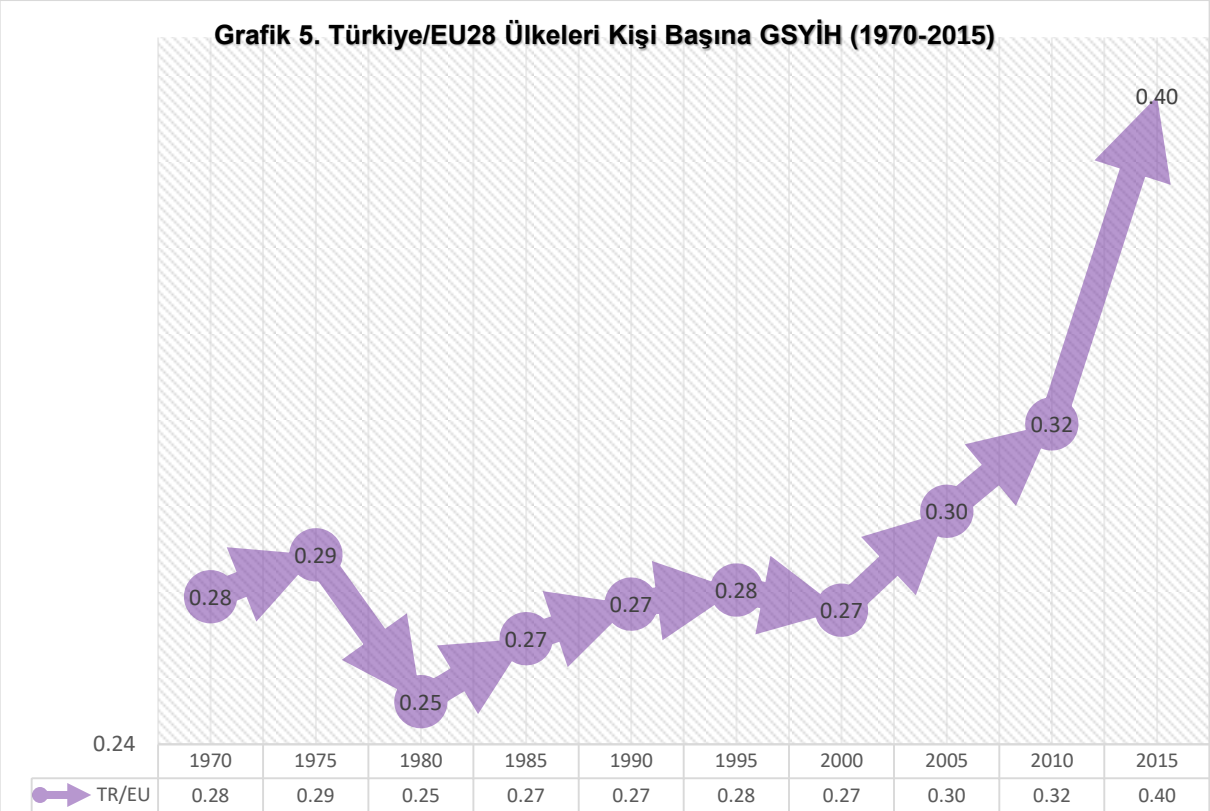
Grafik 3'te Türkiye ve çeşitli Afrika ülkeleri kişi başına GSYİH değerleriyle karşılaştırılmıştır. Bu ülkeler; Kamerun, Kongo, Mısır, Gana, Kenya, Fas, Güney Afrika, Tunus ve Zambiya'dır. Adı geçen 9 ülke ve bu ülkelerin ortalaması kıyas için açısından seçilirken -*diğer kıtalarda da olduğu şekilde*-, ülkelerin belirli bir büyüklükte olması (küçük ada ülkesi olmamaları), doğal kaynak yönünden önemli ölçüde ayrıştırıcı niteliğe sahip olmaması (OPEC üyesi olmamaları vb.) gibi kıstaslar göz önünde tutulmaya çalışılmıştır. Ülkelerin kişi başına GSYİH ortalaması doğrultusunda genel bir değerlendirme yapıldığında, *uzun dönemde, Türkiye'nin bu ülkelerin ortalamasına kıyasla büyük oranda pozitif ayrıştığı ve ülkelerden kişi başına GSYİH yönünden ıraksadığı* yorumu yapılabilir. 1970'li yıllarda iki buçuk kat olan "TR/Afrika" kişi başına GSYİH ortalamasında makasın yıllar geçtikçe açıldığı ve 2015'e gelindiğinde beş kata yakın bir noktaya doğru yol aldığı izlenimi edilmektedir. Üstelik bu ülkeler kalkınma yönüyle ülkemize kıyasla görece geri olmakla birlikte, teorik olarak, ekonomiye katılan her birim ulusal ve uluslararası sermayenin daha büyük pozitif değerlere yol açması beklenebilirdi.[1] Ancak son 35 yıllık gelişme böyle olmamıştır. Küreselleşme, uluslararası entegrasyon ve ticari liberalizasyonun başlangıcı kabul edilen 1980-85 sonrası dönemle birlikte iyice artan kişi başı GSYİH'teki bu ivme, 2005-2010 dönemindeki düşüş dışında hep Türkiye lehine olmuştur.

[1] Bu beklenti, iktisaden David Ricardo'nun Karşılaştırmalı Üstünlükler Teorisini baz alan ve üretim faktörlerinin yoğunluğuna göre üretimi benimseyen Faktör Donatımı (Heckscher-Ohlin) Teorisi ile açıklanmaktadır.

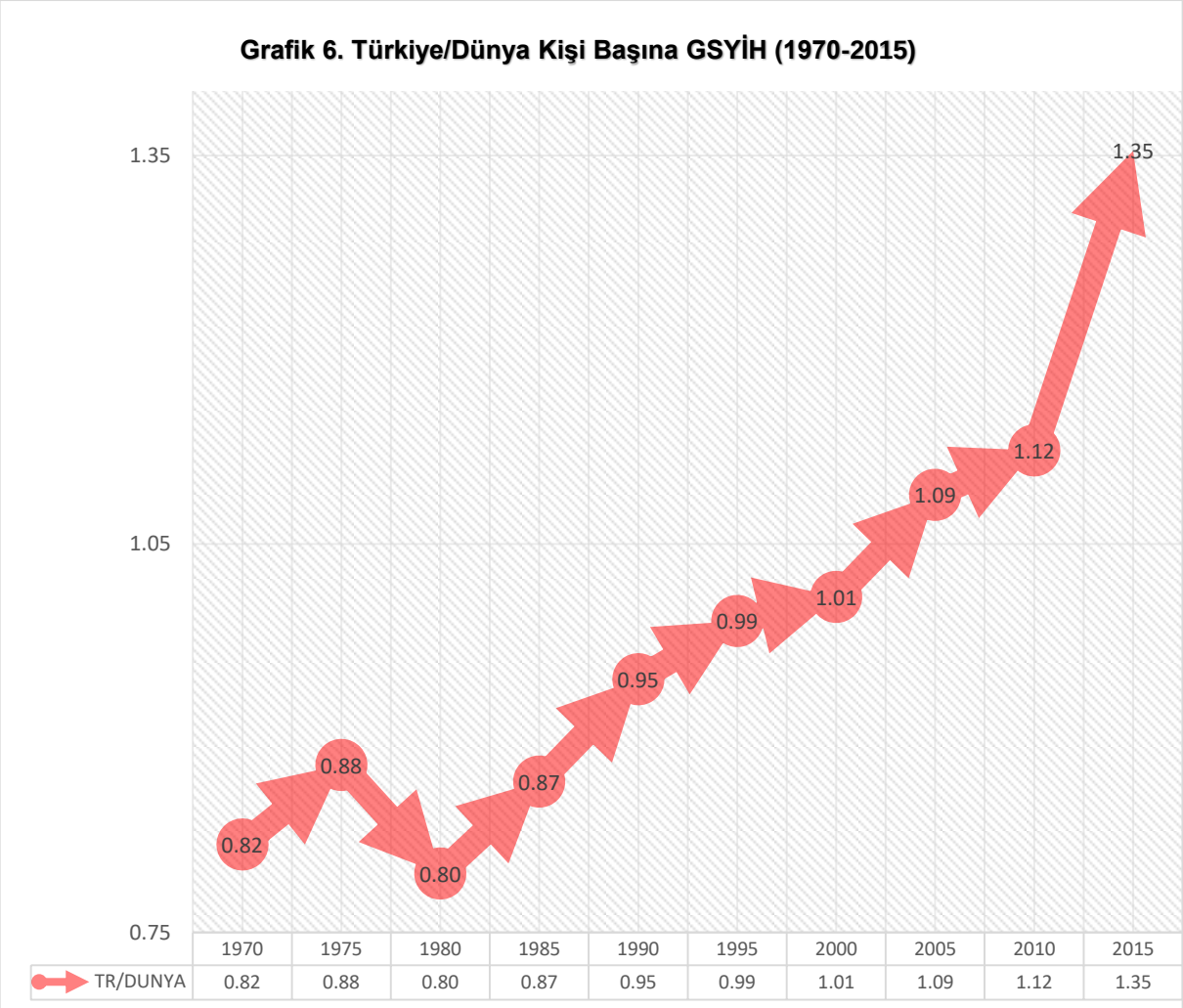


	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Tr/Iran	0.74	0.68	1.17	1.33	1.85	1.87	1.93	1.85	1.70	2.41
Tr/Saudi Arabia	0.19	0.15	0.14	0.36	0.38	0.39	0.45	0.50	0.55	0.65
Tr/Israel	0.33	0.31	0.29	0.31	0.33	0.31	0.30	0.36	0.35	0.42
TR/MENA	0.65	0.55	0.53	0.86	0.92	0.94	0.95	1.07	1.06	1.28

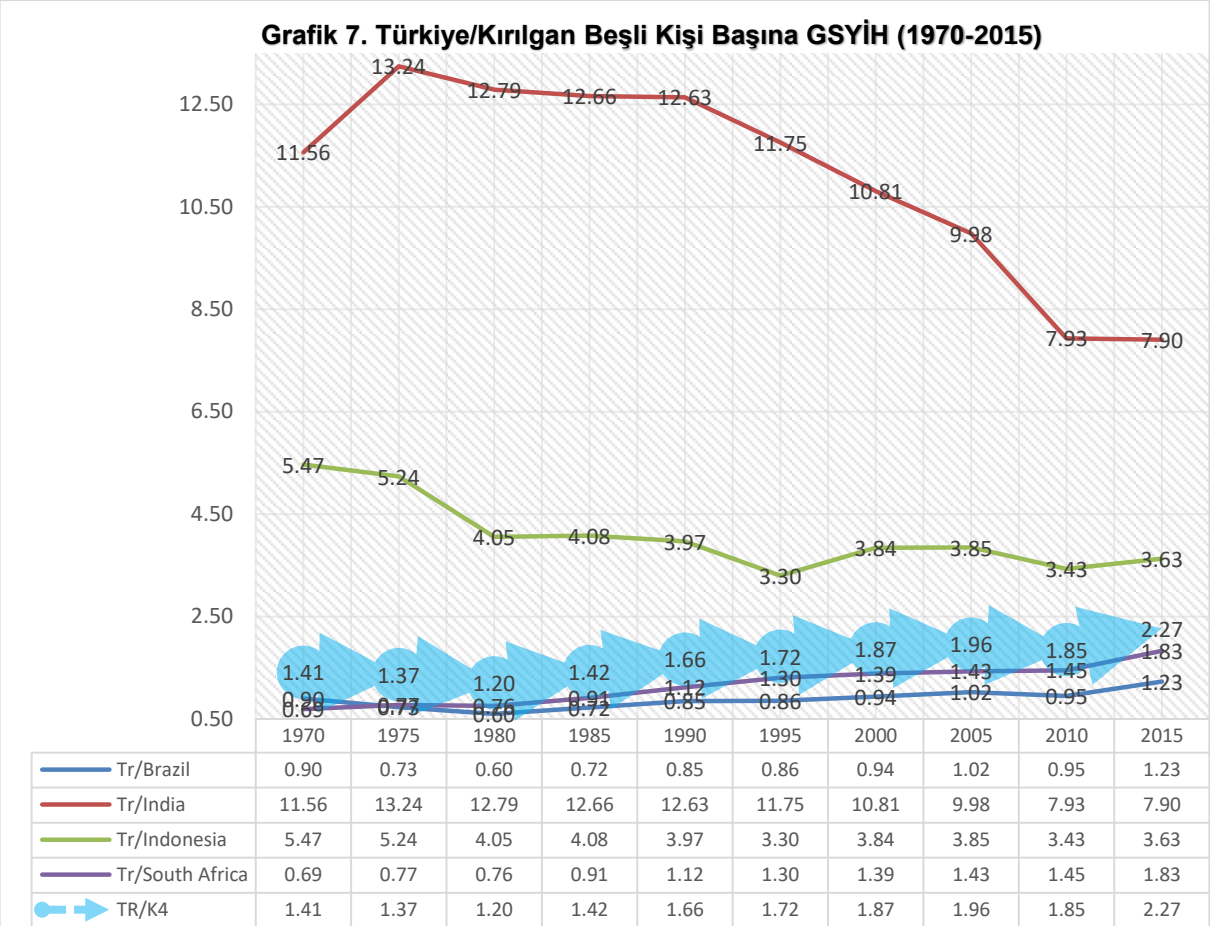
Grafik 4'te Türkiye ve çeşitli MENA ülkeleri kişi başına GSYİH değerleriyle karşılaştırılmıştır. Bu ülkeler; Mısır, İsrail, Fas, Tunus, İran, Irak, Suudi Arabistan ve bu ülkelerin genel ortalamalarıdır. Adı geçen 7 ülke ve ilgili yılların kişi başı GSYİH genel ortalamaları doğrultusunda bir değerlendirme yapıldığında, *uzun dönemde, Türkiye'nin bu ülkelerin ortalamasına kıyasla büyük oranda pozitif ayrıştığı ve örneklemin gelişmiş ülke kanadındaki İsrail ve petrol zengini Suudi Arabistan ile yakınsadığı; buna karşın gelişmekte olan diğer ülkelerleyse ıraksadığı* yorumu yapılabilir. Türkiye, yarım asra yakın bir dönem içerisinde doğal kaynak yönünden zengin ya da teknolojik gelişim anlamında kendisine kıyasla çok daha fazla imkân tedarikine sahip ülkelerin de içinde bulunduğu MENA grubundan daha iyi bir trende sahiptir. İran, devrim sonrası dönemde 80'li yılları müteakiben Türkiye'ye karşı kişi başı GSYİH açısından güç kaybetmiş görünmektedir. Aynı şekilde, petrol odaklı bir diğer ekonomi olan Suudi Arabistan 1970'te Türkiye'nin üç katı kişi başı gelire sahip iken bu oran tüm doğal kaynak farklılıklarına rağmen 2015 yılı itibariyle üçte bir gibi bir noktaya kadar düşmüş görünmektedir. Silah, gen teknolojisi ve benzer alanlarda katma değeri yüksek ürünler üreten bir ülke olan İsrail, 1970 yılında kişi başı GSYİH'te Türkiye'nin beş katından fazla bir gelire sahip iken yakın dönemle birlikte bu oran yarı yarıya gibi bir seviyeye doğru yol almaktadır. Özetle; küreselleşme sonrası süreçte krizler nedeniyle ufak kırılmalarla dahi olsa Türkiye MENA ülkelerinin genel ortalamasına oranla pozitif bir seyir izlemeyi sürdürmektedir.



Grafik 5'te Türkiye ve 28 Avrupa Birliği ülkesinin ortalaması kişi başına GSYİH değerleriyle karşılaştırılmıştır. Bilindiği üzere, Avrupa Birliği'nin temellerini; 1951 yılında Almanya, Fransa, İtalya, Belçika, Lüksemburg ve Hollanda'nın imzaladığı Paris Antlaşmasıyla kurulan Avrupa Kömür ve Çelik Topluluğu (AKÇT) ve aynı ülkelerin 1957 yılında imzaladığı Roma Antlaşmasıyla kurulan Avrupa Ekonomik Topluluğu (AET) ve Avrupa Atom Enerjisi Topluluğu (AAET) oluşturmaktadır. Birinci genişlemenin (İngiltere, İrlanda, Danimarka) yaşandığı 1973 yılını da kapsayan dönem Türkiye kişi başı gelir düzeyi kıyasında negatif etki yaratmışsa da -*ki ilgili yıllarda yaşanan enerji ve petrol krizi de bu durumda muhtemelen etkili olmuştur*- sonraki süreçte 1981'de ikinci (Yunanistan), 1986'da üçüncü (İspanya, Portekiz) ve 1995 yılındaki dördüncü (Avusturya, Finlandiya, İsveç) genişleme süreçlerinde görece durağan bir seyir izlenmiştir. Doğu Bloku ve dolayısıyla Varşova Paktı'nın çöküşüyle Soğuk Savaş sona ermiş; çoğunluğunu Demirperde ülkelerinin ve Baltık ülkelerinin oluşturduğu beşinci genişleme dönemi yaşanmıştır. 2004 ve 2007 yıllarında 12 ülke (Macaristan, Polonya, Çek Cumhuriyeti, Slovakya, Slovenya, Letonya, Litvanya, Estonya, Malta, Güney Kıbrıs Rum Yönetimi, Romanya, Bulgaristan) AB'ye katılmış ve kişi başına GSYİH Türkiye lehine göreli bir ivme kazanmıştır. Altıncı ve son genişleme olan (Hırvatistan) 2013 yılı sonrasında da Türkiye'nin AB'ye olan yakınsaması hızlanarak sürmüş ve kişi başı GSYİH bu yarım asırlık yolculukta AB ortalama gelirinin çeyreğinden yarısına doğru yol almıştır. Bunun ne kadarının gelişmiş Batı ülkeleriyle ilintili olduğu ise ilerleyen grafiklerde analiz edilecektir.

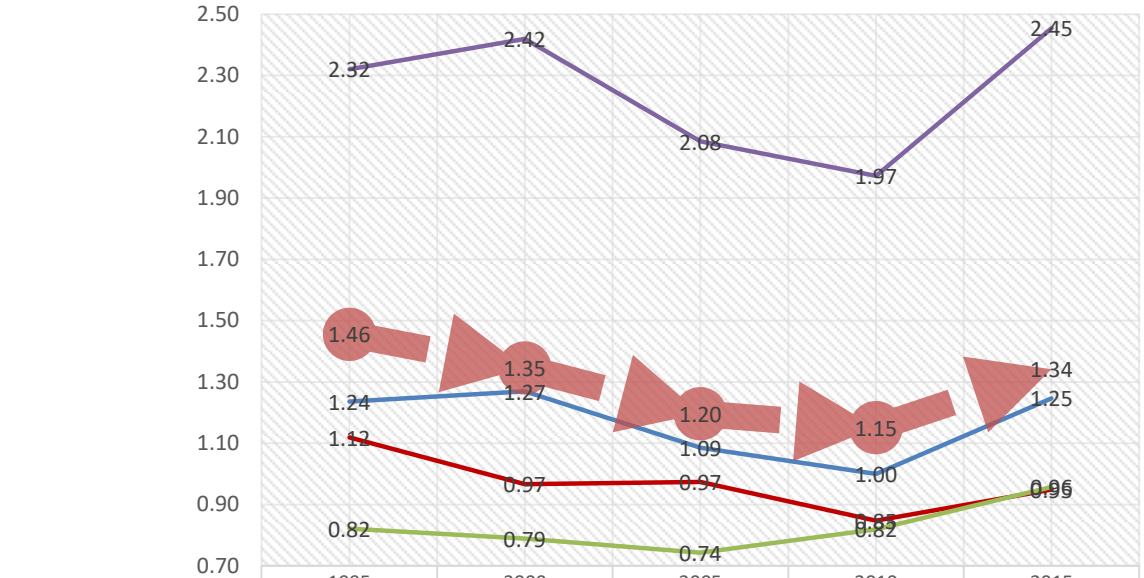


Grafik 6'da Türkiye ve Dünya Bankası Dünya Kalkınma Göstergeleri (WDI) içerisinde yer alan ülkelerin kişi başına GSYİH genel ortalama değerleri karşılaştırılmıştır. Uzun dönemli bir değerlendirme yapıldığında, önceki grafiklerde var olan trendin genel olarak desteklendiği görülmektedir. 1970-75 döneminde dünya ortalamasının altında olmakla birlikte artış yönlü bir görünüme sahip olan GSYİH göstergesi muhtemelen 1973 ve 1978 yıllarında yaşanan uluslararası petrol ve enerji krizlerinin de etkisiyle negatife dönmüştür. Dünyada küreselleşmenin ve ticari liberalizasyonun başlangıç dönemi olarak görülen 1980-85 döneminde ancak 1975'teki ortalamasına dönebilmiştir. Takip eden süreçte, 1989 yılında 32 Sayılı Karar ile Türk Lirasının konvertibl hale dönüşmesi ve uluslararası sermaye akışının serbestleştirilmesinin hukuki altyapısı oluşturulmuştur. Uluslararası entegrasyon ve finansal liberalizasyona eş biçimde yükselişe geçen değerler takip eden on yıllık süreçte 1994 Krizi ve 5 Nisan Kararlarının olumsuz etkilerini deneyimleyerek görece duraksamış; 2000-2001 Krizleri ile yine ivme kaybetmişse de pozitif görünümünü muhafaza etmiştir. Diğer tüm grafiklerde de olduğu üzere, özellikle son beş yıllık süreçte yaşanan artış ise dikkat çekicidir. Dünya kişi başı GSYİH artışlarına kıyasla Türkiye, 2010-2015 döneminde daha yüksek değerler elde etmiştir.



Grafik 7'de son dönemlerde Morgan Stanley'nin cari açık ve enflasyon oranlarının yüksekliği ve dış yatırımlara duydukları ihtiyaç dolayısıyla "Kırılgan Beşli" olarak adlandırdığı Brezilya, Hindistan, Endonezya ve Güney Afrika Cumhuriyeti'nin Türkiye ile olan kıyasına yer verilmektedir. Türkiye ve ilgili ülkeler için veriler Dünya Bankası Dünya Kalkınma Göstergeleri (WDI) içerisinde yer alan kişi başına GSYİH genel ortalama değerleri üzerinden derlenmiştir. Uzun dönemli bir değerlendirme yapıldığında, Türkiye lehine pozitif yönde olmakla birlikte önceki tablolara kıyasla gücü daha düşük olan bir trendin varlığı göze çarpmaktadır. Bu durumun muhtemel nedeni, Türkiye'nin iktisadi büyüme konusuna yaklaşımının Asya karşılaştırmasında ele alınan Çin ve Hindistan gibi büyük beşeri sermayeye sahip ülkeler dışındaki Asya ülkelerine görece benzer yapıda olmasıdır. Bir diğer deyişle, Kırılgan Beşli'ye dair tablo da Asya kıyasında yapılan eğilim ile benzeşmektedir. Türkiye, ortalamada, Brezilya ve Güney Afrika'dan daha yüksek büyüme hızlarına sahipken; Endonezya ve özellikle de Hindistan sahip oldukları nüfus gücü ile rekabet alanında Türkiye'ye kıyasla avantajlı görünmüşlerdir. Ancak bu yorum 2010 dönemine kadar olan zaman dilimi için doğrudur. 2010-2015 dönemi dikkate alındığında ise Türkiye büyüme değerleri ortalaması Hindistan'la benzeşir seviyelere ulaşmış; buna karşın -*tıpkı diğer iki ekonomi olan Brezilya ve Güney Afrika gibi*-, Endonezya'nın da kişi başı büyüme değerlerinin önüne geçmiştir.

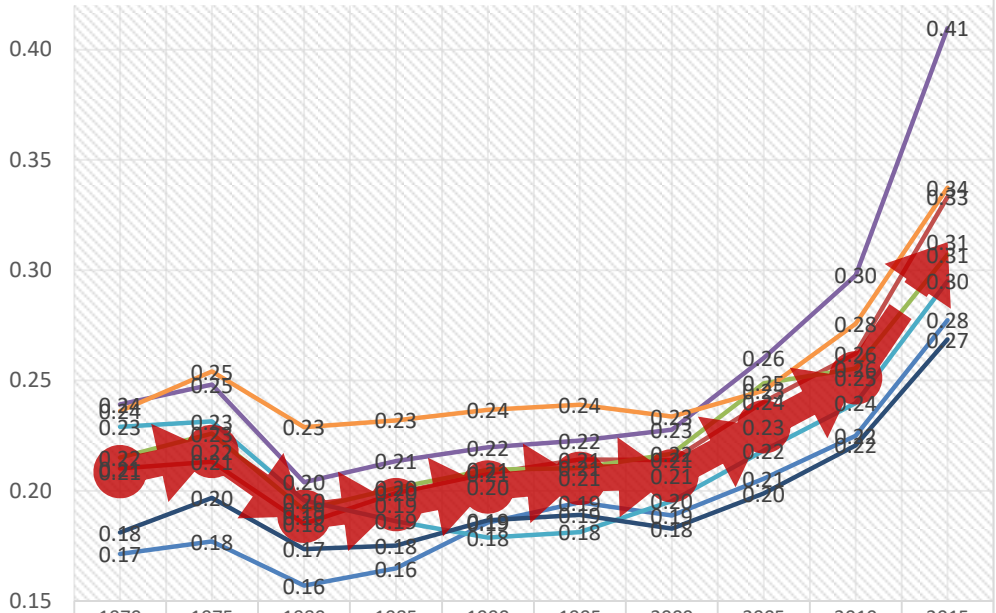
Grafik 8. Türkiye/Geçiş Ekonomileri Kişi Başına GSYİH (1995-2015)



	1995	2000	2005	2010	2015
TR/Rusya	1.24	1.27	1.09	1.00	1.25
TR/Polonya	1.12	0.97	0.97	0.85	0.95
TR/Macaristan	0.82	0.79	0.74	0.82	0.96
TR/Sırbistan	2.32	2.42	2.08	1.97	2.45
TR/22 Demir Perde	1.46	1.35	1.20	1.15	1.34

Grafik 8'de Türkiye ile 22 geçiş ekonomisi kıyaslanmaktadır. Diğer grafiklerin hemen hepsinin aksine (belki Asya örneğiyle kısmen benzeşir biçimde), Türkiye-Demir Perde ülkeleri karşılaştırmasında ortalama eğilim; bu ülkelerin, bizim yirmi yılı aşkın kişi başı GSYİH büyüme ortalamamızın üstünde seyrettiği şeklindedir. İçlerinde diğer sosyalizmden kapitalizme yol alan ülkeler de bulunmakla birlikte hemen hepsi Avrupa Kıtası'nda yer alan bu ülkeler; Arnavutluk, Ermenistan, Azerbaycan, Beyaz Rusya, Bosna-Hersek, Bulgaristan, Hırvatistan, Çekya, Estonya, Gürcistan, Macaristan, Letonya, Litvanya, Makedonya, Moldova, Polonya, Romanya, Rusya, Sırbistan, Slovakya, Slovenya ve Ukrayna'dır. Varşova Paktı'nın çöküşü ve Doğu Bloku'nun 90'lı yılların ilk yarısında dağılmasını takiben yukarıda sayılan pek çok devlet bir araya gelerek Bağımsız Devletler Topluluğu'nu kurmuştur ve sonrasında ayrı birer devlet yapısına kavuşmuştur. 1995'ten 2015'e Grafik 8 incelendiğinde, Batı iktisadi sistemiyle entegrasyona girişilmesi bu ülkelerin durağan iktisadi yapılarında önemli bir ivme oluşturmuş ve büyük ölçüde pozitif değişikliklere yol açmış görünmektedir. En azından, Türkiye'nin pek çok grafikteki pozitif trendinin üzerinde olduğu anlaşılmaktadır. Ancak bu durum 2010-2015 döneminde tersine dönmüştür. Bu anlamda, 2000-2001 Krizlerinin yarattığı ek negatif kırılma, 2005 yılına gelindiğinde, alınan yapısal ve mali önlemlerle (Güçlü Ekonomiye Geçiş, Bankacılık Düzenlemeleri, 5018 Sayılı Yasa) görece duraksamış; 2008 Küresel Mali Krizinin ilk olumsuzluklarının aşıldığı 2010 sonrasında ise Türkiye lehine pozitif yönde evirilmiştir.

Grafik 9. Türkiye/G7 Ülkeleri Kişi Başına GSYİH (1970-2015)



	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Tr/Canada	0.17	0.18	0.16	0.16	0.19	0.19	0.19	0.21	0.22	0.28
Tr/France	0.21	0.21	0.18	0.20	0.21	0.21	0.21	0.24	0.26	0.33
Tr/Germany	0.22	0.23	0.19	0.20	0.21	0.21	0.22	0.25	0.26	0.31
Tr/Italy	0.24	0.25	0.20	0.21	0.22	0.22	0.23	0.26	0.30	0.41
Tr/Japan	0.23	0.23	0.20	0.19	0.18	0.18	0.20	0.22	0.24	0.30
Tr/United Kingdom	0.24	0.25	0.23	0.23	0.24	0.24	0.23	0.25	0.28	0.34
Tr/United States	0.18	0.20	0.17	0.18	0.19	0.19	0.18	0.20	0.22	0.27
TR/G7	0.21	0.22	0.19	0.19	0.20	0.21	0.21	0.23	0.25	0.31

Grafik 9'da Türkiye dünyadaki en gelişmiş piyasa ekonomileri olan G7 ülkeleri ile karşılaştırılmaktadır. Bilindiği üzere, G7 ülkeleri; Kanada, Fransa, Almanya, İtalya, Japonya, Birleşik Krallık ve Amerika Birleşik Devletleri'nden oluşmaktadır. Çalışmada, bu ülkelerin değerleri *-diğer grafiklerde de yapıldığı şekilde-*, ilgili yıl Türkiye kişi başına GSYİH gerçekleşmelerine bölünerek yarım asra yakın süreç için anlamlı bir ilişki kurulması yoluna gidilmiştir. Ortalama değerleri gösteren TR/G7 serisinden de görülebileceği üzere, Türkiye 1970-1975 yıl aralığı için görece pozitif bir ivmeye sahipken muhtemelen 1973 ve 1978 yıllarında yaşanan petrol ve enerji şoklarının negatif etkisini yaşamıştır. Bilindiği üzere, bu gelişmeler, takip eden yıllar için gelişmekte olan ülkelerin önemli borç spiralleri ile yüzleşerek krizlere girdiği yıllar olmasına karşın; Türkiye küreselleşmenin ilk adımlarının atıldığı 80'li yıllardan başlayarak sürekli bir kişi başı gelir artırma trendine girmiş ve özellikle bu ivmeyi son dönemlerde oldukça artırmıştır. Özellikle, 2010-2015 döneminde bu durum giderek belirgin bir hal almıştır.

Hemen hemen tüm grafiklerde ve tüm ülkelere karşı görülen bu 2010-2015 dönemindeki tırmanışın, Dünya Bankası (WDI) verileri baz alındığından yapısal bir kırılma veya hesaplama şeklindeki farklılaşmadan ziyade *-böyle bir gelişme mutlak olarak çok sayıdaki Dünya Bankası'na üye ülkeyi etkileyeceğinden-*, ilgili dönemdeki büyüme değerlerinin diğer ülkelerin tümünden fazla olmasıyla açıklanabileceği düşünülebilir. Gerçekten de bu dönemde, Türkiye kişi başına GSYİH ortalaması %5.7; GSYİH artış ortalaması ise %7.4 olarak gerçekleşmiştir. Oysa aynı verilerin 1975-2015 dönemi genel ortalaması, sırasıyla; %2,8 ve %4.6'tir. Bu durum *-diğer tüm koşullar sabitken-*, son altı yıllık süreçteki keskin artışın nasıl gerçekleştiğine dair ipuçlarını bizlere sunmaktadır. Öte yandan, yine Dünya Bankası (WDI) üzerinden aynı yıl aralığında gerçekleşen GINI katsayısı değerlerine bakıldığında, Türkiye için; '40.5' gibi bir ortalama değerle karşılaşılmaktadır. Bilindiği üzere, bu değer sıfıra yaklaştığı ölçüde gelir dağılımında adalet söz konusu olacaktır. Oysa anket yapılan tüm yıllardaki genel ortalamasına bakıldığında, elde edilen gelirin; %46.7'sini en zengin %20'lik kesim alırken en düşük %20'lik kesim ise toplam gelirin %5.7'sine sahip olmaktadır. Bu çerçevede, ülke mali politikalarının gelirin ikincil dağılımı

vasıtasıyla yeniden düzenlenmesi konusuna ayrıca değinilmesi zaruridir. Bu ise, bir başka çalışmanın konusunu oluşturacaktır.

SONUÇ

Ekonomik büyüme performansları açısından ülkelerin benzeşmesi, farklılaşması ekonomik, siyasi, toplumsal sonuçları nedeniyle önemli gözükmektedir. Bu önemden dolayı uzun dönemde ekonomik büyüme performansı ve bu performansın ülke ve ülke grupları açısından benzeşmesi, farklılaşması ekonomi literatüründe uzun zamandır analiz edilmekte, teoriler geliştirilmektedir.

Konunun bu çerçevesinden bakıldığında 1980 sonrası dönem küreselleşme, uluslararası entegrasyon, ticari ve finansal liberalizasyon süreçleri sonrasında tüm krizlere rağmen Türkiye'nin lehine gelişmeler olmuş ve ekonomik performans anlamında olumlu gidişata yol açmıştır. Özellikle 2000'li yıllardan itibaren Türkiye'nin büyüme performansı farklılığı dikkat çekici gözükmektedir. Özellikle bu farklılık 2010-2015 döneminde tüm ülke gruplarıyla yapılan kıyaslamalarda istisnasız bu şekilde gözükmektedir. Eğer bu Dünya Bankasına sunulan verilerdeki hesaplama şekli değişikliğinden kaynaklanan bir yapısal kırılma değilse[2] tüm ülkelere kıyasla Türkiye'de ekonomik büyüme açısından ciddi bir ivmelenme olduğu savunulabilir. Kişi başına büyüme performansı açısından genel görünümde Türkiye'ye kıyasla gözle görülür derecede iyi olan tek ülke grubu 1990'lı yılların ilk yarısında dibe vurmuş olan, batı ittifakına kayan geçiş ekonomileri (demir perde ülkeleri) ve Çin, Hindistan gibi beşeri sermaye zengini dünya ekonomik büyümesinin lokomotifi olan ekonomilerdir.

Sonuç olarak; gerek gelişmiş ülkelere gerekse de rekabet ettiği düşünülen farklı kıtalardan çok sayıda gelişmekte olan ülkeye kıyasla Türkiye ekonomisi, uzun dönem kişi başı büyüme performansı açısından önemli bir ivmelenme yakalamıştır. Türkiye ekonomisi özellikle 2000'li yıllardan itibaren büyüme rakamları açısından gelişmiş ülkelere yakınsayan/benzeşen ve gelişmekte olan ülkelere ise göreli olarak ıraksayan/farklılaşan bir görünüme sahiptir.

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EVALUATION OF TURKISH PUBLIC UNIVERSITY HOSPITALS

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Abstract

Turkey has had reforms in the field of health under the name of Health Transformation Program since 2003. Public university hospitals have been affected mostly by this reform movement. The aim of this study is to make the financial evaluation of public university hospitals which have a crucial position in Turkish health care system. In order to reach this objective, the financial statements of 33 public university hospital for the period between 2013 and 2015 have been examined. Finding indicate that, liquidity position of the hospitals has decreased gradually and is now lower than the generally accepted value of liquidity. Profitability position of hospitals is negative. Financial structure of hospitals has been deteriorated considerably in time. Furthermore, the overall evaluation of financial statements of the hospitals reveals that there is a negative improvement in the financial ratios from year to year and financial situation of the hospitals is not good. This paper recommends that health policies should be regulated according to the needs of the hospitals and health policy makers should take precautions to adjust public university hospitals' debt so as to improve their performance.

Keywords: Public University Hospitals, Financial Performance, Health System, Ratio Analysis, Turkey.

TÜRKIYE'DEKİ DEVLET ÜNİVERSİTESİ HASTANELERİNİN DEĞERLENDİRMESİ

Özet

Türkiye'de 2003 yılından beri Sağlıkta Dönüşüm Programı adı altında sağlık alanında reform çalışmaları yapılmaktadır. Bu reform hareketinden en çok etkilenen kurumlardan birisi devlet üniversitelerinin hastaneleridir. Bu çalışmanın amacı Türk sağlık sisteminde önemli bir yere sahip olan devlet üniversitelerinin hastanelerinin finansal değerlendirmesinin yapılmasıdır. Bu amacın gerçekleştirilebilmesi için, 2013-2015 yılları itibari ile 33 devlet üniversitesi hastanesine ait finansal tabloları incelenmiştir. Oran analizi sonuçlarına göre devlet üniversitesi hastanelerinin borçlarının sürekli arttığı görülmektedir. Bu bağlamda, hastanelerin likidite pozisyonlarının giderek azaldığı ve kabul görmüş ortalamanın altında olduğu bulunmuştur. Karlılık pozisyonları ise negatiftir. Hastanelerin finansal yapısı zamanla önemli ölçüde bozulmuştur. Ayrıca, hastanelerin bir bütün olarak finansal tablolarının değerlendirilmesi sonucu finansal oranlarda yıldan yıla olumsuz yönde değişme olduğu ve genel finansal durumlarının iyi olmadığı sonucuna varılmıştır. Bu makale, sağlık politikalarının hastanelerin ihtiyaçlarına göre düzenlenmesini, sağlık politikası belirleyicilerinin kamu üniversite hastanelerinin borçlarını ve performanslarını iyileştirmek için önlemler almaları gerektiğini önermektedir.

Anahtar Kelimeler: Devlet Üniversitesi Hastaneleri, Finansal Performans, Sağlık Sistemi, Oran Analizi, Türkiye.

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INTRODUCTION

Health care systems are designed to develop a healthy society. For this reason, health care services are required to cover all needs of individuals in the society and be easily accessible, fair, equal, and high quality (Gürsoy, 2015). Today recent studies have proposed that the problems of health care systems cannot be solved in the short term in neither developed nor developing countries. Thus it can be seen that almost all of them need crucial reform attempts (Erus & Atakke, 2012; Akıncı, et al., 2012; Di Matteo, 2010; Wang, 2010; Yip & Eggleston, 2004). In addition, it is a well-known fact that all around the world there are lots of studies conducted to improve health care services (Cylus & Papanicolas, 2015; Di Matteo & Di Matteo, 2012; Figures et al., 2008; Glied, 2008).

A series of reform packages in the health care sector have been launched by the World Bank and the International Monetary Fund since 1980s with the removal of obstacles in front of the globalization movement (Özgülbaş & Koyuncugil, 2007). Turkey has also been trying to improve health care services as a developing country. Health Transformation Program (HTP) was set up and the public was informed in 2003. The first step was to determine the goals with a view to arranging health care services in a productive, profitable and fair way, and finance them (Gürsoy, 2015). The desire to fulfill health related needs of the citizens by means of making services fair and high qualified was the main encouraging factor (Akdağ, 2015).

Health status in Turkey was started to improve dramatically after HTP (Akdağ, 2015). While life expectancy at birth rose from 71 to 76 in 2011, infant mortality rate per 1.000 live births diminished from 31 in 2000 to 7,7 in 2012 (OECD, 2013). In addition, the maternal mortality rate per 100.000 live birth went down from 70 to 20 in 2013 (WHO, 2007 & 2012). Whereas patient satisfaction was 39.5% in 2003, it increased to 74.8 in 2012 with the help of HTP.

In addition, according to the data on health statistics, total health care expenditure in Turkey was 18.774 billion TL in 2002 and in 2013, it reached 84.390 billion TL, 5.4% of the Gross Domestic Product (GDP). Moreover, the health care costs in Turkey increased by 923% from 2000 to 2013 (Atasever 2014). The biggest share of health expenditures in Turkey is also transferred to hospital services. 42.3% of health expenditures in 2002 and 48.85% in 2015 were based on hospital. (Atasever, 2014; Turkstat, Health Expenditure Statistics 2016). Similarly, hospital health expenditure consists of approximately 40% of US health expenditures (Carey & Burgess, 2000).

On the other hand, HTP has also affected the institutions of higher education in Turkey via university hospitals. They are one of the most complex organizational structures. Hospitals of public universities have a distinct importance due to both their capacities to provide qualified health care services that require academic knowledge and their function of training doctors and other health care assistants (Terzi, 2012). The evaluation of their financial structure is complex because the cost of treatment differs from person to person regarding the severity and variety of illness. Public university hospitals are academic institutions that fulfill important missions such as education and research as well as health service provision. Public university hospitals are required to carry out academic and clinical activities simultaneously in order to fulfill their missions (Uğurluoğlu, 2015). To realize of that mission, it is required to increase the productivity and provide cost effective health services and ensure financial sustainability.

In other words, hospitals of public universities, as an important suppliers of health services, have been affected by health policies applied in recent years and by the cost restricting arrangements of reimbursement organizations and the increased cost of services. So, they have difficulties to cover their cost with their limited resources.

Business concepts such as profitability, productivity, performance and cost have become important for public university hospitals both because of the big the size of the resources they use and the competitiveness of health sector (Gider, 2009). For this reason, the financial status of public university hospitals should be evaluated and health policies should be regulated according to the needs of the hospitals. recent studies indicate that the debts of the university hospitals have been rising persistently (Türkmen, 2016). Despite the financial precautions taken by health policy makers, the Ministry of Finance has also determined that there has been a significant increase in the debt amounts of many university hospitals which had a good financial status in previous years (Yiğit & Yiğit, 2016). On the other hand, because of the limitation of financial data of public university hospitals, there is not enough study to evaluate their financial position. This study aims at evaluating the financial positon of public university hospitals whose financial reports are available at the Audit Reports of the Turkish Court of Accounts between the years 2013 and 2015. This paper is organized as follows: first of all methodology, findings, and conclusion and discussion are discussed. The final section includes policy implications.

METHODOLOGY

Hospitals of public universities, which have an important place in terms of healthcare delivery and quality in Turkey, have faced serious financial problems in recent years. Thus, the objective of this study is to reveal the financial situation of hospitals of public universities.

Within the scope of this study, the public universities which were included in the Audit Reports of the Turkish Court of Accounts between 2013 and 2015 and which have hospitals are examined. Since public university hospitals are institutions with revolving funds, the balance sheets and income statements of the Revolving Fund Management in the audit reports are accepted to reflect the financial status of the hospitals. There are 57 universities with hospitals[5]. Public university hospitals that are managed according to the same administrative and legal principles are included in this research. Public university hospitals that signed the protocol of use with the Ministry of Health and the Public Hospitals Association and public university hospitals which lack financial data for years and foundation universities are excluded from the research. Because of the missing data in the financial statements of these universities, 33 of them are included in the study[6].

The hospitals not taken into the study and the reasons for not taking them are summarized as follows:

- Hospital of Ahi Evran University affiliated with the Public Hospitals Association in 2011, Hospital of Abant İzzet Baysal University affiliated with the Public Hospitals Association in 2014.
- Hospitals of Muğla Sıtkı Koçman and Sakarya Universities were taken over by the Ministry of Health in 2011.
- Anadolu University is not included to the sample because its revolving fund's financial statements include the income and expenses of the distant training program which generates higher revenue than other units, and distorts the analysis results.

[5] The full list of the universities is given in the Appendix 1.
[6] The list of universities which are included in the study is given in the Appendix 2.

- There is missing data problem especially for balance sheets:
  - For 2013, Adıyaman, Ankara, Bozok, Bülent Ecevit, Celal Bayar, Çukurova, Düzce, Erzincan, Hitit, İstanbul Medeniyet, Mehmet Akif Ersoy, Mustafa Kemal, Namık Kemal, Recep Tayyip Erdoğan, Sakarya, and Süleyman Demirel Universities.
  - For 2014, Necmettin Erbakan and Ordu Universities.
  - For 2015, Erciyes and Marmara Universities.

Ratio analysis is used as the financial analysis method by focusing on liquidity, financial structure, activity and profitability. Ratio analysis is often used by several researchers in the evaluation of financial status of hospitals. In this study, ratio analysis is also done on the basis of university hospitals' income statement and balance sheets in the years 2013-2014-2015. Central Bank ratio classification is used in this analysis. The ratios are explained in Table 1.

Table 1: Financial Ratios and Definition

FINANCIAL RATIOS	DEFINITION
LIQUIDITY RATIOS	
1-Current Ratio	Current Assets / Short-Term Liabilities
2-Quick (Acid Test) Ratio	Current Assets-(Inventories+ Prepayments and Accrued Income for the Next Months +Other Current Assets)/ Short-Term Liabilities
3-Cash Ratio	(Liquid Assets+ Marketable Securities)/Short-Term Liabilities
4-Inventories to Current Assets	Inventories/ Current Assets
5-Inventories to Total Assets	Inventories/ Total Assets
6-Inventory Dependency Ratio	(Short-Term Liabilities-(Liquid Assets+ Marketable Securities))/Inventories
7-Short-Term Receivables to Current Assets	(Short-Term Trade Receivables+ Other Receivables) / Current Assets
8-Short-Term Receivables to Total Assets	(Short-Term Trade Receivables+ Other Receivables)/ Total Assets
RATIOS OF FINANCIAL POSITION	
1-Debt Ratio (Leverage Ratio)	(Short-Term Liabilities+ Long-Term Liabilities) / Total Assets
2-Equity (Own Funds) to Total Assets	Equity / Total Assets
3-Equity (Own Funds) to Total Liabilities	Equity/ (Short-Term Liabilities + Long-Term Liabilities)
4-Short-Term Liabilities to Total	Short-Term Liabilities/ (Short-Term Liabilities +

FINANCIAL RATIOS	DEFINITION
Liabilities and Equity	Long-Term Liabilities+ Equity)
5-Long-Term Liabilities to Total Liabilities and Equity	Long-Term Liabilities / (Short-Term Liabilities + Long-Term Liabilities+ Equity)
6-Long-Term Liabilities to Permanent Capital	Long-Term Liabilities / (Long-Term Liabilities+ Equity)
7-Tangible Fixed Assets to Equity	Tangible Fixed Assets (Net) / Equity
8-Tangible Fixed Assets to Long-term Liabilities	Tangible Fixed Assets (Net) / Long-term Liabilities
9-Tangible Fixed Assets to Total Assets	Tangible Fixed Assets (Net) / Total Assets
10-Fixed Assets to Total Liabilities	Fixed Assets / (Short-Term Liabilities + Long-Term Liabilities)
11-Fixed Assets to Equity	Fixed Assets / Equity
12-Fixed Assets to Permanent Capital	Fixed Assets / (Long-Term Liabilities + Equity)
13-Short-Term Liabilities to Total Liabilities	Short-Term Liabilities / (Short-Term Liabilities + Long-Term Liabilities)
14-Current Assets to Total Assets Ratio	Current Assets / Total Assets
TURNOVER (ACTIVITY) RATIOS	
1-Inventory Turnover	COGS / Inventory
2-Receivables Turnover	Net Sales / (Short-Term Trade Receivables+ Long-Term Trade Receivables)
3-Working Capital Turnover	Net Sales / Current Assets
4-Net Working Capital Turnover	Net Sales/ (Current Asset- Short-Term Liabilities)
5-Tangible Fixed Assets Turnover	Net Sales/ Tangible Fixed Assets (Net)
6-Fixed Asset Turnover	Net Sales/ Fixed Assets
7-Equity Turnover	Net Sales / Equity
8-Total Asset Turnover	Net Sales / Total Assets
PROFITABILITY RATIOS	
1-Ratios Relating Profit and Capital	
a) ROE	Net Profit or Loss / Equity
b) ROA	Net Profit or Loss / Total Assets
c) Operating Profit to Assets used in	Operating Profit/ (Total Assets - Financial Fixed

FINANCIAL RATIOS	DEFINITION
Carrying Out Operations	Assets)
2-Ratios Relating to Net Sales	
a) Gross Profit Margin	Gross profit/ Net Sales
b) Operating Profit Margin	Operating Profit / Net Sales
c) Net Profit Margin	Net Profit / Net Sales
d) COGS to Net Sales	COGS / Net Sales
e) Operating Expenses to Net Sales	Operating Expenses / Net Sales

FINDINGS

In order to evaluate general financial position of public university hospitals, firstly their income statements and balance sheets were consolidated, and then Table 2 was formed. The general view of the hospitals indicates that income is lower than expenses, the gap between income and expenses is continuously and dramatically increasing so debt and inventories; receivables do not follow a specific trend; cash is extremely low compared to other accounts, and finally debt to income ratio is rising due to higher increase in debt level compared to income level. Income/Expenses ratio indicates whether hospitals' income meets their expenses or not. If the ratio is equal to 1 or it is higher, the hospital covers its expenses with income; otherwise the hospital cannot afford its expenses. According to Table 2, the income / expenditure ratio of university hospitals is 0.98 for 2013; 0.93 for 2014 and 0.90 for 2015. Public university hospitals haven't been able to cover their expenditures with income in the last three years. The increase level in income and expenditures are different. The difference between income and expenditures is high especially in 2015.

Table 2: General Financial View of Analyzed Hospitals period of 2013-2015 (TL)[7]

	2013	2014	2015	Change (%) 2013-2014	Change (%) 2014-2015
Income	4.410.345.429	5.149.119.861	5.680.181.229	16,75%	10,31%
Expenses	4.514.133.591	5.512.577.810	6.288.176.199	22,12%	14,07%
Income-Expenses	-103.788.163	-363.457.950	-607.994.970	250,19%	67,28%
Income/Expenses	0,98	0,93	0,90	-4,40%	-3,29%
Cash	51.118	55.437	47.870	8,45%	-13,65%
Receivables	1.152.667.978	1.305.028.519	1.173.913.077	13,22%	-10,05%
Inventories	386.656.938	406.174.433	411.997.572	5,05%	1,43%
Debt/Income	77%	78%	91%	2,54%	16,57%

[7] Calculations of values are explained in the Appendix 3.

Very high level of receivables and inventories are striking. Republic of Turkey Social Security Institutions (SSI) constitute 80% of financial resources of hospitals of public universities. Hospitals cannot take the amount of receipts of patients that they formed in Medula System[8] simultaneously, but can receive it two or three months later. That's why the account receivables are that much high. The main inventories of healthcare institutions are pharmaceutical and medical materials. Hospitals try to keep inventories as low as possible; however, it is necessary to have inventory at least three months in order to sustain health service.

1. Liquidity Ratios

Eight liquidity ratios were calculated. The results are given in Table 3. It is seen that liquidity ratios of hospitals are not satisfactory and hospitals have difficulty in paying their short-term debts. The current ratio of public university hospitals is low and it has decreased gradually. For this reason, it is clear that public university hospitals have had great difficulty in paying their short-term liabilities. Quick (acid-test) ratio is the demonstration of the capacity to pay short term liabilities with other current assets that health institution has when inventories cannot be converted into cash (Ağırbaş, 2014). The higher quick ratio means that the enterprise has high capacity to pay its short-term liabilities. The quick ratio is continuously decreasing like the current ratio and getting close to each other in the same trend. Likewise, two ratios indicate that university hospitals have difficulties in paying short-term liabilities.

Table 3: Liquidity Ratios

LIQUIDITY RATIOS	**2013**	**2014**	**2015**
1-Current Ratio	0.830	0.717	0.619
2-Quick (Acid-Test) Ratio	0.642	0.557	0.480
3-Cash Ratio	0.120	0.081	0.139
4-Inventories to Current Assets	0.211	0.209	0.206
5-Inventories to Total Assets	0.208	0.206	0.204
6-Inventory Dependency Ratio	5.021	6.143	6.913
7-Short-Term Receivables to Current Assets	0.629	0.665	0.640
8-Short-Term Receivables to Total Assets	0.619	0.657	0.629

Health institutions outsource goods and services which vary from pharmaceutical product and medical equipment to catering. cleaning and security services. It is required to pay monthly to forms which provide service in catering. cleaning and security etc. Likewise, the firm would like to be paid monthly when they sell medical equipment, pharmaceutical products etc. Therefore, the

[8] Medula is an integrated system through which the SSI pays for the medical supplies and medicines state hospitals, private hospitals, university hospitals, dialysis centers and many other health institutions use.

cash ratio of the health institution is preferred to be at an acceptable level. The average of cash ratio of university hospitals in these three years is 0.11. It means that university hospitals have cash and convertible securities to pay only 11% of their liabilities and there is a poor short-term solvency for hospitals. This causes firms to offer a higher price keeping in mind that that they will be paid later than the normal process. It is seen that university hospitals are in such a vicious circle.

Inventory to current assets ratio indicates how much of the current assets are generated from inventories. The ratio of inventory to total assets shows the amount of inventories in total assets. Public university hospitals have an inventory approximately 21% of their current assets and total assets. As mentioned above, health care institutions need to keep inventories for at least 3 months. For this reason, there has not been a major change in these two rates over the years.

If the quick ratio is lower than 1, inventory dependency ratio specifies what percentage of the inventory should be sold in order to pay short-term liabilities. Even though public university hospitals keep a high amount of inventory, their inventory is not enough to pay their short-term liabilities. They need approximately 6 times more inventory than they have now to pay their debts.

Short-term receivables to current assets and short-term receivables to total assets ratios indicate how much of the assets are generated from short-term receivables. As stated above, SSI provides 80% of financial resources of hospitals of public universities and hospitals wait for their receivables for at least two or three months. It is seen that approximately 63% of the assets of the hospitals are composed of the short-term receivables, which confirms this situation.

2. Ratios of Financial Position

Financial position ratios indicate how much of firms' assets are financed by debt or equity. Fourteen financial position ratios for public university hospitals are listed below. Public university hospitals are financed with debt as shown in Table 4. Generally short term liabilities are high and long-term liabilities are very low. Short term debts are taken from the firms which provide good and services to hospitals. In addition to this, those hospitals borrow from their own universities as a result of insufficiency of their own accounts. Hence, it can be said that hospitals use trade liabilities and intercompany debt to finance themselves. On the other hand, they don't use any bank credit.

Table 4: Ratios of Financial Position

RATIOS OF FINANCIAL POSITION	**2013**	**2014**	**2015**
1-Debt Ratio (Leverage Ratio)	1.186	1.382	1.648
2-Equity to Total Assets	-0.186	-0.382	-0.647
3-Equity to Total Liabilities	-0.157	-0.277	-0.393
4-Short-Term Liabilities to Total Liabilities and Equity	1.184	1.378	1.595
5-Long-Term Liabilities to Total Liabilities and Equity	0.002	0.004	0.057
6-Long-Term Liabilities to Permanent Capital	-0.010	-0.011	-0.088
7-Tangible Fixed Assets to Equity	-0.039	-0.017	-0.010

8-Tangible Fixed Assets to Long-term Liabilities	3.806	1.660	0.126
9-Tangible Fixed Assets to Total Assets	0.007	0.007	0.007
10-Fixed Assets to Total Liabilities	0.014	0.009	0.007
11-Fixed Assets to Equity	-0.092	-0.032	-0.018
12-Fixed Assets to Permanent Capital	-0.093	-0.032	-0.020
13-Short-Term Liabilities to Total Liabilities	0.998	0.997	0.968
14-Current Assets to Total Assets Ratio	0.983	0.988	0.988

Additionally, debt ratio reveals that public university hospitals are under high debt burden. Debt ratio reached 1.65 in 2015 showing that those hospitals have expenditures which are one and a half time higher than their revenues.

Public university hospitals have made loss for a long time therefore their equity is negative. Because hospitals' equity is negative, most of the financial position ratios such as equity to total assets, equity to total liabilities, long-term liabilities to permanent capital, tangible fixed assets to equity, fixed assets to equity and fixed asset to permanent capital are also negative. Considering the changes in equity and total assets, it is seen that equity decreased during 2013-2015 despite the positive increase in total assets. Since equity is negative, equity to asset and equity to total liabilities ratio cannot be interpreted.

Furthermore, as the short-term liabilities to total liabilities ratio is greater than 1, it means that fixed assets are financed by short-term liabilities. The ratio of long-term liabilities to total liabilities and equity is very small and again indicates that hospitals do not use long term debt. Only two university hospitals, Akdeniz University Hospital and Cumhuriyet University Hospital, have long term liabilities. Since hospitals have been financed with debt and debt is greater than their own assets, it is possible to conclude that financial risk of public university hospitals has increased.

Permanent capital refers to the sum of long term liabilities and equity. Since hospitals' long term liabilities are not high, long-term liabilities to permanent capital ratio is very low. Contrarily, current assets to total assets ratio is very high and 99% of total assets are current assets.

Public university hospitals have to recirculate their fixed assets such as equipment, fixtures, etc. to university, so tangible fixed assets to equity, tangible fixed assets to total assets and fixed asset to total liabilities ratios are also very small. As mentioned before, tangible fixed assets to long-term liabilities ratio is high because hospitals don't have huge amounts of long term debt. Public university hospitals owe to firms which provide good and services to hospitals. The contracts with the service providers are for a maximum of 12 months. But it is known that hospitals cannot pay their debts during this period (Yigit & Yiğit, 2016). This situation has also been confirmed by short-term liabilities to total liabilities ratio which indicates that approximately 99% of total liabilities consists of short-term debt.

3. Turnover (Activity) Ratios

Turnover ratios measure the efficiency of health institutions in the service provision. Eight turnover ratios for hospitals are provided below in Table 5. It is seen that turnover ratios are moderately high and most of them are increasing year by year.

Table 5: Turnover (Activity) Ratios

TURNOVER (ACTIVITY) RATIOS	2013	2014	2015
1-Inventory Turnover	7.200	8.944	10.096
2-Receivables Turnover	4.103	4.308	5.323
3-Working Capital Turnover	2.368	2.623	2.792
4-Net Working Capital Turnover	-11.590	-6.636	-4.545
5-Tangible Fixed Assets Turnover	317.529	390.037	416.470
6-Fixed Asset Turnover	136.383	212.219	232.645
7-Equity Turnover	-12.530	-6.777	-4.261
8-Total Asset Turnover	2.327	2.591	2.759

Inventory turnover ratio indicates how fast a health institution converts its inventory into cash. The higher the inventory ratio. the higher the use of medical equipment and pharmaceutical products. It may also mean that if the ratio is high. more patients get health services. Ratio analysis shows that hospitals' inventory turnover ratio is high and significantly increasing.

The continuity of financial activities in health institutions depends on the receipt of receivables. Moreover, reimbursement method and length of the receival period is one of the important problems of analyzed hospitals. Public university hospitals get their receivables from SSI with Medula system. The accrual and monitoring of the receivables are also one of the most important problems for financial managers of hospitals. Those explain high accounts receivables turnover ratio. Receivables turnover ratio shows that public university hospitals have collected their receivables approximately in 89 days in 2013 and 69 days in 2015 and despite the shortening of the period of collecting receivables, there was a waiting period of at least 2 months.

Working capital turnover measures how many times the current assets of the health institutions are renewed in one accounting period and gives information about the efficiency of the current assets. While higher ratio means that the current assets are highly efficient, this efficiency is meaningful when it is in the same direction with profitability. High working capital turnover ratio indicates that patient visits to university hospitals and health care services are proper, medical and pharmaceutical products turnover is high and receivables are collected on a regular basis, but as shown in Table 6 below, hospitals are experiencing profitability problems. The reasons for this should be carefully investigated. Moreover, net working capital turnover is both negative and high, because short-term liabilities are bigger than current assets. It is possible to conclude that financial performance of hospitals is not good and 2013 is the year which has relatively the best performance among those. This situation has also emphasized hospitals short term indebthness problem.

Hospitals fixed assets consist of trade receivables, other receivables, financial fixed assets, tangible fixed assets, intangible assets prepayments and accrued income for the next months and other fixed assets. In general, the largest share among the fixed assets in hospitals is the tangible fixed asset account where MR, Tomography, Angiography, EKO, EEG, X-ray, Ultrasound etc. are

recorded. However, as public university hospitals have transferred their fixed assets to the university, there are very few amounts in these accounts compared to other accounts. Tangible fixed assets turnover ratio and fixed asset turnover ratio are very high due to hospitals' not keeping huge amount of fixed assets and transferring them to their university.

Equity turnover ratio measures how efficiently hospitals' own resources are being used. This ratio is negative because the equity structure of the hospitals is negative. Moreover, the ratio declining rapidly shows that the hospitals' own resources are inadequate and they are financing their activities with foreign resources and they are experiencing a debt payment problem. In other words, equity turnover ratio indicates that owner's equity of hospitals is not sufficient and hospitals mostly use liabilities in financing their services and they cannot afford to pay their debts.

Total asset turnover ratio is used to evaluate the efficiency of all assets of the health institution. The higher the asset turnover ratio is, the better it is. If asset turnover ratio is high, it shows that health provision increases according to assets. As shown in Table 5 total asset turnover ratio is above 2 but it is not high in the period under review.

4. Profitability Ratios

Profitability ratios are important indicators in the evaluation of financial performance of hospitals. Table 6 shows that 8 probability ratios of hospitals. Profitability ratios of public university hospitals indicate that they have probability problems. It is necessary for hospitals both to increase operating profit by decreasing unit cost and to rise profitability by making service higher.

Table 6: Profitability Ratios

PROFITABILITY RATIOS	**2013**	**2014**	**2015**
1-Ratios Relating Profit and Capital			
a) ROE	0.300	0.483	0.465
b) ROA	-0.056	-0.185	-0.301
c) Operating Profit to Assets used in Carrying out Operations	-0.072	-0.173	-0.292
2-Ratios Relating to Net Sales			
a) Gross Profit Margin	-0.031	-0.067	-0.105
b) Operating Profit Margin	0.358	0.288	0.254
c) Net Profit Margin	-0.024	-0.071	-0.109
d) COGS to Net Sales	0.642	0.712	0.746
e) Operating Expenses to Net Sales Ratio	0.388	0.355	0.360

Changes in institutional profitability over the years can be monitored using the ratio of return on equity. Although ROE is positive, ROA and Operating profit to assets used in carrying out operations ratios are negative between the years 2013-2015 as it can be seen in Table 6. The main reason for the negative value of ROA is that hospitals' equity is negative and they have made loss. Positive ROE has not indicated that hospitals make profit, which means that hospitals are unsuccessful in health service and provision. Further, it can be said that the hospitals made loss in 2013-2015.

Gross profit is the positive difference between the sales amount of goods and services sold and the costs of these goods and services. Gross profit margin is required to be high, otherwise it is known that the healthcare institution will have difficulty in meeting the operating expenses. Table 6 above shows that the gross profit margin in 2013 was -0.31 and after that the ratio has been significantly declined from 2014-2015 onwards. This shows the poor financial position of the hospitals. Although the operating profit margin is positive, there is a negative growth in operating profit margin. It is known that health services have high cost. That operating profit margin is positive whereas gross profit margin is negative, indicating that hospitals are under high operating expense and their income cannot compensate their expenses. It was found that public university hospitals cannot cover their operating expenses. When the income tables of public university hospitals are examined in detail, it is seen that although the net sales increased more than the previous year, the cost and expenditure items went up more. In addition, financial expenses increased proportionally more than net sales in line with the increase in the use of short term liabilities. Due to the reasons mentioned above, there is a negative growth in the net profit margin.

Furthermore, the COGS to net sales ratio is expected to be small as well, while the health care provider can make a profit when other expenses are paid. As shown in Table 6, this ratio was 64% in 2013 and has been rising steeply. That is, the cost of health services sold reached 75% by 2015. Public university hospitals, which are seen as the last step in health care service, where complicated diseases are cured and which accept the patients that are not accepted by private hospitals due to cost constraints, are among the institutions that can be easily seen substantial cost of health care service.

Operating expenses consist of research and development expenses, marketing, sales and distribution expenses and general and administrative expenses. It has been determined that the main expenditure amounts in operating expenses are general and administrative expenses by the time university hospitals' balance sheets are examined. Therefore, operating expenses to net sales ratio reveals that approximately 37% of the health service sales of the university hospitals should be allocated to expenditures of general and administrative expenses. It is enormously high and any hospital cannot easily afford it.

CONCLUSION AND DISCUSSION

Public university hospitals which have crucial importance in health care services have recently become institutions which are not able to finance their income and expenses. Thus, university hospitals were granted 377 million and 209 million TL in 2010 and 2011, respectively. 451 million TL fund was also transferred in 2011 as the income differences of the lecturers due to decrease in their income after HDP. In 2005 and 2006, 55 million TL and 105 million TL, which corresponds to 1000 TL and 1750 Tl, respectively, were transferred as hands-on training These

transfers could be viewed as the examples of the arrangements made to recover the cost structures of the hospitals (Türkmen, 2016). However, findings of this study indicate that the financial supports have fallen short of the expectations and hospitals still go through financial straits.

Financial performance of the public university hospitals should also be high to provide sustainable health care service. Their performances are dependent on both health policies affecting their financial structure, and financial indicators, such as liquidity, financial position, rate of turnover, profit etc. This study focuses on financial performances of the university hospitals to get new perspective about the financial problems of the hospitals. This study indicates that university hospitals were failed to finance their income and expenses between 2013 and 2015 and made huge loss. Debts of university hospitals increased consistently and even many hospitals which had good financial performance in previous year became indebted. In summary, according to ratio analysis results, the hospitals should increase liquidity, efficiency of receivables and profitability; control the unit cost; balance income and expenditures by rising health service provision in order to improve their financial status. This study also found that the hospitals' management should improve the current ratio by lowering the current liabilities. Public university hospitals should increase efficiency of their assets.

Public university hospitals' financial success depends on the effective management of assets and debts. Hospitals' funds should be managed in line with their purpose. Thus, sustainable health care service can be achieved via successful financial management which prevents financial difficulties and fulfils the financial obligations. Public university hospitals should measure both their organisational performance and financial performance to increase them. More specifically, identifying organizational and environmental factors which affect financial performance in public university hospitals and developing suitable strategies about them will increase the financial success of the universities.

Public university hospitals should keep the financial indicators such as profit, liquidity and debt capacity at the level of generally accepted financial standards. Otherwise, they will not be able to solve financial problems by associating them with only legal regulations and managing the hospitals without following business administration rules (Yiğit et al. 2012; Kısa, 2011).

POLICY IMPLICATION

Health care service in academic centers is 30% more expensive due to the training and research studies. Therefore, this difference is subsidized by the government as the training and research studies cannot be renounced in almost every country in the world (Terzi, 2012). Thus, financial conditions of public university hospitals should be improved to enable services of patient care, special patient service, and complicated health care, which make academy indispensable for public.

In order to increase their revolving fund income, financial structure disorganizations of public university hospitals make them go towards routine health care services needed to be done in the second even in the first step and this means public university hospitals are losing their essential features. Besides, raising scientists which is one of the main duties of the university hospitals will not be possible under these circumstances. An accessible, active and financially sustainable health care system will only be possible with a strong public health care service consciousness.

There are three options to achieve the objectives of health care system against the health care costs and limited sources. The first one is increasing the income for health care system, the second one is reducing the expenses and the services and the third one is making plans to obtain the best productiveness from the existing sources (Thompson et al., 2009).

In this context; a financial sustainability approach can be used to solve the financial problems of the university hospitals. The solutions determined by WHO in 2012 for the financial problems are as seen below:

1- "Measure value and invest for the greatest returns."

Public university hospitals are shared values of this country in science, education and research studies. Considering the features of public university hospitals such as raising health care staff mission and being the treatment centres of the complicated illnesses, they should be the institutions of investment. Their mission to be both a health and science center are crucial to protect, heal and develop public health. Thus, in public university hospitals education system allocation should be received based on the income and the number of the lecturers, assistants, students and beds.

High amounts of BAP[9], which increase the expenses of public university hospitals, and are covered by revolving fund should be absorbed from the government budget. In the current situation, salaries of the contracted staff are paid from the revolving fund and employee compensation[10], night shift payments should also be paid from this budget.

2- "Foster skill will to create value –conscious customers."

Patients, namely citizens, Patients should be canalized to suitable health institutions based on their medical needs by providing them with the exact information about health system. Citizens should raise awareness of not preferring public university hospitals for routine health care services such as circumcision or wound care and treatment.

3- "Pay for value, not for volume".

Promotions to make payment to public university hospitals are needed to be revised once again and Health Practice Notification (SUT)[11] prices should be regulated by considering the complicated processes in the hospitals.

[9] Scientific Research Projects, abbreviated as BAP (Bilimsel Araştırma Projeleri), is a system developed with a view to supporting research in higher education institutions. The system is implemented in accordance with the Regulation on Scientific Research Projects in Higher Education Institutions enforced by the Higher Education Council on January 1, 2002. (https://www.anadolu.edu.tr/en/research/scientific-research-projects/what-is-bap, accessed 17.07.2017).

[10] Turkish translation is "Denge Tazminatı".

[11] Health Practice Notification abbreviated as SUT (Sağlık Uygulama Tebliği)

Business management expenses should be taken with account while pricing medical consumables and SUT and material prices should reflect market prices.

4- "Proactively reach out to predict and prevent ill health and manage disease."

Citizens should be informed in community health services and illnesses are needed to be prevented before they occur.

5- "Reinvent the delivery system with new models of care."

In order to lead patients head towards third step health care systems of public university hospitals, the number of patients applying to the hospitals should be reduced by using patient-oriented and low-cost ways such as partial referral system, domiciliary care and differentiations in shares.

By developing health tourism, the number of the patients especially from abroad is needed to be increased in public university hospitals. Furthermore, doctors and staff should be encouraged to work more by letting them know that public university hospitals will be able to determine the prices of the services done by private health insurances and take the price differences from the healthcare systems and doctors and staff will be able to exceed maximum revolving fund price in accordance with this purpose.

With the aim of evaluating unutilised capacity of university hospitals, use of medical and surgery devices should be promoted out of working hours.

6- "Promote technology innovations that lower cost and leverage talent to raise quality."

Considering the feature of public university hospitals as science centers at the same time, finance of some of the medical equipment to be used in these hospitals is needed to be afforded by SSI and by supporting technology innovations, the quality of service should be improved.

7- "Implement modern management practices and focus on performance."

After the regulations related with Affiliation Applications of Ministry of Health, University Hospitals published on the 28989 edition of the Official Journal dated May 3, 2014, while some of the public university hospitals became affiliated, the others preferred not to be affiliated for the concern of losing their autonomy. This situation caused a pricing difference between the affiliated and non-affiliated universities. Public universities should be charged the same price schedule and financial support should be given to them equally.

Hence, a new modern management system should be created to gather all public university hospitals under a single roof. Additionally, productivity, performance, cost, effectiveness and management problems of the university hospitals are needed to be solved.

Accessing financial indicators of university hospitals should be made easier, financial statements should be published open to the public and followed regularly. Besides, by doing instant analyses between productive and non-productive hospitals, the causes of unproductiveness should be found out.

By following the productiveness of the services presented by public university hospitals closely, minimum service productivity performance standards should be brought and in payments based on performance productivity and costs should be considered instead of the total income of public university hospitals.

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APPENDIX

Appendix-1: The list of universities which were included in the Audit Reports of the Turkish Court of Accounts between 2013 and 2015

	University Name		University Name
1	Abant İzzet Baysal University	30	Hitit University
2	Adıyaman University	31	İnönü University
3	Adnan Menderes University	32	İstanbul Medeniyet University
4	Afyon Kocatepe University	33	İstanbul University
5	Ahi Evran University	34	Kafkas University
6	Akdeniz University	35	Kahramanmaraş Sütçü İmam University
7	Anadolu University	36	Karadeniz Teknik University
8	Ankara University	37	Kırıkkale University
9	Atatürk University	38	Kocaeli University
10	Balıkesir University	39	Marmara University
11	Bozok University	40	Mehmet Akif Ersoy University
12	Bülent Ecevit University	41	Mersin University
13	Celal Bayar University	42	Muğla Sıtkı Koçman University
14	Cumhuriyet University	43	Mustafa Kemal University
15	Çanakkale Onsekiz Mart University	44	Namık Kemal University
16	Çukurova University	45	Necmettin Erbakan University
17	Dicle University	46	Ondokuz Mayıs University
18	Dokuz Eylül University	47	Ordu University
19	Dumlupınar University	48	Osmangazi University
20	Düzce University	49	Pamukkale University
21	Ege University	50	Recep Tayyip Erdoğan University
22	Erciyes University	51	Sakarya University
23	Erzincan University	52	Selçuk University
24	Fırat University	53	Süleyman Demirel University
25	Gazi University	54	Trakya University
26	Gaziantep University	55	Uludağ University
27	Giresun University	56	Yıldırım Beyazıt University

28	Hacettepe University	57	Yüzüncü Yıl University
29	Harran University		

Appendix-2: The list of universities which were analzed in this study

	University Name		University Name
1	Adnan Menderes University	18	İnönü University
2	Afyon Kocatepe University	19	İstanbul University
3	Akdeniz University	20	Kafkas University
4	Atatürk University	21	Kahramanmaraş Sütçü İmam University
5	Balıkesir University	22	Karadeniz Teknik University
6	Cumhuriyet University	23	Kırıkkale University
7	Çanakkale Onsekiz Mart University	24	Kocaeli University
8	Dicle University	25	Mersin University
9	Dokuz Eylül University	26	Ondokuz Mayıs University
10	Dumlupınar University	27	Osmangazi University
11	Ege University	28	Pamukkale University
12	Fırat University	29	Selçuk University
13	Gazi University	30	Trakya University
14	Gaziantep University	31	Uludağ University
15	Giresun University	32	Yıldırım Beyazıt University
16	Hacettepe University	33	Yüzüncü Yıl University
17	Harran University		

Appendix 3: General financial view of the analyzed hospitals for period between 2013-2015

	Definition
Income	Net Sales+ Income and Profit from Other Operations+ Extraordinary Income and Profit
Expenses	Cost of Sales+ Operating Expenses+ Expense and Loss from Other Operations+ Extraordinary Expense and Loss+ Provisions for Taxation and Other Legal Liabilities
Income-Expenses	Income-Expenses
Income/Expenses	Income/Expenses
Cash	Cash
Receivables	Short-Term Trade Receivables+ Short-Term Other Receivables+ Long-Term Trade Receivables+ Long-Term Other Receivables
Inventories	Inventories
Debt/Income	(Short-Term Liabilities+ Long-Term Liabilities+ Previous Year's Losses+ Net Loss for the period) /Income

Evaluation of Wind Energy Potential and Economic Analysis of Wind Energy Turbine Using Present Value Cost Method at Famagusta, Rizokarpaso, Kyrenia, Morphou, Nicosia and Ercan in Cyprus: Case Study

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Abstract: Wind energy, which is among the most promising renewable energy resources, is used throughout the world as an alternative to fossil fuels. In the assessment of wind energy for a region, the use of two-parameter Weibull distribution is an important tool. In the present study, the wind characteristics and wind energy potential in six sites, namely Ercan, Famagusta, Rizokarpaso, Kyrenia, Morphou and Nicosia have been statistically analyzed. For this purpose, wind speed data, collected for a one-year period between January-December 2016, were evaluated. The results concluded that the annual mean wind speed is ranging between 2.47 and 4.58 m/s. Yearly and seasonal parameters of Weibull distribution at different heights (40, 50 and 60 m) were obtained by extrapolation of the 10 m data at all sites. In addition, yearly and seasonal wind power density values of each height were calculated. In this study, the economic assessments were conducted to determine the present value cost method (PVC) from the wind in the island. The assessments used extrapolations of 10 m level wind data sets for the sites and wind turbine characteristics of five wind energy conversion systems ranging from 20 kW to 800 kW. The results showed that the capacity factors of all turbines in the selected sites are ranged between 1.1% and 10.77%. The average minimum cost per kW h was obtained in Rizokarpaso as US$0.00183/kW h with Enercon E 33 while the highest average cost is US $3.304/kW h with GEV-MP in Kyrenia.

Keywords: Cyprus; Present value cost; Wind energy; Wind turbine; Weibull distribution

1. Introduction

Wind, a clean source of renewable energy that produces no kind of pollution with nearly zero operational costs once a turbine is erected, has been experiencing rapid growth in the last two decades. One of the most important economic benefits of wind power is that it reduces the exposure of our economies to fuel price volatility. And it also has a major advantage which is eliminating transmission losses by its ability of generating the power near the load centers.

Globally, wind energy has proved to be one of the cheapest forms of low carbon electricity (Kidmo et al., 2016). Under ambitious growth rates, the wind power could generate between 16.7% and 18.8 % of the global electricity by 2030 and also could save over 3 billion tons of CO_2 emissions annually (Global Wind Energy Council, 2006). Worldwide, 52,016 MW of new generating capacity was added at the end of 2014, bringing the total cumulative installed WT capacity to 372,961 MW, to just about 3 % of the global electricity supply (Kidmo et al., 2016). Although solar photovoltaic (PV) experienced the fastest capacity growth rates of any energy technology, with 39.0 and 38.2 % in 2013 and 2014 respectively, wind energy achieved the most power capacity added of any renewable technology (REN21, 2016).

Electricity is one of the main drivers that contribute to improve economic opportunities and, even a better quality. Cyprus is geographically predisposed to winds from the Mediterranean. The current

electricity generation is mostly dependent on the imported fossil fuel resources. In Northern side, the Electricity Authority of Northern Cyprus distributes power, generated by two 60 MW fuel oil-fired generators along with six 17.5 MW diesel generators (Electricity Production Plants in TRNC, 2017). Another energy company, AKSA, supports the grid with 92 MW capacity of diesel generators. These aside, the only alternative energy source is a photovoltaic (PV) power plant installed in Serhatköy with a capacity of 1.27 MW. Thus, about 99% of the energy generation is from conventional energy resources. Summing the resources, the total power generation of Northern Cyprus is around 300 MW. In the southern part of Cyprus on the other hand, there is a PV power plant that has a 4.5% share of the total power generation. Besides, there are wind power plants installed in critical regions of southern part of Cyprus that has a total capacity of 165 MW (Ercan et al., 2014). The total power generation capacity of Southern Cyprus is about 1 GW (Ercan et al., 2014).

The primary objective of this paper is to address the study of the statistical properties of the wind speed and wind potential in Cyprus by considering six locations, namely, Ercan, Famagusta, Rizokarpaso, Kyrenia, Morphou and Nicosia in which the data are recorded by Meteorology Department located in Nicosia. Data collected from January-December 2016 periods are analyzed using the Weibull distribution. Seasonally and yearly Weibull parameters, probability of observing wind speed and wind directions are determined for each region as a result of the study.

Investigation of wind energy generation and the economic analysis of wind turbine applications in Cyprus are also carried out by PVC method of analysis for the various wind energy conversion system (WECS) with power capacities ranging from small to medium and large size.

This study consists of three parts, the first provides a brief overview of the evaluation of the wind power resources and its prospects in Cyprus, the second phase focuses on the analysis of wind data, producing electricity from wind power and capacity factors, while the third phase includes the economic study of selected sites using the method of the present value of costs (PVC).

2. Wind data measurements

For the assessment of wind energy resources in Cyprus, the measurement daily wind speed (2016) data from meteorological department were used. The wind data for the six selected locations were captured at the height of 10 m by a cup anemometer. The recorded wind speeds were obtained on daily basis and thereafter computed as the mean of the speed for each month. The coordinates of each observation point and the period of records of each station are presented in Table 1.

Table 1. Details of each station used in the analysis

	Coordinates					
Station name	**Latitude [°N]**	**Longitude [°E]**	**Measuring Height[m]**	**Period records**	**Year**	**Characteristics of the station**
Ercan	35° 09' 34	33° 30' 00	10	2016	1	Airport
Famagusta	35° 06’ 54	33° 56’ 33	10	2016	1	coastal
Rizokarpaso	35° 37' 36	34° 24' 31	10	2016	1	coastal
Kyrenia	35° 20’ 25	33° 19’ 08	10	2016	1	coastal
Morphou	35° 11’ 53	32° 59’ 38	10	2016	1	coastal
Nicosia	35° 10’ 08	33° 21’ 33	10	2016	1	Surrounded by building

3. Theory

3.1 Statistical analysis model

The knowledge of wind speed frequency distributions is very important factor to evaluate the wind potential in an area. If the wind speed at the location is known, then the power potential of the site can easily be obtained. Wind data obtained with various observation methods has a wide range therefore in wind energy analysis, it is necessary to have a few parameters that can explain the behavior of a wide range of wind speed data. The simplest and most practical method of the procedure is to use distribution function (Ahmed, 2013). There are several density functions which can be used to describe the wind speed, frequency, include, for example, the three parameter Weibull distribution (Stewart & Essenwanger, 1978), the Rayleigh distribution (Dorman, 1982) and the gamma distribution (Sherlock, 1951). In recent years, most attention has been focused on two parameters Weibull distribution for wind energy applications, not only due to its greater flexibility and simplicity but also because it can provide a good agreement with experimental data (Bowden et al., 1983; Lun & Lam, 2000). In addition, if the Weibull distribution is determined for the wind at a certain height, the distributions at other heights may be easily deducted (Hennessey, 1977). The Weibull distribution is characterized by two parameters: the dimensionless shape parameter k; and the scale parameter c which has units similar to the speed (m/s). The probability density for the wind velocity v is calculated by (Justus et al., 1978):

$$f_w(v) = \left(\frac{k}{c}\right)\left(\frac{v}{c}\right)^{k-1} e^{-\left(\frac{v}{c}\right)^k} \quad (1)$$

The corresponding cumulative probability function of Weibull distribution (Akpinar & Kavak Akpinar, 2007) is

$$F_w(v) = 1 - exp\left[-\left(\frac{v}{c}\right)^k\right] \quad (2)$$

Several methodologies are used to determine Weibull parameters, the application of which is related to the area surface roughness, relief conditions, urbanization locations and other factors. Therefore, it is essential to choose an appropriate method to determine Weibull distribution parameters in order to properly assess energetic wind performance of the area. Therefore, numerical method, maximum likelihood estimation is applied to get parameter estimation in the Two-parameter Weibull distribution. Maximum likelihood method is the most popular and most appropriately used, as it assesses wind variation patterns. Weibull distribution parameters are calculated using the formula below (Chang, 2011)

$$k = \left(\frac{\sum_{i=1}^{n} v_i^k ln(v_i)}{\sum_{i=1}^{n} v_i^k} - \frac{\sum_{i=1}^{n} ln(v_i)}{n}\right) \quad (3)$$

$$c = \left(\frac{1}{n}\sum_{i=1}^{n} v_i^k\right)^{\frac{1}{k}} \quad (4)$$

3.2 Wind speed extrapolation and electrical power output

The selected wind turbines are designed to operate at different hub heights when compared to the available measured wind data; hence, the captured wind speed height (10 m) can be extrapolated to the turbine hub height through the power law expression given as:

$$\frac{v}{v_0} = \left(\frac{h}{h_0}\right)^{\alpha} \quad (5)$$

where *v* is the wind speed at the wind turbine hub height h, v_0 is the wind speed at original height h_0, and α is the surface roughness coefficient. In most cases, the accurate value of the surface roughness coefficient is not readily available or ascertained. Therefore, another approach is to use the Weibull probability function parameter values determined at the measured height and extrapolate them to the hub heights using the following expressions (Justus et al., 1978) as:

$$c(h) = \mathrm{c}_0\left(\frac{h}{h_0}\right)^n \quad (6)$$

$$k(h) = \frac{\mathrm{k}_0\left[1 - 0.088\ln\left(\frac{h_0}{10}\right)\right]}{\left[1 - 0.088\ln\left(\frac{h}{10}\right)\right]} \quad (7)$$

where c_0 and k_0 are the scale and shape factors, respectively, at the measurement height h_0, while h is the hub height. This approach is employed in this study to determine the capacity factor and mean power output from selected commercial wind turbines. This is because, it is easier to implement once the shape and scale factors of the Weibull function at the measured height has been determined. The exponent n is defined as (Justus et al., 1978):

$$n = \frac{[0.37 - 0.088ln(\mathrm{c}_0)]}{1 - 0.088\ln\left(\frac{h}{10}\right)} \quad (8)$$

Each wind energy conversion system (WECS) is planned to operate at its maximum efficiency within its designed rated wind speed and power. As a result, once Weibull scale and shape parameters are estimated, the performance of a wind turbine at a given location can be easily computed using the average power output ($P_{e,ave}$)) and capacity factor (C_f). In this work, the electrical power output (P_e) of a model WT is simulated using (Akpinar & Akpinar, 2005; Paul et al., 2012):

$$\mathrm{P_e}\begin{cases} 0 & (v < v_c) \\ P_{eR}\dfrac{v^k - v_c^k}{v_r^k - v_c^k} & (v_c \le v < v_r) \\ P_{eR} & (v_r \le v < v_f) \end{cases} \quad (9)$$

The performance of any installed wind turbine at any location can be evaluated by the mean power output ($P_{e,ave}$) over a period of time (usually, monthly and annually) and the capacity factor C_f (representing the fraction of the mean power output over a period of time to the rated electrical power $P_{eR}$of the turbine). The mean power output $P_{e,ave}$ and C_f can be calculated using the following expressions based on Weibull distribution function (Akpinar & Akpinar , 2005):

$$P_{e,ave} = P_{eR}\left(\frac{e^{-\left(\frac{v_c}{c}\right)^k} - e^{-\left(\frac{v_r}{c}\right)^k}}{e^{-\left(\frac{v_r}{c}\right)^k} - e^{-\left(\frac{v_c}{c}\right)^k}} - e^{-\left(\frac{v_f}{c}\right)^k}\right) \quad (10)$$

$$C_f = \frac{P_{e,ave}}{P_{eR}} \quad (11)$$

v_c, v_r, and v_f are the respective cut-in wind speed, rated wind speed and cutoff wind speed of the wind energy conversion system (WECS). The capacity factor can be used to identify sites that are suitable for wind energy development and for the selection of wind turbine among available turbine to be installed in a site with known wind speed characteristics. The accumulated annual energy output (E_0) is given by:

$$E_0 = P_{e,ave} \times 8760\ (kW\ h) \quad (12)$$

3.3 Energy cost analysis

The viability of a wind energy plants depends on its ability to generate energy at a low operating cost (Gölçek et al., 2007). According to (Gökçek & Genç, 2009), the main parameters governing the economics of wind-power include the following:

1. Investment costs (including auxiliary costs for the foundation, grid connection etc.).
2. Operation and maintenance costs.
3. Electricity production/ average wind speed.
4. Turbine lifetime.
5. Discount rate.

These factors may vary from country to other country and region to region. However, among all the parameters listed, turbine electricity production and their investment costs are the most important; choosing the right turbine site is thus critical to achieve economic viability, since electricity

production is highly dependent on wind conditions. Apart from the cost of the wind turbine that is set by the manufacturers, costs of other activities are location dependent.
In (Gökçek & Genç, 2009), the specific cost of a wind turbine varies widely from one manufacturer to another as shown in Table 2. Several methods as discussed in (Lackner et al., 2010) have been used in literatures for the computation of wind energy cost. The PVC method is adopted in this work because:

1. It considers the dynamic development of the relevant economic factors.
2. Different occurrences of costs and income are taken into account regardless of whether the money has been or will be paid or received in the past or in the future through deduction of accrued interest (discounting) of all payments flows to a common reference time.

Table 2. Cost of wind turbines based on the rated power

Wind turbine size [kW]	Specific cost [US$/kW]	Average specific cost [US$/kW]
10 to 20	2200 to 2900	2550
20 to 200	1500 to 2300	1900
200 >	1000 to 1600	1300

As expected, new wind energy conversion system always have low expenditures on operation and maintenance; however, the operation and, especially, the maintenance costs increase as the useful life of the power plant decreases (Gökçek & Genç, 2009). Other factors which can influence the cost of electricity produced by wind energy conversion system include cost of construction and other infrastructures, wind speed regime in selected location, turbine lifetime, and discount rate (Gökçek & Genç, 2009; Mathew, 2006). Out of the three different ways of quantifying the cost of wind turbines (cost per unit kilowatt, cost per unit rotor area, and cost per unit kilowatt hour of electricity produced) as expressed in (Mathew, 2006), cost of electricity per unit kilowatt hour is adopted in this work. The present value of costs (PVC) is given in (Ahmed Shata & Hanitsch, 2006) as the following equation:

$$PVC = \frac{1}{E_{WT}}\left[I + C_{omr}\left(\frac{1+i}{r-i}\right) \times \left[1 - \left(\frac{1+i}{1+r}\right)^{t}\right] - S\left(\frac{1+i}{1+r}\right)^{t}\right] \quad (13)$$

1. In addition, the following was taken into consideration in evaluating the costs of kW h of energy produced by turbines at the respective locations.
2. The interest rate (r) and inflation rate (i) were taken to be **8% and 6%**, respectively [7].
3. Machine life (t) as designed by the manufacturer is 20 years (Ahmed Shata & Hanitsch, 2006).
4. O&M costs constitute a sizeable share of the total annual costs of the wind turbine. Operational costs are annually recurring and involved in routine operation of wind farms; these costs are fixed and can be estimated in a straightforward deterministic manner (Ohunakin et al, 2012). However, maintenance cost is not fixed and cannot be calculated in a straightforward manner, but it is only activated by stochastic variables, as it does not have a specific value but often got from a range of values. It was also reported that C_{omr} varies from 15% to 30% of the total initial cost (annual wind turbine cost + other initial costs). Because wind power technology is not yet mature in Cyprus, operation and maintenance cost C_{omr} is assumed **25%** of the initial capital cost of the wind turbine installation system (system price/lifetime).
5. Most of the farms are sited close to rural areas of the country that are not linked by practical roads. Hence, most of the costs involved with installation (especially cost of civil work, turbine transportation and road construction) are always higher than normal, when compared with the costs that will be incurred if plants are to be sited in an urban terrain. Major installations always have to be carried out alongside other project work in rural

communities, because of this scrap value (S) was taken to be 10% of the turbine price and civil work.

6. Investment (I) is the summation of turbine price and other initial costs, including provisions for civil work, land, infra-structure, installation and grid integration. Since most of the projects will be executed in the rural area/suburbs of the country, the cost of land and labor for civil work may be very cheap; hence, the other initial cost can be taken as 20% of the actual turbine price
7. The cost per kW h of electricity generated (UCE) can be determined by the following expression (Ohunakin et al, 2012; Gass et al., 2013):

$$UCE = \frac{PVC}{E_{wt}} \quad (14)$$

The availability of the wind power resource for generation electricity is taken as η = 75% and the total energy output over the wind turbine lifetime (in Kilowatt-hour) is computed as

$$E_{wt} = 8760 \times \eta \times t \times P_R \times C_f \quad (15)$$

3.4 Wind Power Density

It is well known that the power of the wind (P_v) that flows at speed *v* through a blade sweep area A increases as the cube of its velocity and is given by (Chang et al., 2003)

$$P_v = \frac{1}{2}\rho A v^3 \quad \text{in [Watt]} \quad (16)$$

where V is velocity in m/s, A is swept area in m^2 and ρ is the density of air

Monthly or annual wind power density (P_w) per unit area of a site based on a Weibull probability density function can be expressed as follows (Chang et al., 2003):

$$P_w = \frac{1}{2}\rho c^3 \left(1 + \frac{3}{k}\right) \quad \text{in [Watt]} \quad (17)$$

Where ρ = air density at the site. The air density is calculated using the following expression (Mathew, 2006):

$$\rho = \frac{353.049}{T} e^{-\frac{0.034\,h}{T}} \quad (18)$$

4.5 Performance of wind turbines

Five wind turbines with power ranging from 20 kW to 330kW (Yuanda Tech Electr, 2017; ENERCON, 2017; Polaris America, 2017; Endurance Wind Power, 2017; Vergnet Wind Turbine, 2017) were selected for performance assessment and economic analysis. The characteristic properties of the selected wind turbines using their respective designed hub heights are shown in Table 3. In order to determine the number of wind turbines that could be installed in each site, the two following conditions should be esteemed:

- If the wind direction is parallel to the diameter of the wind turbine, the distance between the wind turbines should be 6 to 9 times the diameter of the wind turbine.
- If the wind direction is perpendicular to the diameter of the wind turbine, the distance between the wind turbines should be 3 to 5 times the diameter of the wind turbine.

Table 3. Characteristics of the selected wind turbines

Characteristics	P10-20	G3120	P-15-50	Enercon E33	GEV-MP
Hub height [m]	36.6	42.7	50	50	60
Rate power [kW]	20	35	50	330	275
Rotor diameter [m]	10	19.2	15.2	33.4	32
Cut-in wind speed [m/s]	2.5	3.5	2.5	2.5	35
Rate wind speed [m/s]	10	8	10	13	15

Cutoff wind speed [m/s]	25	25	25	25	20

4. Results and discussion

4.1 Daily variation of wind speed

The daily time-evolution of wind velocity is quite important for the integration of wind power into the overall energy supply. Figure 1 shows the daily time variation of the mean wind speed for six stations which represent different climate regimes. It is seen that winter has a maximum of about 7.0 m/s wind speed at Famagusta and Rizokarpaso, while spring has minimum wind speed in both locations (Figure 1). In addition, it is observed that daily average wind speed at Kyrenia, Morphou and Nicosia varies between 1 and 4.5 m/s. Moreover, the maximum average daily wind speed at Ercan is reached 6 m/s in winter as shown in Figure 1, while in spring and summer, it is ranging between 3.5 and 5.5 m/s.

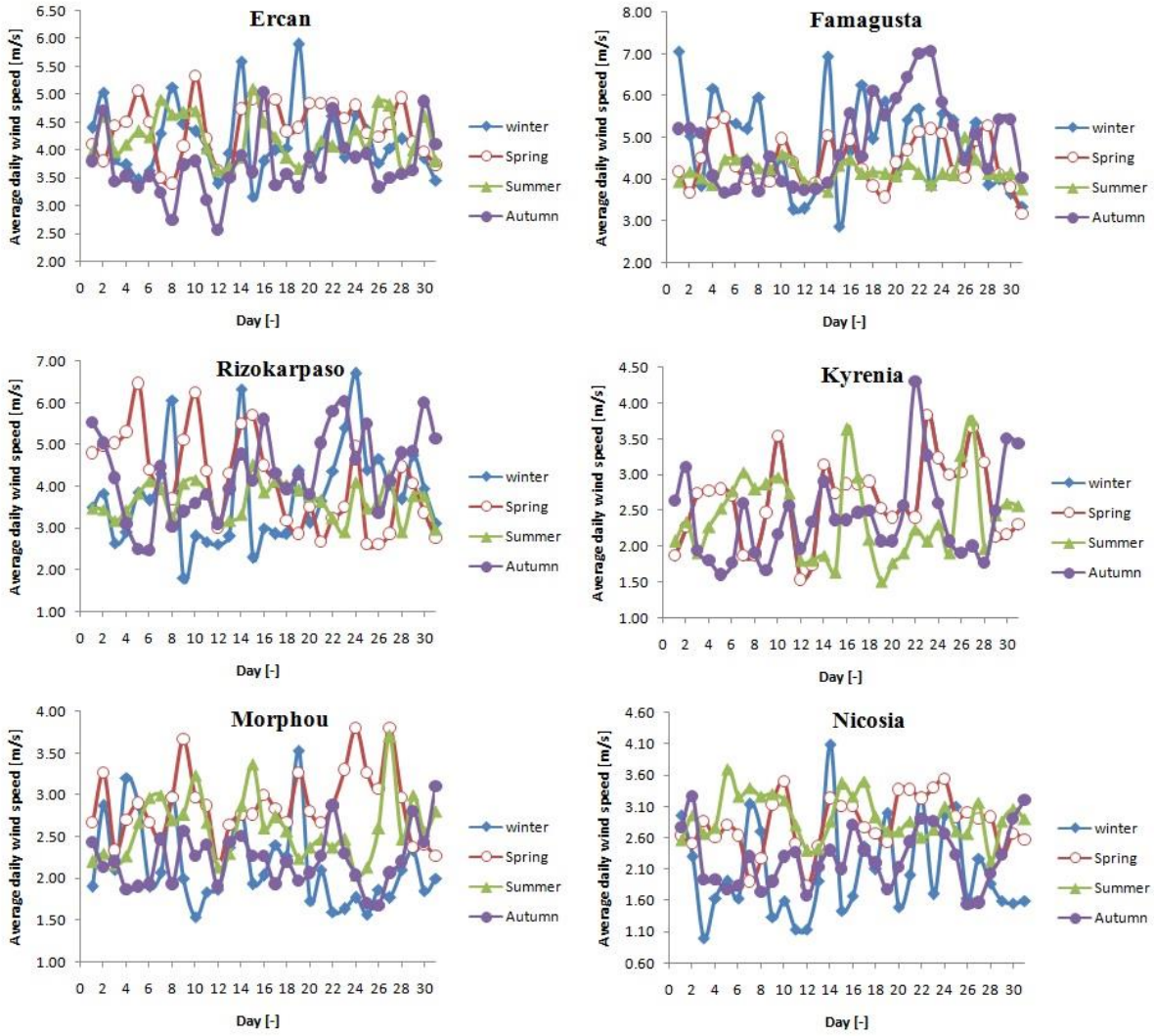

Figure 1. Daily variation of mean wind speed at six different locations

4.2 Mean yearly wind speed

Wind speeds are different as months and seasons vary. Figure 2 shows mean yearly wind speed for different location in Cyprus. It is noticed that average yearly mean wind speed is varying between 2 and 5 m/s. Results clearly shows that Famagusta has higher mean yearly wind speed (about 5 m/s) compared to other locations. In addition, Yearly mean wind speed for 2016 at Ercan and Rizokarpaso are almost equal to 4 m/s, while at Kyrenia, Morhpou and Nicosia, the yearly average wind speed is about 2.5 m/s.

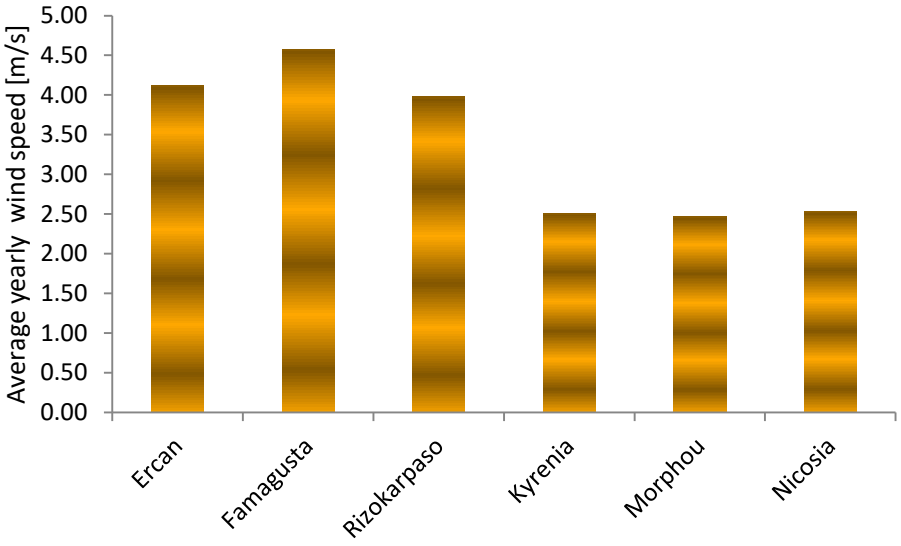

Figure 2. Mean yearly wind speed at different locations

4.3 Wind direction

Wind direction was also determined from the measurements for each station. Wind direction for each month at different locations is shown by the wind frequency rose as shown in Figure 3. Increasing wind frequency was used as an indicator of a main direction. As shown from the Figure 3, the dominant direction of the wind for Famagusta was found to be Northeast (NE) in autumn, the highest wind frequencies distribution occurred in November. While the second direction from which the wind blows mostly was determined as the West (W) direction during autumn. In winter season, the dominant direction of the wind for the region (Famagusta) was found to be Southwest (SW) with a frequency value of almost 30% as shown in Figure 3.

Additionally, it can be seen that during winter, wind direction with the greatest frequency is East (E) and Southwest (SW) for Morphou and Ercan, respectively. In spring season, wind direction with the greatest frequency in March and April is East and West in May for Morphou. Also, for Ercan, wind direction with the greatest frequency is Southwest in March and West in April and May. In summer and autumn season, wind direction with the greatest frequency is West for Ercan. The airport (Ercan) is quite an inappropriate location to set up the wind turbine because this site has a high value of surface roughness, and the turbine will be dangerous to airplanes. For Morphou, wind direction with the greatest frequency is Northwest (NW) during summer. The wind direction with the greatest frequency is NW during September and E during October and November for Morphou.

Most of the wind blows in the East, Northeast and South direction at Kyrenia which depends on the season. Moreover, the data from the present location of Nicosia indicates that Southwest has the greatest frequency in all seasons.

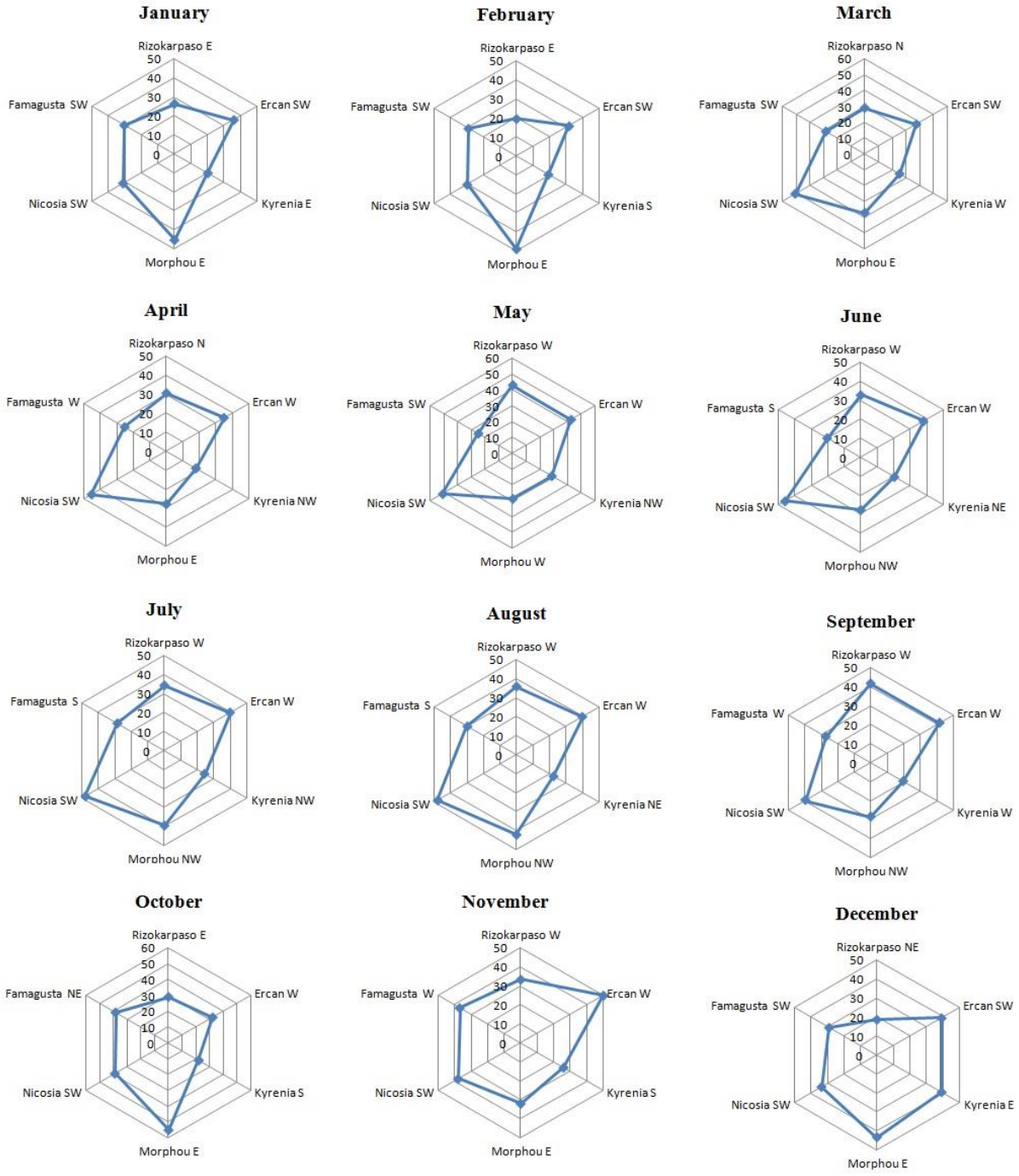

Figure 3. Wind frequency rose for 2016 at different location

4.4 Wind characteristics analysis

Figures 4, 5 and 6 illustrate the seasonal and annual (yearly) Weibull distributions of wind speed at three different sites which have the highest wind speed value compared to other sites. Additionally, Table 4 presents the descriptive statistics of each station including minimum, maximum, mean, standard deviation, coefficient of variation, coefficient of skewness, coefficient of kurtosis and Weibull parameters. During the period from January to December 2016, Famagusta has the highest mean wind speed with a value of 4.87 m/s in autumn, while the lowest is observed at Nicosia, with a value of 2.04 m/s in winter. Moreover, the coefficients of variation are moderately low, ranging from -5.3 to 1.11 i.e. the negative and positive values indicate that the distributions are left and right skewed, respectively. Kurtosis is a measure of the degree of peakedness of the distribution curve. When kurtosis coefficient is negative values which indicate that the data is spread out and the curve is flatter than normal curve. It is observed that the coefficients of kurtosis are moderately high, ranging from -1.32 to 0.9.

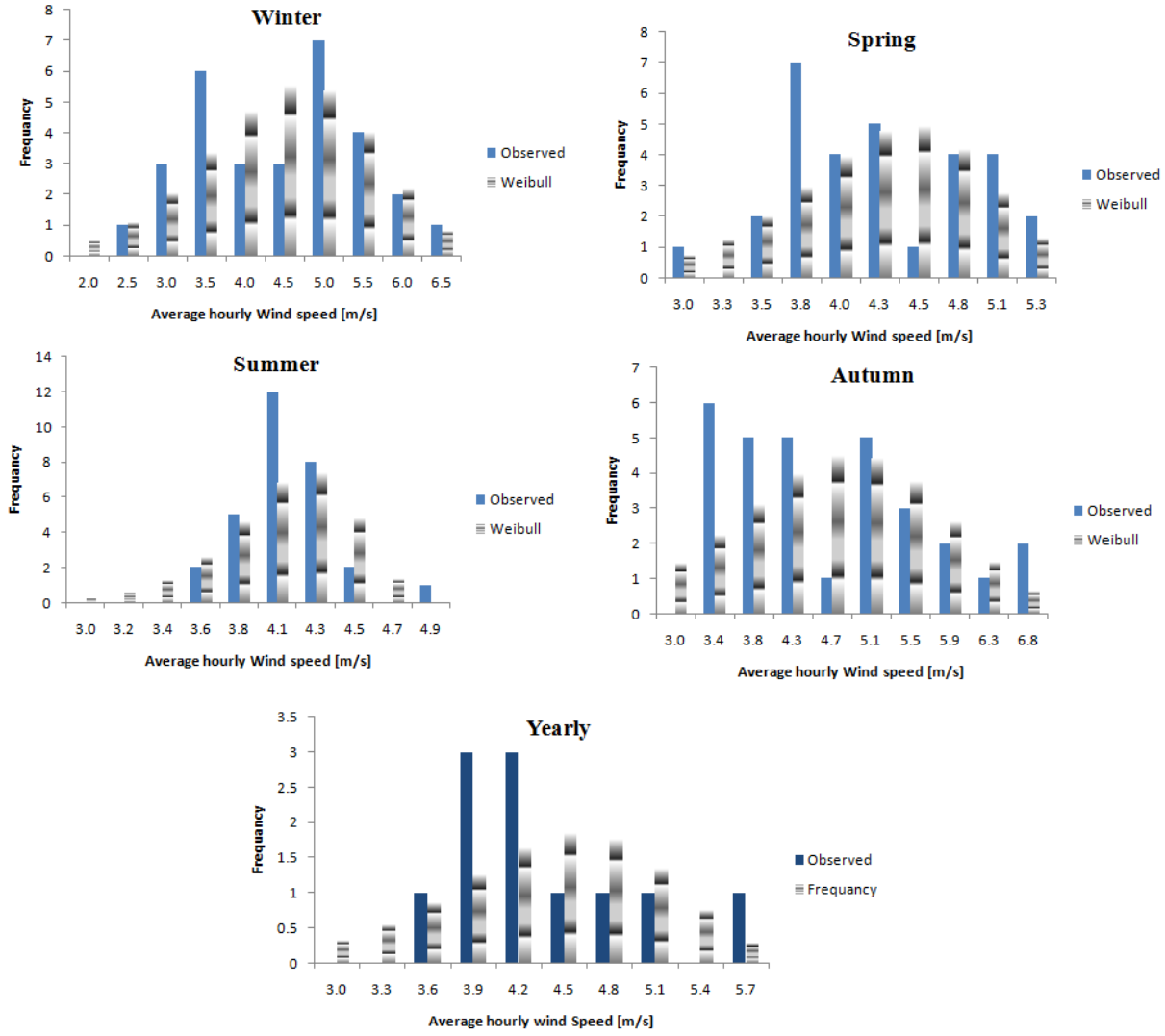

Figure 4. Comparison of the season and annual observed wind speed frequency and wind speed frequency simulated by Weibull function at Famagusta

The variation of wind speeds often described using the Weibull two-parameter density function. This is statistical method which widely accepted for evaluation local wind probabilities and considered as a standard approach. Maximum Likelihood Method (MLM) was chosen to calculate both Weibull's parameters. For all the six measurement sites, the calculated annual Weibull scale parameter (c) varies from 2.29 m/s to 5.28 m/s, and the range of annual shape parameter (k) is 2.93 to 14.31 (Table 1). The suitability of a distribution to fit the wind speed data is evaluated based on the Anderson-Darling (AD) and P-value (Kolmogorov–Smirnov statistic). Results indicate that, Weibull distribution provides generally the best fit to the wind speed data at 10 m height and for all stations (the p-value is greater than the significance level which is equal to 0.05).

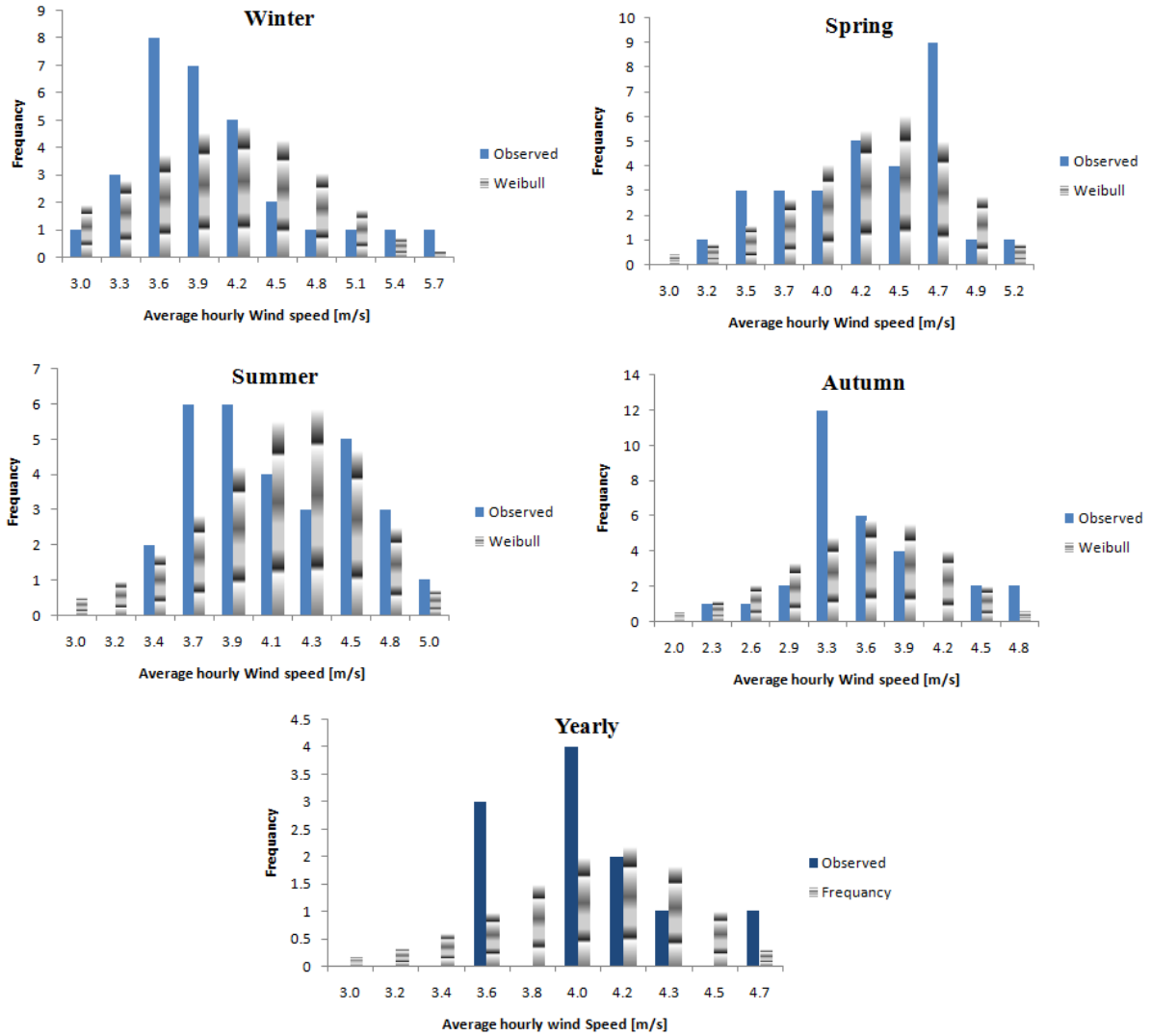

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Figure 5. Comparison of the season and annual observed wind speed frequency and wind speed frequency simulated by Weibull function at Ercan

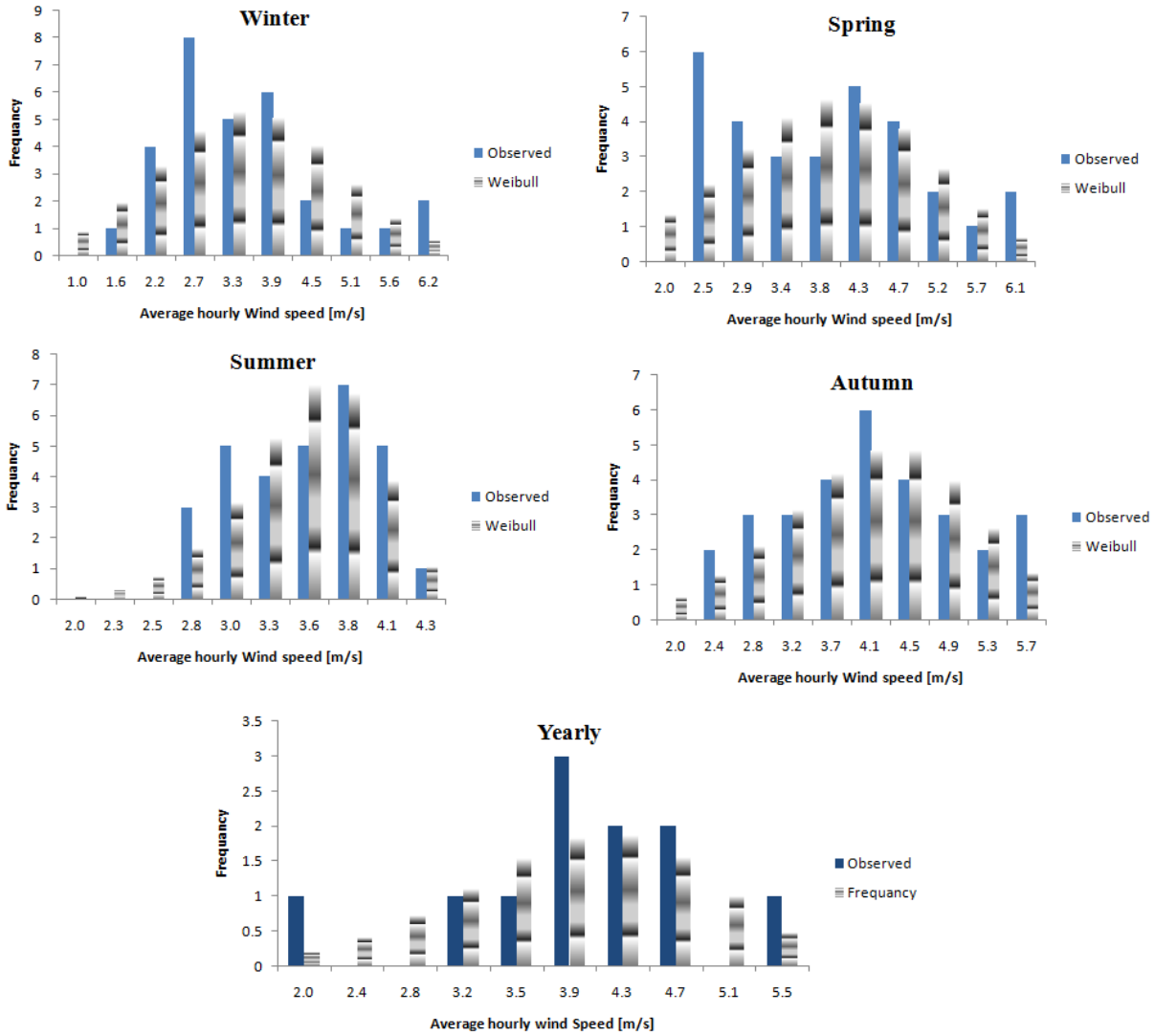

Figure 6. Comparison of the season and annual observed wind speed frequency and wind speed frequency simulated by Weibull function at Rizokarpaso

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Table 4. Seasonally and yearly Weibull parameters for the sites used at a 10m height

Ercan

	v_{min}	v_{max}	v_m	σ	Variance	Skewness	Kurtosis	k	c	AD	p-value
winter	3.17	5.90	4.15	0.62	0.39	1.07	0.81	6.33	4.43	0.17	0.29
spring	3.40	5.33	4.39	0.51	0.26	-0.33	-0.93	10.40	4.61	0.12	0.76
summer	3.60	5.10	4.23	0.42	0.18	0.31	-1.11	10.79	4.42	0.14	0.53
autumn	2.57	5.03	3.70	0.56	0.32	0.62	0.28	6.60	3.94	0.17	0.29
Yearly	3.59	4.82	4.10	0.35	0.13	0.43	-0.76	12.07	4.26	0.13	0.98

Famagusta

	v_{min}	v_{max}	v_m	σ	Variance	Skewness	Kurtosis	k	c	AD	p-value
winter	2.87	6.93	4.74	1.05	1.10	0.06	-1.10	5.16	5.16	0.14	0.58
spring	3.17	5.47	4.41	0.61	0.37	0.08	-1.16	8.19	4.67	0.14	0.54
summer	3.70	5.00	4.20	0.28	0.08	0.55	0.45	14.31	4.33	0.16	0.36
autumn	3.67	7.07	4.87	1.00	1.01	0.57	-0.78	5.14	5.28	0.16	0.42
Yearly	3.72	5.88	4.54	0.62	0.38	0.81	-0.48	7.43	4.81	0.22	0.58

Rizokarpaso

	v_{min}	v_{max}	v_m	σ	Variance	Skewness	Kurtosis	k	c	AD	p-value
winter	1.80	6.70	3.78	1.20	1.45	0.74	-0.13	3.35	4.21	0.12	0.70
spring	2.60	6.47	4.11	1.11	1.23	0.35	-0.96	4.09	4.53	0.11	0.86
summer	2.90	4.50	3.66	0.44	0.19	-0.14	-1.12	9.82	3.84	0.10	0.92
autumn	2.47	6.03	4.29	0.98	0.97	0.01	-0.90	4.99	4.68	0.08	0.97
Yearly	1.95	5.74	4.16	0.95	0.91	-0.53	-0.17	5.45	4.51	0.15	0.95

Kyrenia

	v_{min}	v_{max}	v_m	σ	Variance	Skewness	Kurtosis	k	c	AD	p-value
winter	1.53	3.83	2.66	0.55	0.30	0.05	-0.43	5.39	2.88	0.09	0.96
spring	1.53	3.83	2.66	0.55	0.30	0.05	-0.43	5.39	2.88	0.09	0.96
summer	1.50	3.77	2.41	0.58	0.34	0.53	-0.57	4.42	2.64	0.09	0.93
autumn	1.60	4.30	2.40	0.63	0.39	1.11	0.90	3.87	2.64	0.19	0.20
Yearly	1.99	3.07	2.46	0.35	0.12	0.07	-1.32	8.23	2.61	0.13	0.98

Morphou

	v_{min}	v_{max}	v_m	σ	Variance	Skewness	Kurtosis	k	c	AD	p-value
winter	1.53	3.53	2.16	0.51	0.26	1.01	0.10	4.28	2.37	0.22	0.11
spring	2.17	3.80	2.88	0.42	0.18	0.51	-0.27	7.06	3.07	0.16	0.40
summer	2.03	3.70	2.62	0.39	0.15	0.80	0.30	6.63	2.79	0.12	0.71
autumn	1.67	3.10	2.22	0.33	0.11	0.64	0.07	6.68	2.37	0.14	0.56

Yearly	1.98	3.25	2.49	0.37	0.14	0.46	-0.72	7.20	2.64	0.17	0.86

Nicosia

	v_{min}	v_{max}	v_m	σ	Variance	Skewness	Kurtosis	k	c	AD	p-value
winter	1.00	4.10	2.04	0.75	0.56	0.89	0.03	2.93	2.29	0.16	0.38
spring	1.83	3.53	2.82	0.44	0.19	-0.32	-0.52	8.24	3.01	0.13	0.66
summer	2.23	3.70	2.95	0.35	0.12	0.12	-0.73	9.19	3.11	0.12	0.74
autumn	1.53	3.27	2.26	0.47	0.22	0.42	-0.77	5.17	2.45	0.14	0.54
Yearly	2.01	3.26	2.57	0.42	0.18	0.00	-1.54	7.30	2.75	0.17	0.86

v_{min}	Minimum wind speed in [m/s]	v_m	Mean wind speed in [m/s]
v_{max}	Maximum wind speed in [m/s]	σ	Standard deviation

Wind power density is pivotal for wind energy assessment, which indicates how much energy is available at the concerned site for conversion by a wind turbine. Having known the air density values for each season and month, the calculated wind power density (PD) values at 40, 50, 60 and 70 m heights are presented in Tables 5. As it shows, the seasonally and yearly variation of the wind power density basically follows the variation of the height of the hub.

Table 5. Seasonally and yearly Weibull parameters and wind power density (PD) for the sites used at a different heights

	10m			40m			50m			60m			70m		
Ercan															
	k	**c [m/s]**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**
winter	6.33	4.43	79.86	7.21	6.46	238.14	7.38	6.93	292.55	7.52	7.36	348.66	7.64	7.76	406.63
spring	10.40	4.61	78.77	11.85	6.72	237.80	12.12	7.17	286.97	12.35	7.61	341.68	13.05	8.87	535.69
summer	10.79	4.42	69.07	12.29	6.45	208.68	12.57	6.92	257.04	12.81	7.36	306.92	13.53	8.59	484.76
autumn	6.60	3.94	55.75	7.52	5.75	166.41	7.69	6.29	216.50	7.84	6.70	260.06	8.28	7.88	416.95
Yearly	12.07	4.26	60.48	13.75	6.22	183.15	14.07	6.72	229.80	14.33	7.14	275.14	15.14	8.36	437.69
Famagusta															
	k	**c [m/s]**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**
winter	5.16	5.16	135.71	5.88	7.37	377.40	6.02	7.88	457.66	6.13	8.34	539.45	6.48	9.66	823.53
spring	8.19	4.67	86.99	9.33	6.67	244.98	9.54	7.25	312.76	9.72	7.69	371.76	10.27	8.96	580.24
summer	14.31	4.33	61.47	16.29	6.19	175.19	16.67	6.81	232.59	16.98	7.23	278.31	17.94	8.46	442.07
autumn	5.14	5.28	145.74	5.85	7.54	405.23	5.99	8.03	485.79	6.10	8.50	571.71	6.44	9.83	869.26
Yearly	7.43	4.81	97.72	8.47	6.87	274.51	8.66	7.43	345.19	8.82	7.88	409.35	9.32	9.16	635.04
Rizokarpaso															
	k	**c [m/s]**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**
winter	3.35	4.21	88.53	3.82	6.19	264.32	3.90	6.65	324.90	3.98	7.07	387.42	4.20	8.28	609.06
spring	4.09	4.53	100.51	4.66	6.65	302.02	4.77	7.06	358.62	4.86	7.50	425.97	5.13	8.75	663.15
summer	9.82	3.84	46.37	11.18	5.65	142.73	11.44	6.16	184.50	11.66	6.56	222.30	12.32	7.73	359.36
autumn	4.99	4.68	102.23	5.69	6.87	309.06	5.82	7.25	361.56	5.93	7.70	428.93	6.26	8.96	665.73
Yearly	5.45	4.51	89.01	6.21	6.63	269.79	6.35	7.04	321.37	6.47	7.48	382.29	6.83	8.73	597.59
Kyrenia															
	k	**c [m/s]**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**	**k**	**c**	**PD [W]**
winter	5.39	2.88	23.21	6.14	4.46	82.42	6.29	4.84	104.63	6.40	5.19	128.24	6.77	6.21	216.54
spring	5.39	2.88	23.21	6.14	4.46	82.42	6.29	4.84	104.63	6.40	5.19	128.24	6.77	6.21	216.54
summer	4.42	2.64	19.26	5.03	4.08	67.99	5.14	4.50	90.05	5.24	4.83	110.91	5.54	5.82	189.66
autumn	3.87	2.64	20.43	4.41	4.09	71.82	4.51	4.50	94.99	4.60	4.84	116.92	4.86	5.82	199.55
Yearly	8.23	2.61	15.10	9.37	4.04	54.25	9.59	4.45	72.48	9.77	4.79	89.57	10.32	5.76	154.55
Morphou															
	k	**c**	**PD**	**k**	**c**	**PD**	**k**	**c**	**PD**	**k**	**c**	**PD**	**k**	**c**	**PD**

		[m/s]	[W]			[W]			[W]			[W]			[W]
winter	4.28	2.37	14.09	4.87	3.77	53.92	4.98	4.11	69.43	5.08	4.42	86.13	5.37	5.36	149.99
spring	7.06	3.07	25.67	8.04	4.88	99.67	8.22	5.10	113.17	8.38	5.46	138.27	8.85	6.52	231.65
summer	6.63	2.79	19.65	7.55	4.43	76.16	7.73	4.71	90.63	7.87	5.05	111.41	8.32	6.06	189.62
autumn	6.68	2.37	12.01	7.61	3.77	46.54	7.79	4.11	60.06	7.94	4.43	74.64	8.38	5.36	130.66
Yearly	7.20	2.64	16.38	8.20	4.21	63.62	8.39	4.51	77.73	8.55	4.84	95.92	9.03	5.83	164.87

Nicosia

	k	c [m/s]	PD [W]	k	c	PD [W]	k	c	PD [W]	k	c	PD [W]	k	c	PD [W]
winter	2.93	2.29	15.19	3.33	3.66	58.22	3.41	4.00	75.00	3.47	4.31	93.08	3.67	5.23	162.21
spring	8.24	3.01	23.35	9.38	4.82	92.29	9.60	5.03	104.29	9.78	5.39	127.64	10.33	6.43	214.80
summer	9.19	3.11	24.83	10.46	4.96	98.37	10.70	5.15	109.59	10.91	5.52	133.91	11.52	6.58	224.44
autumn	5.17	2.45	14.56	5.89	3.92	56.81	6.02	4.23	70.96	6.14	4.55	87.89	6.48	5.50	152.49
Yearly	7.30	2.75	18.28	8.32	4.39	72.03	8.51	4.65	85.19	8.67	5.00	104.86	9.16	6.00	179.09

4.5 Wind turbine energy output and capacity factor

The annual output energy and the capacity factor of large and small different wind turbines for the six stations were calculated. Figure 7 depicts the capacity factors of the wind turbines. It can be noted that the highest capacity factor is obtained in the site of Rizokarpaso for the all used wind turbines. The value varies between 1.1% (GEV-MP) and 10.77% (P-15-50) in contrast in the site of Kyrenia, the capacity factor was lowest, and it varies between 0.0014 % and 0.043 % for GEV-MP and P10-20 respectively. It can be noted, also, that the capacity factor is highest for the wind turbine P-15-50 in the all site and lowest for the wind turbine GEV-MP over the sites. In general the capacity factor is greater for the wind turbines which the nominal speed is lower. This remark was observed in the one hand for the large wind turbines and on the other hand for the small wind turbines.

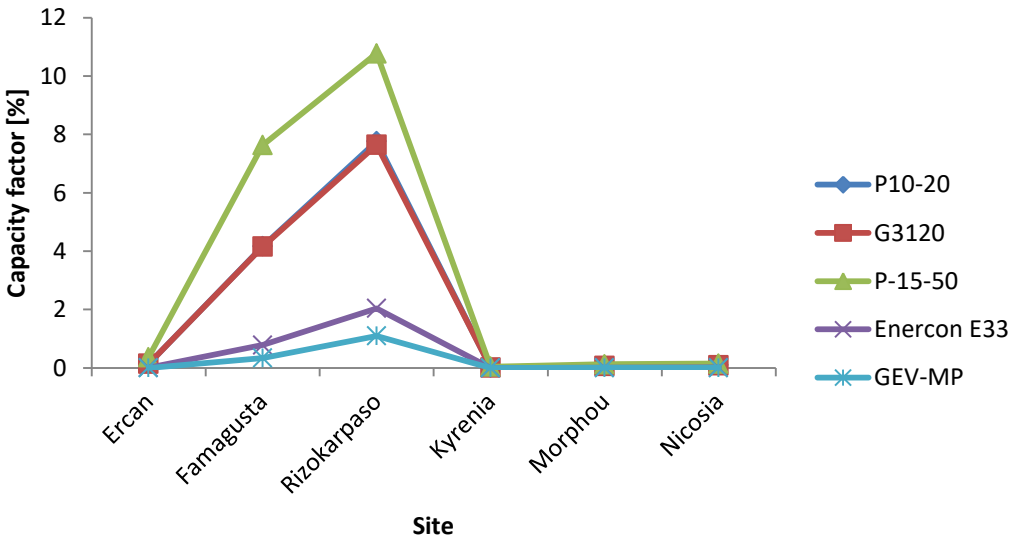

Figure 7. Yearly capacity factor (%) of five wind turbines in the all sites

Figure 8 shows the cost of unit energy (UCE) per kW h based on the PVC method. This cost is computed using Eqs. (13) and (15) together with parameters discussed in Section 3.3 applied on the five wind turbines chosen for the selected locations. The lowest value of electricity cost is obtained in Rizokarpaso as US $0.00183/kW h with minimum specific cost of wind turbine using Enercon E33 model. Furthermore, the highest cost of unit energy per kW h using maximum specific cost of wind turbine shown in Table 3, are obtained using GEM-MP as 1.873, 0.013, 0.0040, 3.304, 0.749, and US$ 0.647/kW h in Ercan, Famagusta, Rizokarpaso, Kyrenia, Morphou and Nicosia, respectively. For any of selected wind turbine, the lowest and the highest costs were Rizokarpaso and Kyrenia, respectively. This further established Rizokarpaso as having high wind sources among the selected location and that PVC depend on the wind characteristics of particle site (reflected by the capacity factor).

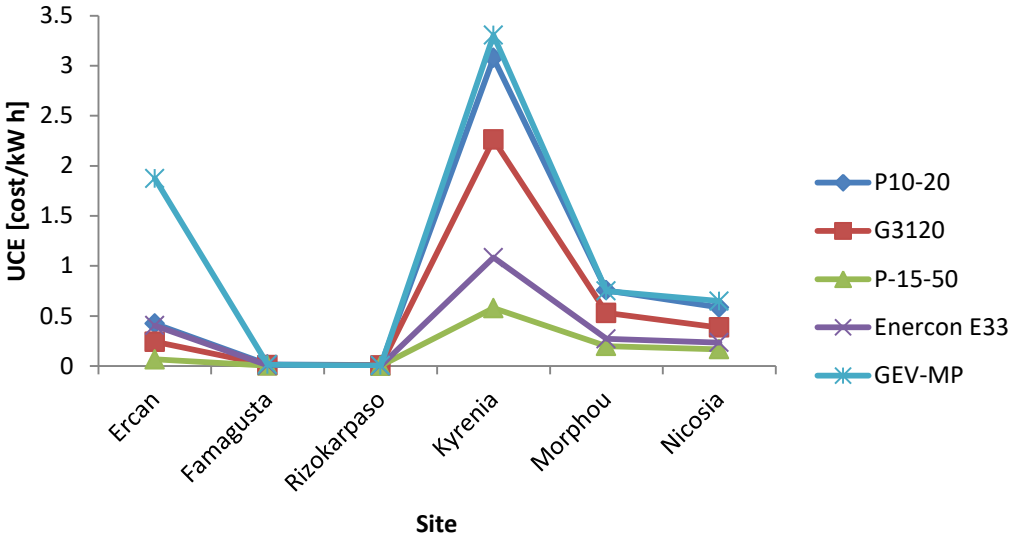

Figure 8. Yearly cost per kWh of electricity generated of five wind turbines in the all sites

5. Conclusions

The aim of this paper was to evaluate the wind potential for electricity generation by using one year of wind collected data each hour in six sites located in Cyprus. The wind speed and the wind power density were determined for the period of a year at six different location in Cyprus, namely, Ercan, Famagusta, Rizokarpaso, Kyrenia, Morphou and Nicosia. The wind speed distribution of locations was found by using Weibull distribution functions. The Weibull parameters estimation were performed for each season in a year. After the determination of the Weibull parameters at 10 m height, the power density values at different heights were calculated. Also, in this study, wind turbine performance assessment and economic analysis of selected wind turbine were examined. Moreover, the performance study of the all wind turbines was achieved in the all sites through determining the factor capacity and the cost of unit energy (UCE) per kW h based on the PVC method. From the statistical analyzing and electricity generation calculations, it has been reached to the following conclusions:

- All the locations considered have mean wind speeds above 2 m/s. Maximum yearly mean wind speed value of 4.58 m/s was obtained in Famagusta and a minimum value of 2.47 m/s was obtained in Morphou.
- At 10 m height, the yearly Weibull parameters k (dimensionless) and c (m/s) ranged from 5.45 to 12.07 and 2.61 to 4.81 m/s, respectively. The yearly average values of wind power density were ranging in between 15.10 and 97.72 W/m^2.
- The highest capacity factor was found in Rizokarpaso for all used wind turbin which was 10.77% usingP-15-50 wind turbine. Whereas, the minimum is found in Kyrenia as 0.00345% using the Enercon E33 wind turbine.
- The lowest value of electricity cost is obtained in Rizokarpaso as US $0.00183/kW h with minimum specific cost of wind turbine using Enercon E33 model.
- The wind energy is not economically viable in Kyrenia, Morphou and Nicosia, due to its high generation prices, which are conditioned by the high installation costs and the use of turbines with low power of generation.

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Finansal Piyasalarda Uzun Dönemli Bağımlılık ve Etkin Piyasalar Hipotezi

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Özet

Bu makalenin amacı etkin piyasalar hipotezini Amerika, İngiltere, Türkiye ve Rusya finansal piyasaları için uzun dönemli bağımlılık kapsamında test etmektir. Çalışmada yöntem olarak Dönüştürülmüş Genişlik ve Trendten Arındırılmış Dalgalanma Analizi kullanılmıştır. Veriler günlük frekansta olup Mayıs 2013 ile Mayıs 2015 arası dönemi kapsamaktadır. Sonuç olarak gelişmekte olan ülke borsalarının gelişmiş ülke borsalarına göre daha etkin olduğu bulunmuştur. Bununla beraber uzun hafıza özelliği getirilerden daha fazla oynaklığın göstergesi olan getiri karelerinde görülmüştür.

Anahtar kelimeler: Etkin piyasalar, Uzun dönemli hafıza

Long-Term Dependence in Financial Markets and Efficient Market Hypothesis

Abstract

The aim of this paper is to test the efficient market hypothesis for America, England , Turkey and Russia financial markets by means of the long-term dependence approach. In study, Rescaled Range Analysis and Detrended Fluctuation Analysis are employed. The data used in daily frequency covers the period May 2013 to May 2015. As a result emerging markets are found more efficient than developed markets. Furthermore, the long memory property is more appeared in squares of returns used as proxies for volatility than returns.

Keywords: Efficient markets , Long term memory

1. GİRİŞ

Finansal piyasaların etkinliği ekonomik kaynakların dağılımı üzerinde olumlu rol oynarken aynı zamanda borsalardaki manipülasyonun da önüne geçmektedir. Etkin bir piyasada yatırımcılar piyasa üstü getiri elde etmek için değil, piyasa kadar getiri sağlayabilmek için işlem yaparlar. Etkin finansal pazarlara sahip devletler ise piyasalara müdahale etmez ve regülasyon politikalarından uzak dururlar (Mookerjee, ve Yu,1999).

Hem reel ekonomi hem de sermaye piyasaları açısından önem arz eden etkinlik kavramı Fama (1970) tarafından etkin piyasalar hipotezi adıyla ilk defa finans yazınına girmiştir. Etkin piyasalar hipotezi hisse senedi fiyatlarının mevcut bütün bilgiyi yansıttığı için rassal yürüyüş sergilediğini dolayısıyla da art arda yaşanan fiyat değişmelerinin (getiriler) bağımsız ve özdeş dağılıma sahip olması gerektiğini varsaymaktadır. Bu durum geçmiş fiyat hareketlerini kullanarak gelecekteki fiyatların öngörülemediğini ifade etmektedir. Bilginin fiyatlara yansıması durumuna göre zayıf, yarı güçlü ve güçlü formda etkinlik olarak piyasalar üçe ayrılmaktadır. Zayıf formda bile etkinliğin sağlandığı piyasalarda, sistemli bir şekilde alım-satım yaparak piyasa üstü getiri elde etmek söz konusu olamaz.

Geleneksel finans yazınında yatırımcıların piyasaya ulaşan yeni bilgiye *doğrusal* şekilde tepki verdikleri belirtilmektedir. Bu varsayım yatırımcıların yeni bilgiyi eşanlı olarak değerlendirdiğini ve kümülatif olarak bekletmediğini ima etmektedir. Bir bütün olarak bakıldığında hisse senedi getirilerinin normal, özdeş ve bağımsız dağılması beklenmektedir. Ancak yeni paradigma yatırımcıların piyasaya ulaşan yeni bilgilere *doğrusal olmayan* tepkiler verdiğini ileri sürmektedir (Hiemstra ve Jones, 1994).

Doğrusal olmayan sistemlerin ana özelliği, önce oluşan koşullara duyarlılık göstermesi yani sınırsız hafızaya sahip olmasıdır. Eğer bir borsa serisinde uzun hafızadan kaynaklanan bir *süreklilik* mevcut ise günlük fiyat değişmeleri ile gelecekteki günlük fiyat değişmeleri arasında korelasyon var demektir. Aynı durum serinin haftalık frekanstaki hali içinde geçerlidir. Yani haftalık fiyat değişmeleri ile yine gelecekteki haftalık fiyat değişmeleri arasında korelasyon vardır. Bu olgu aylık ve yıllık frekanslar içinde şüphesiz geçerli olmaktadır (Skjeltorp, 2000).

Finansal getiri serilerinin uzun hafızaya sahip olması portföy seçimi bağlamında yatırım ufkunu etkilediği için önem arz etmektedir. Örneğin uzun hafızaya sahip bir borsada aynı zamanda ortalamaya dönüş eğilimi de söz konusu ise getiri hareketleri artma trendine geçtikten bir süre sonra tam ters yönde devam edecektir. Bununla beraber yatırımcılar sadece getirinin işaretine bakarak karar vermezler. Getiri serilerinin karesi yada mutlak değeri de, elde edilmesi düşünülen getirinin miktarı ve oynaklığı hakkında bilgi vermesi bakımından yatırımcıların karar mekanizmasında etkili olmaktadır (Grau-Carles, 2000).

Bu makalenin amacı gelişmiş ve gelişmekte olan ülkelerin hem getiri hem de oynaklıklarındaki uzun hafıza özelliğini Hurst üssel katsayısı ve Trendten arındırılmış dalgalanma analizi (DFA) yöntemi aracılığıyla analiz etmektir. Çalışmanın yaygın literatüre katkısı ülkelerin gelişmişlik seviyesine göre borsa davranışlarına ait bilgiler sunmasıdır. Bununla beraber bu çalışma bizim bilgimize göre, Türkiye sermaye piyasasının uzun hafıza özeliğini Hurst ve DFA yönetimi ile karşılaştırmalı olarak inceleyen ilk çalışmadır. Çalışmanın bundan sonraki bölümleri literatür taraması, metodoloji, ampirik uygulama ve sonuç kısmı olarak sıralanmıştır.

2. LİTERATÜR

Borsa verilerini baz alıp geçmiş verileri kullanarak sürekli bir şekilde anormal getiri elde etmenin mümkün olmadığını ileri süren etkin piyasalar hipotezini geçersiz kılan nedenlerden biri getiri ve getirilerin karelerinde uzun hafıza özelliğinin bulunmasıdır (Ferreira ve Dionísio, 2016). Bu nedenle uzun hafıza özelliğine sahip borsalarda ekonometrik modellerin öngörü performansı diğer borsalara göre daha başarılı olmaktadır (Henry, 2002). Getiri serilerindeki otokorelasyonun kaynağının yeni haberlere finansal piyasaların gecikmeli olarak tepki vermesi sebep gösterilirse,

serilerde uzun hafıza özelliğinin bulunması sürpriz sayılmamalıdır (Lo, 1991). Uzun hafıza özelliğini gösteren Hurst katsayısının borsalar için geleceğe dair beklentileri şimdiden gösteren bir korku endeksi olarak yorumlanabileceği Ukranya borsası bağlamında Caporale vd., (2016) tarafından gösterilmiştir. Li vd., (2016) ise uzun hafıza özelliği bulunan borsalarda işlem maliyetlerini arttırmanın arbitraja dayalı anormal getiri sağlamayı engellemediğini savunmuşlardır. Cajueiro vd., (2005) Brezilya borsasında işlem gören firmaların sermaye karlılığı, piyasa kapitalizasyonu ve borç özsermaye oranlarının Hurst katsayıları ile anlamlı ilişki içinde olduğunu tespit ederek, uzun hafıza özelliğinin söz konusu değişkenlerden kaynaklandığını ileri sürmüşlerdir. Wright (2001) çalışmasında gelişmekte olan ülkelerde uzun hafıza özelliğinin gelişmiş ülkelere göre daha fazla olmasının sebebini gelişmekte olan ülkelerdeki risk faktörlerinin sürekliliği olarak ifade etmiştir.

Dünya borsalarında uzun hafıza yapısı gerek yerli gerekse yabancı araştırmacılar tarafından birçok farklı yöntem ile analiz edilmiştir. Örneğin Opong vd., (1999) İngiltere borsasında etkinliği FTSE-ALL, FTSE-100, FTSE-250, FTSE-350 endekslerinde Hurst, BDS ve GARCH modelini kullanarak test etmişlerdir. Sonuç olarak İngiltere borsasındaki dört endekste, rassal yürüyüş modelinin öngördüğü çevrimler ve eğilimlerden daha fazla çevrimlerle karşılaşıldığı rapor edilmiştir. Yazarlar serilerin normal, bağımsız ve özdeş dağılımdan geldiği hipotezini İngiltere borsası için red etmişlerdir. Lux (1996) Almanya borsasındaki dört endeksi günlük frekansta Hurst katsayısı yöntemi ile analiz etmiş ve sonuç olarak borsadaki uzun hafızanın daha çok oynaklık bazında gerçekleştiğini bulmuştur. Di Sario vd., (2008) Borsa İstanbul 'un getiri, mutlak getiri ve oynaklığın göstergesi olan getirilerinin karelerini 1998-2004 günlük frekansta analiz ederek Borsa İstanbul'un uzun hafızaya sahip olduğunu ispatlamışlardır. Cavalcante ve Assaf (2004) Brezilya borsasının oynaklığını R/S analizi ve FİGARCH modeli ile analiz etmişler ve sonuç olarak gelişmekte olan Brezilya borsasının diğer gelişmiş ülke borsaları ile benzer derecede uzun dönemli hafızaya sahip olduğunu bulmuşlardır. Rejichi ve Aloui (2012) Ortadoğu ve Kuzey Afrika borsalarının piyasa etkinliğine etki eden faktörlerin işlem maliyetleri ve piyasa kapitilizasyonu olduğunu rapor etmişlerdir. Ayrıca çalışmada İsrail, Türkiye ve Mısır borsalarının regresyon analizi ile elde edilen Hurst üssel sayılarının benzerlik gösterdiği vurgulanmıştır. Cajueiro ve Tabak (2004) Çin borsasındaki A ve B tipi endekslerini, Singapur borsasını ve Hong Kong borsasını Hurst katsayısı yöntemini kullanarak analizi etmişlerdir. Sonuç olarak Hong Kong borsasının en etkin piyasa olduğunu ve kurumsal yatırımcıların işlem yaptığı Çin B endeksinin aynı ülkedeki S tipi endeksten daha az etkin olduğunu bulmuşlardır. Aygören (2008) 03/07/1987-28/09/2007 tarihleri arasındaki günlük getirileri kullanarak Borsa İstanbul için piyasa etkinliğini araştırmıştır. Dönüştürülmüş Genişlik yönteminin kullanıldığı çalışmada Hurst katsayısı 0,586 olarak hesaplanmış ve Borsa İstanbul'un etkin bir piyasa olmadığı sonucuna varılmıştır. Benzer bir sonucu Ural ve Demireli (2009) Hurst katsayısı modeli vasıtasıyla BİST Ulusal Tüm, BİST Ulusal 100 ve sektör endeksleri için elde etmişlerdir. Jiang ve Cai (2007) Japonya ve Çin borsalarının oynaklığını DFA yöntemi ile analiz etmişlerdir. Sonuç olarak oynaklığın yüksek olduğu dönemlerde piyasaların daha fazla etkin olduğunu bulmuşlardır. Bariviera vd., (2012) yedi Avrupa ülkesindeki sabit getirili menkul kıymet endekslerinin etkinliğini DFA analizini kullanarak araştırmışlardır. Çalışmada küresel krizin sabit getirili yerel bono endekslerindeki uzun hafızayı güçlendirirken, yabancı sabit getirili bono endekslerinde aynı özelliği zayıflattığı tespit edilmiştir. So (2000) Amerika finansal piyasalarında Geweke ve Porker-Hudak parametrik testini kullanarak yaptığı araştırmada S&P 500 ve Dow Jones endekslerinde uzun hafıza özelliğine rastladığını belirtmiştir. Günay (2015) BİST fiyat ve işlem hacmi endekslerini 04.01.2000-19.03.2014 dönemi kapsamında dönüştürülmüş genişlik analizi, eğilimden arındırılmış dalgalanma analizi, kutu sayım, yarı-periyodogram ve variogram yöntemlerini kullanarak analiz etmiş ve sonuç olarak her iki endekste uzun hafızaya işaret eden fraktal bir yapıya rastlamamıştır.

3. METEDOLOJİ

Çalışmada borsaların uzun dönemli korelasyonlarını hesaplamak için Hurst Üssel Katsayısı ve Eğilimden Arındırılmış Dalgalanma Analizi olmak üzere iki farklı yöntem kullanılmıştır. Hurst

üssel katsayısı yöntemi zaman serisinin gözlemlerinin kendi ortalamasından sapmalarını serinin standart sapması ile ölçeklendirerek belli aralıklar için hesaplanmasına dayanır (Horta vd., 2014).

Finansal getiri serilerinin ardışık gözlemlerini $\{r_1, r_2 \dots\dots, r_t\}$ olmak üzere, τ tahmin dönemi ve $\overline{r_t}$ serinin ortalaması ise R/S istatistiği aşağıdaki gibi hesaplanır (Bariviera, 2011):

$$(R/S)_\tau = \frac{1}{s_\tau}\left[max_{1\le t\le\tau}\sum_{t=1}^{\tau}(r_t - \overline{r_t}) - min_{1\le t\le\tau}\sum_{t=1}^{\tau}(r_t - \overline{r_t})\right] \quad (1)$$

Standart sapma s_τ ise şöyle hesaplanır:

$$s_\tau = \left[\frac{1}{\tau}\sum_\tau (r_t - \overline{r_t})^2\right]^{\frac{1}{2}} \quad (2)$$

Hurst katsayısı ise aşağıdaki gibi elde edilir:

$$(R/S)_\tau = (\tau/2)^2 \quad (3)$$

Elde edilen hurst katsayısı , (H)=0.5 ise seride uzun dönemli bağımlılık yok anlamına gelmektedir. H<0.5 ise uzun dönemli bağımlılık vardır ancak sürekli değildir. H>0.5 ise seri hem uzun dönemli bağımlılığa ve sürekliliğe sahip olduğu anlamına gelir.

Ancak durağan olmama gibi durumlarda Hurst katsayısı sahte uzun dönemli otokorelasyonuda dikkate alarak katsayının olduğundan fazla büyük çıkmasına neden olmaktadır. Bu sahte otokorelasyondan kurtulmak için Trendten arındırılmış dalgalanma analizi (DFA) yöntemi Peng (1994) tarafından geliştirilmiştir. Bu yöntemde bağımsız değişkenin kendi trendinden olan sapmalarının ortalaması ile katsayı elde edilir. Yöntem aşağıdaki gibi özetlenebilir (Grau-Carles, 2001):

$\{x_t\}$, t=1,……,n olmak üzere bir zaman serisinin önce integrali alınır.

$$y(t') = \sum_{t=1}^{t'} x(t) \quad (4)$$

Bu aşamadan sonra elde edilen yeni seri m gözlemli aralıklara bölünür ve her bir aralık için hesaplanan en küçük kareler doğrusu bütün veriye uydurulur. Bu doğruda y ' nin koordinatı $y_{m(t')}$ ile gösterilir.

İntegrali alınmış ve trendten arındırılmış serideki sapmaların ortalamasının karekökü ise aşağıdaki gibi hesaplanır:

$$F(m) = \sqrt{\frac{1}{t}\sum_{t'=1}^{T}[y(t') - y_m(t')]^2} \quad (5)$$

4. VERİ ve AMPİRİK UYGULAMA

Çalışmada ekonometrik analizi gerçekleştirmek için Amerika, İngiltere, Rusya ve Türkiye borsalarının günlük frekansta, 10.05.2013-12.05.2015 dönemi kapsamındaki verileri kullanılmıştır. Bütün veriler datastream veri tabanı aracılığıyla yerel para birimi cinsinden elde edilmiştir. Ampirik analizlere başlamadan önce tablo 1' de borsaların getiri ve oynaklıklarına ait tanımlayıcı istatistikler gösterilmiştir.

Tablo 1: Tanımlayıcı İstatistikler

	Ortalama	S.Sapma	Çarpıklık	Basıklık	JB	Q(5)	LM(5)
(a) Getiri serileri (r)							
Amerika	0.000	0.007	-0.305	3.761	0.00	-0.036	0.00
İngiltere	0.000	0.007	-0.264	4.685	0.00	-0.022**	0.00
Türkiye	-0.000	0.016	-0.627	8.200	0.00	0.044	0.00
Rusya	0.000	0.013	-0.894	12.236	0.00	0.032	0.00
(b) Oynaklık serileri (r^2)							
Amerika	0.000	0.000	3.106	18.09	0.00	0.319*	0.22
İngiltere	0.000	0.000	4.001	23.11	0.00	0.011*	0.00
Türkiye	0.000	0.000	10.586	158.81	0.00	0.016***	0.96
Rusya	0.000	0.000	16.355	322.29	0.00	0.021***	0.98

Getiri istatistiklerine bakıldığında bütün borsaların normal dağılım sergilemediği görülmektedir. Ayrıca çarpıklık katsayıları borsaların ilgili dönemde yatırımcılara kazandırmaktan çok kaybettirdiklerini göstermektedir. Etkin piyasalar hipotezi ile çelişen otokorelasyon katsayısı ise sadece İngiltere borsası için anlamlı çıkmıştır. Oynaklık serileri incelendiğinde ise dikkat çeken nokta otokorelasyonun bütün borsalar için anlamlı bulunmasıdır. Bu durum oynaklık kümelenmesinden kaynaklanmaktadır.

Tablo 2: Birim Kök İstatistikleri

	ADF	%1	%5	%10	P değeri
Amerika	-22.8326	-2.5758	-1.9599	-1.6448	0.00
İngiltere	-22.3929	-2.5758	-1.9599	-1.6448	0.00
Türkiye	-24.126	-2.5758	-1.9599	-1.6448	0.00
Rusya	-22.6254	-2.5758	-1.9599	-1.6448	0.00

Dönüştürülmüş genişlik analizi ve eğilimden arındırılmış dalgalanma analizini gerçekleştirmek için gerekli olan borsa getiri serilerinin durağanlık koşulunu sağladığı tablo 2 de görülmektedir.

Tablo 3: Dönüştürülmüş Genişlik Analizi Sonuçları

	Hurst Katsayısı	Std. hata	t-istatistiği	P değeri
(a) Getiri serileri (r)				
Amerika	0.602	0.0264	22.7630	0.00
İngiltere	0.667	0.0204	32.5823	0.00
Türkiye	0.538	0.0227	23.7216	0.00
Rusya	0.499	0.0365	13.6516	0.00
(b) Oynaklık serileri (r^2)				
Amerika	0.733	0.02443	30.04077	0.00
İngiltere	0.781	0.0364	21.4234	0.00
Türkiye	0.662	0.0170	38.9411	0.00
Rusya	0.653	0.0164	39.6833	0.00

Dönüştürülmüş Genişlik (R/S) analizine göre borsalarda uzun hafıza özelliğinin olmaması diğer bir anlatımla piyasaların etkin olması H katsayısının 0.5 değeri alması ile mümkün olmaktadır. Bu referans değerin altında ya da üstündeki değerler piyasaların etkin olmadığını göstermektedir.

Tablo 3 getiri serilerinde en fazla Rusya borsasının etkinliğe yakın olduğunu, diğer borsaların ise belirgin şekilde uzun dönemli hafızaya sahip olduğunu göstermektedir. Oynaklık serileri baz alındığında ise bütün borsaların uzun dönem bellekli olduğu belirgin şekilde görülmektedir.

Tablo 4 ’te ise eğilimden arındırılmış dalgalanma analizine göre hesaplanan H katsayısına ilişkin bilgiler sunulmuştur. Tablo incelendiğinde ilk dikkat çeken nokta hesaplanan H katsayılarının önceki yönteme göre önemli derecede düşük çıkmasıdır. Türkiye borsasının getirilerinin eğilimden arındırılmış dalgalanma analizi kapsamında rassal yürüyüş sergilediklerini söyleyebiliriz. Amerika ve İngiltere borsalarının H katsayısı dönüştürülmüş analiz yönteminde 0.5’den yüksek çıkarken, bu analizde 0.5’in altında bulunmuştur. Rusya borsasının H katsayısı ise her iki yönteme göre 0.5 civarında gerçekleşmiştir.

Tablo 4: Eğilimden Arındırılmış Dalgalanma Analizi Sonuçları

	Hurst Katsayısı	Std. hata	t-istatistiği	P değeri
(a) Getiri serileri (r)				
Amerika	0.413	0.0179	23.0440	0.00
İngiltere	0.475	0.0172	7.6352	0.00
Türkiye	0.501	0.0125	39.8452	0.00
Rusya	0.513	0.0132	38.8116	0.00
(b) Oynaklık serileri (r^2)				
Amerika	0.700	0.0154	45.3127	0.00
İngiltere	0.706	0.0222	31.7849	0.00
Türkiye	0.666	0.0304	21.8478	0.00
Rusya	0.637	0.0397	16.0440	0.00

Oynaklık serileri baz alındığında, eğilimden arındırılmış dalgalanma analizi yöntemine göre de H katsayıları 0.5 'den epeyce yüksek bulunmuştur. Bu durum hem gelişmekte olan hem de gelişen borsalarda oynaklığın uzun hafızaya sahip olduğunu diğer bir anlatımla borsalara gelen şokların kalıcı olduğunu göstermektedir.

5. SONUÇ

Ektin piyasalarda, piyasa üstü getiri elde mümkün değil iken, etkin olmayan piyasalarda sürekli alım-satım işlemi yaparak ya da al-tut stratejisi ile piyasa üstü getiri elde etmek olanaklı hale gelmektedir. Bu çalışmada Dönüştürülmüş Genişlik ve Eğilimden Arındırılmış Dalgalanma analizi yöntemine göre gelişen ve gelişmiş olan ülke borsalarının getiri ve oynaklıklarında uzun dönemli hafıza özelliği test edilmiştir. Sonuç olarak Türkiye ve Rusya borsalarının rassal yürüşe benzer bir dağılım sergilediği bulunmuştur. Bununla beraber bütün borsalarda uzun hafıza özelliğinin oynaklık serilerinde daha belirgin şekilde ortaya çıkması söz konusu ülkelerin türev piyasalarında işlem yaparak piyasa üstü getiri kazanmanın mümkün olduğunu göstermektedir.

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Portfolio Optimization By General Semi-Variance Approach For Risk Measurement using Gaussian Kernel Estimation

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Abstract

One of most important issues which investors are struggling in investment strategic planning is applying best method to quantify risk in portfolio optimization problem. Most of risk metrics calculate overall risk with no consideration about upside and downside risks and cause less accuracy in finding optimal investment portfolio. In this paper, we proposed Generalized Semi-variance approach using Gaussian Kernel Estimation as a nonparametric probability density estimation method to be taken as the risk metric to improve reliability and eliminate drawbacks which will be discussed in this paper. Based on quantitative and empirical findings discussed in this paper, we found this method more accurate and realistic for measuring risk in portfolio optimization problem.

Keywords: GSV, Portfolio Optimization, LPM, Gaussian Kernel Estimation, GCLPM.

Introduction

One of the key problems for investment decision making is to calculate risk/return variable accurately. While financial analysts and managers work on portfolio optimization problem, they firstly should determine methods to calculate return/risk. The basic model for portfolio optimization refers to Markowitz article in 1952 [1] discussing risk/return by employing the standard-deviation as risk variable and expected return of stocks as return variable. There have been a lot of researches for portfolio optimization new methods such as single-index model, multi-index model [2] and the Mean-absolute deviation (MAD) model [3].

The single-index model assumes linear relationship between stock return and return of the market index. The multi-index model extends the linear relation on a single-index to multiple indexes. This model considers mean absolute deviation as the risk measure to estimate covariance matrix in mean-variance model. There are other important variables likely effects computationally and theoretically on portfolio optimization problem such as probability distribution of stock price time series which will be discussed in further sections. One the other hand, there has been conceptual researches on risk definition and computation methods.

This paper studies portfolio optimization by considering non-parametric probability distribution based on structure of stocks listed in Tehran Stock Exchange like so Many other stock markets. The

remainder of this paper is organized into six sections. Section 2 discussed about non-parametric distributions compared t normal distribution. Section 3 reviews downside risk measurement methods. In section 4, we study Generalized Semi Variance method using Gaussian Kernel Estimation as a risk measure. For reliability analysis, we consider methods like cross validation method which will be represented in this section. Section 5 shows computational findings in stocks listed Tehran Stock Exchange whilst we run some tests mentioned in previous section. The paper ends with summary and conclusions in section 6.

2. Non-parametric distribution

The probability density function is basic concepts in statistic literature. For calculation probabilities associated with X as decision variable,

$$P(a < X < B) = \int_a^b f(d)dx, \;\; a < b \tag{1}$$

Where f(.) denotes the probability distribution function. These methods are highly dependent to probability distribution of data that you want to analyze. One approach for density estimation is parametric. Let's assume the data drawn from one of known parametric family of distributions, like normal distribution with mean μ and variance σ^2. The density f(.) underlying the data could then be estimated by finding estimates of μ and σ^2 from the data and substituting these estimates into the formula for the normal density. In financial literature, most methods estimate probability distribution of data series by parametric approach, but there are a lot of evidences in various studies show this assumption is not valid.[4]

The other approach for distribution estimator is non-parametric. The approach will be non-parametric in that less rigid assumptions will be made about the distribution of the observed data. In this paper, we study kernel estimator for distribution density estimation. At first, we introduce naive estimator and then, we will discuss the kernel estimator to generalize the naïve estimator to overcome some of the its difficulties. For computing the naïve estimator, if the random variable X has density *f*, then

$$\lim_{\varphi \to 0} \frac{1}{2\varphi} p(x - \varphi < X < x + \varphi) \tag{2}$$

Where ϕ is bandwidth. For any given ϕ, $p(x - \varphi < X < x + \varphi)$ can be calculated by the proportion of the sample falling in (x- ϕ, x+ ϕ). If we choose smaller ϕ and set natural estimator $\hat{f}$ as follow, we can call that the naive estimator,

$$\hat{f}(x) = \frac{1}{2N\varphi} [number\ of\ x_i\ belong\ (x - \varphi, x + \varphi)] \tag{3}$$

To express the estimator more transparently, the weight function can be defined by

$$W(x)=\begin{matrix}\frac{1}{2} & |x|<1\\ 0 & O.W\end{matrix} \quad (4)$$

So, the naive estimator can be written

$$\hat{f}(x)=\frac{1}{2N}\sum_{i+1}^{N}\frac{1}{\varphi}\left(\frac{X-x_i}{\varphi}\right) \quad (5)$$

To generalize the naive estimator to overcome some difficulties like $\hat{f}$ is not continuous function, we replace the weight function W by a kernel function K,

$$\int_{-\infty}^{+\infty} K(x)\ dx=1 \quad (6)$$

By analyze with the definition the naïve estimator, the kernel estimator is

$$\hat{f}(x)=\frac{1}{N\varphi}\sum_{i=1}^{N}K\left(\frac{X-x_i}{\varphi}\right) \quad (7)$$

3. Downside Risk Measurement

3.1 Mean-Variance framework

For choosing optimal decision, investors can approach to different frameworks. Markowitz's mean-variance framework is one of them which have at least two important limitations. Firstly, it assumes that the probability distribution of return series is parametric and a symmetric bell-shaped (normal), so that many times in various studies, a lot of evidences show different results [5].

These kind of data series are asymmetrically distributed which make the variance as an inefficient risk measure, because it counts upside changes in nature as a part of risk and penalize it a much as downside part of changes in return under the mean returns, which leads to wrong asset allocation and financial decisions. Secondly, this approach ignores investor's risk aversion to implement their financial decisions. After a while, Markowitz in 1970 showed the drawbacks of variance in portfolio optimizations [6]. He also talked about validity of variance and downside risk measurement when probability distribution is normal and better efficiency of downside risk measures when it's not normal.

3.2 Semi-variance approach

Variance besides, Markowitz also suggested other downside risk measures such as Semi-variance below the target return, and semi-variance below the mean value. The key variable is Lower Partial Moment (LPM) which is the most important variable in such measurements and used in related studies like Fishborn (1977) [7], Harlow and Roa (1989) [8], etc. For example, the mentioned

drawbacks of variance is been covered in developing "α-t" model by Harlow and Rao (1989) [8] in which 'α' is the investor's risk aversion and 't' is the target return of investment proposed by Roy (1952) [9]. For example, Harlow in 1991 [10] employed LPM in portfolio selection as

$$LPM_n = \sum_{R\varphi=-x}^{T} P_p(R_t - R_\varphi)^n \quad (8)$$

Where P_p is the probability of each return happening. One of special cases of LPMs is the semi-variance corresponds to the LPM with the distribution's expected value as target return and a weight coefficient of n=2.

In portfolio selection, empirical and simulation studies also show superiority of mean-LPM based portfolio selection criteria towards the traditional mean-variance based approach under the assumption of shortfall-risk oriented investors (Porter and Gaumnitz, 1972 [11]; Leibowitz and langetieg, 1989 [12]; Sortino and Forsey, 1996 [13]). By accepting the superiority, Hogan and Warren (1972) [14] in their article show the essential mathematical properties of mean-semivariance models, where they prove the convexity and differentiability of this model and showed theoretical and computational validity of mean-semi-variance model.

3.3 Generalized Semi-variance using kernel estimation

Generalized Semi-variance (GSV) as another downside risk measure introduced for obtaining optimal hedge ratio in risk management using future contacts (De Jong et al [15]; Lien and Tse, 1998 [16]). For computation of GSV,

$$V_{\delta,\alpha}(R_\varphi) = \int_{-\infty}^{R_t} (R_t - R_\varphi)^\alpha dG(R_\varphi), \alpha > 0 \quad (9)$$

Where $G(R_\varphi)$ can be introduced as probability distribution function of stock returns, R_t is the target return of investor and α represents the investor risk aversion. As you can observe in above equation, if we restrict the value of α to b any positive integer number, GSV can be known as one of LPMs. Although both Fishborn (1977) [7] and Bawa (1978) [17] discussed the relationships among GSV, stochastic dominance, and expected utility, Bawa restricted the value of α to positive integers, whereas Fishborn allowed α to be any positive real number. Now, one of important variables can effect reliability of GSV results is $G(R_\varphi)$, because estimating method for probability density of R_ϕ can change result of portfolio selection problem. As discussions in previous section, we employed nonparametric density estimation for $G(R_\varphi)$ as an improvement to previous methods in downside risk measurement and then portfolio selection problem. For this purpose, we applied *Gaussian Kernel Estimation* using the optimal bandwidth (ϕ) by minimizing MISE between $G(R_\varphi)$ and true pdf $f(R_\varphi)$. We assume $G(z) = (2\pi)^{-0.5} \exp(^{-z^2}/_2)$ as Gaussian core in kernel estimation.

Suppose we have N data sample of R_ϕ, the probability density function of R_ϕ as a given point y, can be estimated by;

$$f(y) = \frac{1}{N\varphi}\sum_{i=1}^{N} g(\frac{y - R_\varphi}{\varphi}) \tag{10}$$

Consequently, upon substituting the estimation for the true unknown density, the lower partial moment of R_ϕ can be estimated by

$$\vartheta\big(R_t, n, R_\varphi\big) = \int_{-\infty}^{R_t} (R_t - y)^n \frac{1}{N\varphi}\sum_{i=1}^{N} g(\frac{y - R_\varphi}{\varphi})dy \tag{11}$$

To determine the optional size of ϕ, the Cross Validation method given in Silverman (1986) [18] is employed in this study, so we have

$$MISE(\varphi) = \frac{1}{N^2\varphi}\sum_{i=1}^{N}\sum_{i=1}^{N} g^*\left(\frac{y - R_\varphi}{\varphi}\right) + \frac{2}{N\varphi}g(0) \tag{12}$$

Where g(x) is the explained Gaussian core.

4. Portfolio optimization by GSV approach using Gaussian Kernel Estimation

In supervised learning, it is expected that the points with similar predictor values x_i, naturally have close response (target) value y_i. In Gaussian processors, the covariance function expresses this similarity. It specifies the covariance between the two latent variables $f(x_i)$ and $f(x_j)$, where both x_i and x_j are d-by-1 vectors. In other words, it determines how the response at one point x_i I effected by response at other xj, i≠j, i=1, 2,…,n. The covariance function k (x_i, x_j) can be defined by various kernel functions.

In extending the Semi-variance measure of risk the capital asset pricing model (CAPM), Hogan and Warren (1974) [14] introduced the Co-variance concept, an asymmetric measure of the relative risk between a risky asset and an efficient market portfolio. Bawa and Lindenberg (1977) [19] generalized the Co-semi variance measure into the n-degree LPM structure, which is called a Generalized Co-Lower Partial Moment (GCLPM) and defined as

$$\tau_n\big(R_t, R_i, R_j\big) = \int_{-\infty}^{R_t}\int_{-\infty}^{+\infty} (R_t - R_i)^{n-1}(R_t - R_j)dF(R_i, R_j) \tag{13}$$

Where τ is GCLPM and $dF(R_i, R_j)$ in equation (i) is the joint probability density function of the returns of asset i and j.

Now, as we discussed in section 2 and 3.3, we will apply Gaussian Kernel Estimation for calculating the joint probability density function to improve the quality of new risk measure. So for computing kernel density estimation with higher dimension like 2D dimensions, we should generalize this approach.

For Given N independent realizations $X_N \equiv \{X_1, \ldots, X_N\}$ from an unknown continuous probability density function (p.d.f.) f on X, the Gaussian kernel density estimator is defined as

$$\hat{f}\left(x;\sqrt{\varphi}\right) = \frac{1}{N}\sum_{i=1}^{N} \emptyset\left(X, x_i;\sqrt{\varphi}\right) \tag{14}$$

Where

$$\emptyset\left(X, x_i;\sqrt{\varphi}\right) = \frac{1}{\sqrt{2\pi\sqrt{\varphi}}} e^{\frac{-(X-x_i)^2}{2\sqrt{\varphi}}} \tag{15}$$

is a Gaussian p.d.f. (kernel) with location Xi and scale $\sqrt{\varphi}$. Much research has been focused on the optimal choice of $\sqrt{\varphi}$ in above, because the performance of $\hat{f}$ as an estimator of *f* depends crucially on its value [20, 21]. As we discussed before, well-studied criterion used to determine an optimal $\sqrt{\varphi}$ is the Mean Integrated Squared Error (MISE).

So then for eliminating mentioned drawbacks in section 2 and improving the quality of GCLPM computation as one of key variables in solving portfolio optimization problem, we propose,

$$\tau_n\left(R_t, R_i, R_j\right) = \int_{-\infty}^{R_t}\int_{-\infty}^{+\infty} (R_t - R_i)^{n-1}(R_t - R_j)\frac{1}{N}\sum_{i=1}^{N}\frac{1}{\sqrt{2\pi\sqrt{\varphi}}} e^{\frac{-(X-x_i)^2}{2\sqrt{\varphi}}} dx_i dx_j \tag{16}$$

Where we employed *Gaussian Kernel Estimation* using *the optimal bandwidth* for estimating $dF(R_i, R_j)$.

Now, we will apply this new risk metric in portfolio optimization problem to obtain enhanced and more accurate efficient frontier. For this purpose, we have

$$\min z = \sum_{i=1}^{N}\sum_{j=1}^{N} \omega_i \omega_j \tau_n\left(R_t, R_i, R_j\right)$$

Subject to (17)

$$R_p = \sum_{i=1}^{N} \omega_i \bar{R}_i$$

$$\sum_{i=1}^{N} \omega_i = 1$$

$\omega_i \geq 0$, i=1, 2, …, N.

For finding efficient frontier, we will minimize the sum of weighted GCLPM whilst trying to maintain the return of portfolio in optimum level.

5. Analysis of Results

In this section, we try to analyze the quantitative results of this new measure. For this purpose, we applied this model into broad selection of stocks listed in Tehran Stock Exchange by assuming 0.26 as common target return in Iran financial market and 2 as the order of moment.

Table 1. numerical results based on GSV

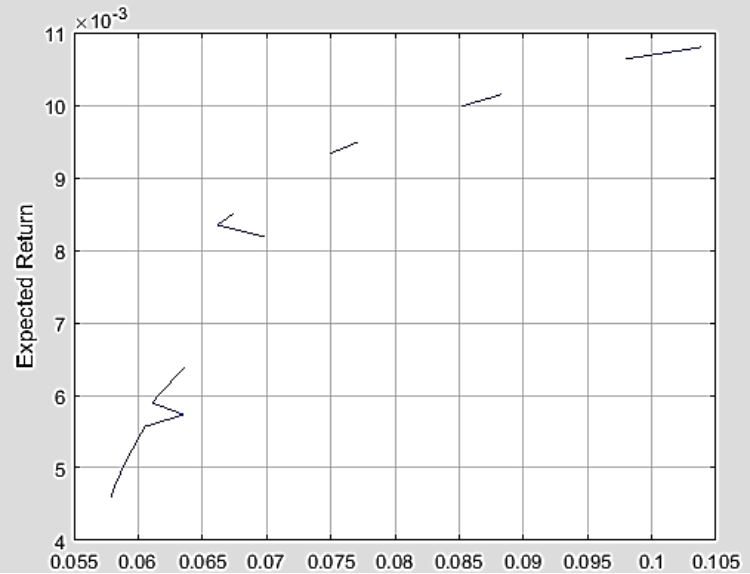
Name/instrument	LPM	Variance	Opt. Bandwidth	Expected return
BMLT1	0.0108	0.0005	0.002544	0.000370000
MB511	0.0044	0.000187	0.001315	0.000620000
ALBZ1	0.0048	0.000334	0.0027095	0.001000000
BPAR1	0.0039	0.000245	0.002146	0.001400000
BSTE1	0.0058	0.00035	0.00243115	0.000208000
HSHM1	0.0061	0.00041	0.00333022	0.001400000
Keshtirani I.R.Iran	0.0069	0.000175	0.00103072	0.000412110
KAVR1	0.0351	0.000695	0.009278	0.0014
BHMN1	0.0034	0.000562	0.00659782	0.001100000
PKOD1	0.0036	0.000573	0.00659908	0.001400000
SIPA1	0.0034	0.000659	0.00729598	0.001100000
IKCO1	0.0041	0.000554	0.00608509	0.000740000
BDYZ1	0.0045	0.000675	0.00675927	0.001100000
ZOBZ1	0.0048	0.000795	0.0086037	0.001700000
ZF411	0.0005	0.00015	0.00086663	0.001300000
PZGZ1	0.0055	0.000555	0.00451385	0.000549000
PARK1	0.0042	0.000329	0.00284267	0.001500000
PNTB1	0.0057	0.000463	0.00246461	0.002200000
PKHA1	0.0050	0.000224	0.00158685	0.001300000
PFAN1	0.0077	0.000144	0.00059609	0.001100000
PSHZ1	0.0095	0.000198	0.0007692	0.000532000
SSIN1	0.0050	0.000234	0.00177718	0.000946000
FKAS1	0.0055	E-053.34	0.00029565	0.000283000
FKHZ1	0.0051	0.000202	0.00124742	0.001100000
SORB1	0.0084	0.000288	0.00272848	0.000594000
FOLD1	0.0042	0.000289	0.0023655	0.000669000
Alloy IRAN Foolad	0.0049	0.00031	0.00250677	0.000194000
CHML1	0.0054	0.000236	0.00154762	0.000545000
GOLG1	0.0043	0.000235	0.00172389	0.001300000
PMRZ1	0.0044	0.000435	0.0041684	0.002000000
KHMZ1	0.0039	0.000245	0.002145	0.001400000
OIMC1	0.0080	0.00013	0.00044006	0.001200000
BANS1	0.0042	0.00036	0.0033285	0.000859000
BSDR1	0.0049	0.000294	0.0022054	0.000866000
BPAR1	0.0047	0.000282	0.00237522	0.000500000
ZF071	0.0051	0.000233	0.00181785	0.000361000
BPST1	0.0039	0.00054	0.00633503	0.000316000
BTEJ1	0.0056	0.000274	0.00162337	0.000938000
SSAP1	0.0038	0.000633	0.00804986	0.000420000

The numerical result for variance, expected return and LPM are on daily basis and historical data for selected stocks is for recent five years. In next step, we calculated the CGLPM for these stocks based on proposed equation in section 5.

Table 2. numerical results based on GCLPM using Guassian Kernel Estimation																																						
GCLPM	BMLT1	MB511	ALBZ1	BPAR1	BSTE1	HSHM1	Keshtirani I.R.Iran	KAVR1	BHMN1	PKOD1	SIPA1	IKCO1	BDYZ1	ZOBZ1	ZF411	PZGZ1	PARK1	PNTB1	PKHA1	PFAN1	PSHZ1	SSIN1	FKAS1	FKHZ1	SORB1	FOLD1	Foolad Alloy IRAN	CHML1	GOLG1	PMRZ1	KHMZ1	OIMC1	BANS1	BSDR1	BPAR1	ZF071	BPST1	BTEJ1	SSAP1
BMLT1	0.011	0.004	0.005	0.003	0.005	0.004	0.003	0.006	0.003	0.004	0.005	0.005	0.005	0.005	0.004	0.007	0.006	0.001	0.004	0.004	0.005	0.003	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.008	0.003	0.005	0.004	0.004	0.003	0.006	0.004	0.004	0.004
MB511	0.004	0.004	0.002	0.002	0.004	0.004	0.006	0.008	0.004	0.004	0.004	0.006	0.007	0.007	0.003	0.006	0.005	0.004	0.003	0.006	0.004	0.007	0.002	0.005	0.004	0.003	0.005	0.004	0.003	0.009	0.003	0.005	0.006	0.004	0.003	0.003	0.003	0.005	0.005
ALBZ1	0.005	0.002	0.005	0.007	0.012	0.012	0.006	0.016	0.008	0.011	0.010	0.012	0.015	0.015	0.010	0.017	0.010	0.007	0.013	0.012	0.011	0.014	0.005	0.008	0.009	0.006	0.012	0.009	0.008	0.018	0.007	0.006	0.008	0.010	0.011	0.009	0.014	0.009	0.011
BPAR1	0.003	0.002	0.007	0.004	0.012	0.017	0.014	0.017	0.008	0.012	0.011	0.014	0.014	0.014	0.011	0.018	0.012	0.007	0.010	0.015	0.015	0.017	0.008	0.009	0.008	0.009	0.011	0.012	0.011	0.014	0.010	0.009	0.009	0.014	0.012	0.011	0.020	0.013	0.014
BSTE1	0.005	0.004	0.012	0.012	0.006	0.007	0.006	0.017	0.006	0.006	0.007	0.010	0.009	0.009	0.006	0.017	0.013	0.005	0.010	0.009	0.012	0.015	0.004	0.006	0.005	0.006	0.006	0.007	0.007	0.013	0.005	0.007	0.009	0.007	0.005	0.008	0.014	0.007	0.009
HSHM1	0.004	0.004	0.012	0.017	0.007	0.006	0.009	0.011	0.005	0.007	0.007	0.008	0.009	0.009	0.006	0.006	0.004	0.004	0.004	0.006	0.005	0.005	0.004	0.005	0.003	0.005	0.004	0.005	0.005	0.008	0.006	0.004	0.004	0.006	0.005	0.006	0.007	0.009	0.008
eshtirani l.R.Iran	0.003	0.006	0.006	0.014	0.006	0.009	0.007	0.059	0.019	0.031	0.030	0.039	0.045	0.045	0.020	0.043	0.028	0.016	0.036	0.024	0.028	0.043	0.012	0.019	0.018	0.017	0.028	0.022	0.026	0.033	0.023	0.019	0.025	0.027	0.020	0.026	0.039	0.033	0.036
KAVR1	0.006	0.008	0.016	0.017	0.017	0.011	0.059	0.001	0.009	0.012	0.012	0.013	0.013	0.013	0.009	0.018	0.012	0.005	0.012	0.014	0.010	0.017	0.006	0.007	0.008	0.007	0.010	0.007	0.010	0.018	0.010	0.006	0.010	0.010	0.010	0.011	0.011	0.010	0.022
BHMN1	0.003	0.004	0.008	0.008	0.006	0.005	0.019	0.009	0.003	0.002	0.002	0.001	0.001	0.001	0.002	0.003	0.002	0.001	0.003	0.001	0.002	0.002	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.003
PKOD1	0.004	0.004	0.011	0.012	0.006	0.007	0.031	0.012	0.002	0.004	0.006	0.007	0.005	0.005	0.003	0.008	0.006	0.003	0.008	0.006	0.006	0.007	0.004	0.004	0.004	0.004	0.005	0.005	0.006	0.010	0.004	0.004	0.003	0.007	0.006	0.005	0.006	0.006	0.007
SIPA1	0.005	0.004	0.010	0.011	0.007	0.007	0.030	0.012	0.002	0.006	0.003	0.003	0.003	0.003	0.001	0.005	0.004	0.001	0.005	0.003	0.004	0.005	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004
IKCO1	0.005	0.006	0.012	0.014	0.010	0.008	0.039	0.013	0.001	0.007	0.003	0.004	0.005	0.005	0.003	0.006	0.003	0.003	0.005	0.005	0.004	0.007	0.003	0.004	0.003	0.003	0.005	0.004	0.004	0.006	0.003	0.003	0.004	0.004	0.004	0.003	0.005	0.004	0.007
BDYZ1	0.005	0.007	0.015	0.014	0.009	0.009	0.045	0.013	0.001	0.005	0.003	0.005	0.005	0.013	0.006	0.011	0.006	0.005	0.010	0.006	0.010	0.006	0.004	0.005	0.005	0.005	0.007	0.008	0.009	0.010	0.005	0.009	0.008	0.008	0.007	0.007	0.011	0.008	0.006
ZOBZ1	0.009	0.011	0.022	0.017	0.015	0.010	0.053	0.021	0.003	0.009	0.006	0.010	0.013	0.005	0.006	0.011	0.006	0.005	0.010	0.006	0.010	0.006	0.004	0.005	0.005	0.005	0.007	0.008	0.009	0.010	0.005	0.009	0.008	0.012	0.007	0.007	0.011	0.008	0.019
ZF411	0.004	0.003	0.010	0.011	0.006	0.006	0.020	0.009	0.002	0.003	0.001	0.003	0.006	0.006	0.001	0.006	0.008	0.003	0.009	0.007	0.004	0.004	0.003	0.003	0.004	0.003	0.005	0.004	0.005	0.006	0.003	0.006	0.003	0.007	0.006	0.003	0.007	0.005	0.007
PZGZ1	0.007	0.006	0.017	0.018	0.017	0.006	0.043	0.018	0.003	0.008	0.005	0.006	0.011	0.011	0.006	0.006	0.010	0.007	0.011	0.010	0.009	0.009	0.006	0.006	0.004	0.005	0.010	0.007	0.009	0.012	0.007	0.010	0.009	0.007	0.009	0.008	0.009	0.007	0.009
PARK1	0.006	0.005	0.010	0.012	0.013	0.004	0.028	0.012	0.002	0.006	0.004	0.003	0.006	0.006	0.008	0.010	0.004	0.004	0.007	0.008	0.010	0.007	0.004	0.006	0.005	0.005	0.008	0.006	0.005	0.012	0.007	0.004	0.005	0.005	0.009	0.006	0.007	0.006	0.008
PNTB1	0.001	0.004	0.007	0.007	0.005	0.004	0.016	0.005	0.001	0.003	0.001	0.003	0.005	0.005	0.003	0.007	0.004	0.006	0.009	0.011	0.009	0.011	0.004	0.006	0.006	0.006	0.009	0.008	0.008	0.013	0.007	0.005	0.008	0.010	0.009	0.007	0.013	0.009	0.013
PKHA1	0.004	0.003	0.013	0.010	0.010	0.004	0.036	0.012	0.003	0.008	0.005	0.005	0.010	0.010	0.009	0.011	0.007	0.009	0.005	0.010	0.009	0.011	0.005	0.006	0.004	0.007	0.009	0.008	0.007	0.014	0.009	0.006	0.009	0.008	0.009	0.012	0.012	0.010	0.014
PFAN1	0.004	0.006	0.012	0.015	0.009	0.006	0.024	0.014	0.001	0.006	0.003	0.005	0.006	0.006	0.007	0.010	0.008	0.011	0.010	0.008	0.019	0.023	0.012	0.015	0.014	0.015	0.024	0.020	0.028	0.038	0.020	0.015	0.017	0.024	0.021	0.023	0.033	0.024	0.037
PSHZ1	0.005	0.004	0.011	0.015	0.012	0.005	0.028	0.010	0.002	0.006	0.004	0.004	0.010	0.010	0.004	0.009	0.010	0.009	0.009	0.019	0.010	0.022	0.010	0.013	0.014	0.015	0.013	0.018	0.022	0.020	0.015	0.012	0.014	0.019	0.017	0.017	0.029	0.016	0.026
SSIN1	0.003	0.007	0.014	0.017	0.015	0.005	0.043	0.017	0.002	0.007	0.005	0.007	0.006	0.006	0.004	0.009	0.007	0.011	0.011	0.023	0.022	0.005	0.006	0.011	0.008	0.011	0.016	0.012	0.015	0.020	0.010	0.011	0.011	0.012	0.011	0.010	0.018	0.008	0.021
FKAS1	0.004	0.002	0.005	0.008	0.004	0.004	0.012	0.006	0.001	0.004	0.002	0.003	0.004	0.004	0.003	0.006	0.004	0.004	0.005	0.012	0.010	0.006	0.006	0.042	0.035	0.030	0.059	0.048	0.043	0.069	0.052	0.036	0.049	0.069	0.040	0.052	0.074	0.053	0.096
FKHZ1	0.004	0.005	0.008	0.009	0.006	0.005	0.019	0.007	0.000	0.004	0.002	0.004	0.005	0.005	0.003	0.006	0.006	0.006	0.006	0.015	0.013	0.011	0.042	0.005	0.007	0.007	0.009	0.006	0.009	0.013	0.008	0.008	0.009	0.015	0.011	0.012	0.013	0.010	0.014
SORB1	0.004	0.004	0.009	0.008	0.005	0.003	0.018	0.008	0.001	0.004	0.002	0.003	0.005	0.005	0.004	0.004	0.005	0.006	0.004	0.014	0.014	0.008	0.035	0.007	0.008	0.002	0.003	0.002	0.002	0.003	0.002	0.001	0.003	0.003	0.002	0.002	0.003	0.003	0.004
FOLD1	0.004	0.003	0.006	0.009	0.006	0.005	0.017	0.007	0.001	0.004	0.002	0.003	0.005	0.005	0.003	0.005	0.005	0.006	0.007	0.015	0.015	0.011	0.030	0.007	0.002	0.004	0.002	0.002	0.002	0.006	0.002	0.002	0.003	0.004	0.003	0.002	0.003	0.005	0.003
Foolad Alloy IRAN	0.004	0.005	0.012	0.011	0.006	0.004	0.028	0.010	0.001	0.005	0.002	0.005	0.007	0.007	0.005	0.010	0.008	0.009	0.009	0.024	0.013	0.016	0.059	0.009	0.003	0.002	0.005	0.009	0.010	0.012	0.005	0.007	0.007	0.007	0.007	0.009	0.009	0.007	0.011
CHML1	0.003	0.004	0.009	0.012	0.007	0.005	0.022	0.007	0.001	0.005	0.003	0.004	0.008	0.008	0.004	0.007	0.006	0.008	0.008	0.020	0.018	0.012	0.048	0.006	0.002	0.002	0.009	0.005	0.004	0.006	0.006	0.004	0.007	0.010	0.006	0.008	0.011	0.006	0.011
GOLG1	0.003	0.003	0.008	0.011	0.007	0.005	0.026	0.010	0.001	0.006	0.003	0.004	0.009	0.009	0.005	0.009	0.005	0.008	0.007	0.028	0.022	0.015	0.043	0.009	0.002	0.002	0.010	0.004	0.004	0.011	0.007	0.006	0.007	0.012	0.009	0.011	0.011	0.008	0.015
PMRZ1	0.008	0.009	0.018	0.014	0.013	0.008	0.033	0.018	0.003	0.010	0.004	0.006	0.010	0.010	0.006	0.012	0.012	0.013	0.014	0.038	0.020	0.020	0.069	0.013	0.003	0.006	0.012	0.006	0.011	0.004	0.009	0.011	0.011	0.010	0.011	0.011	0.011	0.008	0.018
KHMZ1	0.003	0.003	0.007	0.010	0.005	0.006	0.023	0.010	0.001	0.004	0.002	0.003	0.005	0.005	0.003	0.007	0.007	0.007	0.009	0.020	0.015	0.010	0.052	0.008	0.002	0.002	0.005	0.006	0.007	0.009	0.004	0.011	0.009	0.009	0.012	0.008	0.011	0.006	0.010
OIMC1	0.005	0.005	0.006	0.009	0.007	0.004	0.019	0.006	0.001	0.004	0.002	0.003	0.009	0.009	0.006	0.010	0.004	0.005	0.006	0.015	0.012	0.011	0.036	0.008	0.001	0.002	0.007	0.004	0.006	0.011	0.011	0.008	0.019	0.025	0.022	0.029	0.037	0.027	0.036
BANS1	0.004	0.006	0.008	0.009	0.009	0.004	0.025	0.010	0.001	0.003	0.002	0.004	0.008	0.008	0.003	0.009	0.005	0.008	0.009	0.017	0.014	0.011	0.049	0.009	0.003	0.003	0.007	0.007	0.007	0.011	0.009	0.019	0.004	0.006	0.006	0.003	0.006	0.004	0.007
BSDR1	0.004	0.004	0.010	0.014	0.007	0.006	0.027	0.010	0.002	0.007	0.002	0.004	0.008	0.008	0.007	0.007	0.005	0.010	0.008	0.024	0.019	0.012	0.069	0.015	0.003	0.004	0.007	0.010	0.012	0.010	0.009	0.025	0.006	0.005	0.000	0.000	0.000	0.000	0.010
BPAR1	0.003	0.003	0.011	0.012	0.005	0.005	0.020	0.010	0.002	0.006	0.003	0.004	0.007	0.007	0.006	0.009	0.009	0.009	0.009	0.021	0.017	0.011	0.040	0.011	0.002	0.003	0.007	0.006	0.009	0.011	0.012	0.022	0.006	0.000	0.005	0.009	0.012	0.010	0.013
ZF071	0.006	0.003	0.009	0.011	0.008	0.006	0.026	0.011	0.002	0.005	0.003	0.003	0.007	0.007	0.003	0.008	0.006	0.007	0.012	0.023	0.017	0.010	0.052	0.012	0.002	0.002	0.009	0.008	0.011	0.011	0.008	0.029	0.003	0.000	0.009	0.005	0.016	0.009	0.013

BPST1	0.004	0.003	0.014	0.020	0.014	0.007	0.039	0.011	0.002	0.006	0.003	0.005	0.011	0.011	0.007	0.009	0.007	0.013	0.012	0.033	0.029	0.018	0.074	0.013	0.003	0.003	0.009	0.011	0.011	0.011	0.011	0.037	0.006	0.000	0.012	0.016	0.004	0.004	0.006
BTEJ1	0.004	0.005	0.009	0.013	0.007	0.009	0.033	0.010	0.001	0.006	0.003	0.004	0.008	0.008	0.005	0.007	0.006	0.009	0.010	0.024	0.016	0.008	0.053	0.010	0.003	0.005	0.007	0.006	0.008	0.008	0.006	0.027	0.004	0.000	0.010	0.009	0.004	0.006	0.014
SSAP1	0.004	0.005	0.011	0.014	0.009	0.008	0.036	0.022	0.003	0.007	0.004	0.007	0.006	0.006	0.007	0.009	0.008	0.013	0.014	0.037	0.026	0.021	0.096	0.014	0.004	0.003	0.011	0.011	0.015	0.018	0.010	0.036	0.007	0.000	0.013	0.013	0.006	0.014	0.004

As we calculated LPM and GCLPM, we can build the risk matrix for using in portfolio optimization problem. In next step, we minimized the sum of weighted GCLPM whilst trying to maintain the return of portfolio in optimum level.



6. Summary and Conclusions

In making investment decisions, ability to measure risk/return of investment scenarios plays key role for investors. In this paper, we reviewed previous studies on risk measurement methods and their applications in portfolio optimization problem. The drawbacks of each method and progress to eliminate them has been discussed and we built our proposition to suggest more realistic and accurate risk metric by consideration of various evidences about nonparametric probability distributions in financial markets. For this purpose, we suggest employing Gaussian Kernel Estimator in computation of LPM and GCLPM as the components of risk matrix for portfolio optimization. In this new model, we introduced substitution for co-variance by improving accuracy of joint probability density estimation and considering the target return and risk aversion of investor in asset allocation.

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The Significance of Non-Cash Turnover In Economic Growth

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Abstract

In banking we can witness the globalization of financial services, mainly due to cutting-edge IT technologies. As innovative solutions constantly appear, the society's needs and demands in the scope of financial services also increase. This revolutionary change entails replacing traditional forms of cash payment by modern and pioneer payment instruments.

The aim of the paper is to review the main trends across research studies connected with non-cash turnover. In respective parts the major trends are presented. They are dedicated to non-cash turnover and include: economic growth, grey zone, non-cash expenses, and non-cash turnover determinants. Each trend was supported by the most vital and comprehensive empirical studies conducted by various researchers worldwide. The conclusions in the field of non-cash turnover can be formulated on the basis of the analyses presented. The effects of considerations allow to indicate the possible trends in the field of non-cash turnover and constitute an added value of the publication.

Key words: non-cash turnover, e-payments, grey zone, economic growth
JEL Codes: E42, E51

1. Introduction

The paper aims to identify the main research trends in non-cash turnover such as: economic growth, grey zone, non-cash charges and non-cash turnover determinants. These areas are scrutinized most frequently in the literature, but at the same time the outcomes are ambiguous. The most important and complex studies were analyzed. They concerned non-cash turnover as one of the financial transactions in retail payment system, which have already been implemented in the world. The review of literature encompasses as well theoretical studies as empirical ones. As a matter of fact, highly-developed countries apply non-cash transactions, which is justified by numerous benefits. However, rash and ill-considered implementation of non-cash transactions may lead to plenty of limitations in a given economy. Considering many cultural and economic differences in the use of cash in particular states, this process cannot be treated equally in all countries. Besides, in case of

underdeveloped or developing countries, the existence of non-cash turnover may stimulate or expand grey zone, which is desirable for the state to grow. The need for grey zone can be justified by ineffective and insufficient state structure, which does not satisfy the society's needs.

The conclusions or recommendations in the field of non-cash turnover were formulated on the basis of the analyses presented. The effects of considerations indicate the possible trends in non-cash turnover and constitute an added value of the publication. The aim of the paper is to review the main trends in the subject-matter research studies, indicate research inaccuracy, highlight the significance of non-cash turnover and its impact on economic development. The publication also attempts to answer if non-cash payments are unambiguously beneficial for economy (and if yes – in what conditions) or if socioeconomic conditions in which non-cash turnover hampers economic growth were identified.

In the first part of the article non-cash turnover was defined and its conditionings were specified. Respectively, the influence of non-cash transactions on economic growth and the connections of grey zone with non-cash turnover were analyzed. Another chapter was dedicated to non-cash expenses.

2. Non-cash turnover and its conditionings

Non-cash turnover has a long-term tradition. Its history dates from 19th century and came to existence in the United States. It was strictly related to the appearance of pay cards. They could be used in only one store, and being a holder of this kind of card meant their right to receive the ordered goods and accept them as a client's credit. Not until the war pay cards resembling today's ones appeared on the market.

A significant element of payment system is performing payments. Payment means transferring funds from a debtor's into a creditor's bank account [Polasik and Maciejewski 2009:15]. The other commonly known definition of non-cash turnover is used by BIS (Bank for International Settlements) and European Central Bank (Europejski Bank Centralny). According to this definition payment means transferring a beneficiary's acceptable liabilities to a third party [Bank for International Settlements]. The experts from Finland define payment as a transaction and process aimed at transferring a payer's funds to a creditor being a direct payee or with participation of intermediary. Payments, in other words transfer of funds, are performed with the application of payment tools or with the help of non-bank fund transfer methods [Dahlberg and Öörni 2006: 13-14]. The basic non-cash payment instruments comprise: pay cards, credit transfers, direct debits and cheque clearances. These instruments are simultaneously included in elaborations and statistics prepared by European Central Bank (Blue Book) and Bank for International Settlements in Basle (Red Book). As a consequence of globalization of financial services, mainly due to technology advancement over the last thirty years and the emergence of cutting-edge IT solutions, traditional non-cash payment instruments are more and more frequently superseded by more modern ones, using the funds gathered on bank accounts, microprocessor smart cards or e-money [Scholnick and others 2007: 1468-1483]. Concluding, non-cash turnover is defined as a cash settlement, in which both sides, that is debtor and creditor, are the holders of their own bank accounts and they do not use cash at any stage of their mutual settlements (National Bank of Poland 2008: 9]. It can be stated that non-cash settlements substitute cash as they correspond to the classic function of effectively used money such as: measure of value, accumulation, change and unit of account [Arnold 2007: 574-581].

The research on non-cash payment determinants is crucial from the financial point of view. The overall review of studies on this issue indicates varied factors which determine the form of payment. The first studies on a microeconomic scale that test clients' payment behaviours with the use of single-equation logit, probit and Poisson model predominantly

focused on American, German, Dutch and Finnish market. For several years these investigations have been also conducted in Poland. J. Marzec, M. Polasik, and P. Fiszeder concluded that demographic characteristics allowed to distinguish and observe groups of people who used cash and debit cards [Marzec and others 2013: 375–402]. According to their findings individuals who are single, in older age, live in the countryside, are not educated enough and approach new technologies with greater carefulness, are not willing to employ non-cash transactions. Besides, basing on their observations, young women, people better educated and those who have access to the Internet, are more inclined to pay by debit cards in comparison with the rest of society. T. Koźliński conducted a research study on non-cash payment habits with the use of payment records. The researcher indicates that one of the most significant factors hampering non-cash transactions is improperly developed infrastructure [Koźliński 2013: 264-265]. In small groceries, local grocer's shops or on the markets and at a newsagent's the lack of card acceptance is a common occurrence. In case of online transactions the most crucial deterrent is lack of computer, Internet connection or inability to use home banking. According to the studies on payment habits conducted mainly by central banks, one can draw the conclusion that consumers change their habits in this respect quite slowly and need distinctive incentives to alter their practices or manners [Leinonen 2008: 12].

N. Jonker carried out a similar investigation among the Dutch households [Jonker 2007: 271-303]. She aimed to identify out-of-price electronic features of payment instruments. Her findings enhance the significance of the components such as: comfort and convenience (in the context of usefulness), acceptance of transactions at any place and speed. A vital factor determining consumers' inclinations to use innovative payment instruments is their advantage over already or commonly-used ones in terms of security and cost. However, it is worth highlighting that most of these characteristics are negatively correlated to each other. For instance, a more secure payment method is usually more expensive and requires a more complex interaction between seller and buyer, hence a user is urged to hierarchize them [Boer and others 2010: 99].

Consumers' various behaviours have a heavy impact on applying non-cash transactions [Jonker 2007: 271-303]. The explorations show that females employ non-cash payments more often than males as they attend different places and do the shopping more frequently, hence they are much more likely to encounter a point-of-sale terminal or customer service desk. On the other hand, men travel by car more for business purposes so they use e-purse services paying e.g. for a car park or they use a credit card covering some accommodation fees. While comparing gender payment habits E.S. Mot, J.S. Cramer and E.M. Gulik reached similar conclusions in 1989 and J. Stavins in 2001. Another factor determining the form of payment is age. Young people (up to 24) mostly pay in cash, but human beings between 25 and 34 choose non-cash transactions far more often. The reason of this state of being is that youngsters do not run the households and they mostly purchase something for themselves to satisfy their needs, and not the needs of all family members. Furthermore, they are not holders of driving licence, which deprives them of the right to use point-of-sale terminals. In addition, youth under 18 are not entitled to possess a credit card, which also entails little likelihood to make payments. Age as a significant determinant of payment method was noticed and thoroughly discussed in R.W. Meijer's findings [Meijer 2010: 1-9].

Another essential reason influencing the choice of payment method, which was also spotted by N. Jonker, is income and education. The higher income and education level, the greater inclination or probability to use more innovative forms of payment. J. Stavins presents a convergent opinion. However, some negative and positive correlations were raised as well. The inverse relationship concerns age and using cash to make payments. Referring to the positive aspects, there are credit card-age and income-education relationships. The degree

of urbanization and regional disparities also have a meaningful influence on consumers' behaviour. In case of humans living in a big agglomeration, there is more likelihood to use a credit card by 8-10% in comparison with the residents of small towns and villages. Some other determinants of payment method were identified and scrutinized by D. Humphrey, M. Kim, B. Vale [Humphrey and others 2001: 216-234], E. Klee [Klee 2004], or H. Allen [Allen 2003: 428-438] and J. Zinman [Zinman 2005: 30-31]. They point out that one of the leading determinants of non-cash transactions is expenses incurred by clients, transaction speed (the more the **transaction speed**, the better the customer satisfaction and system availability provision), ease of use and learnability, or loyalty programs offered by companies and linked with payment instruments. Summing up, one can be stated that all findings and research studies that have been conducted so far, do not confirm unambiguously which of the above mentioned characteristics is most significant while choosing a payment instrument.

3. Impact of non-cash turnover on economic growth

The review of literature encompassing theoretical studies concerning the influence of non-cash turnover on economy, hitherto empirical explorations dedicated to this issue and numerous reports indicate there is a positive impact of non-cash transactions on economic growth. Positive relationships between non-cash payments and economic development were observed by i.a. I. Hasan, T. Renzis and De H. Schmiedel [Hasan and others 2012: 1-41]. They investigated the dependence between retail payments and overall economic growth on the basis on the statistics from the 27 countries over the years 1995-2009. The outcomes proved that electronic retail payments (e-payments) boosted overall economic advancement, consumption and trade [Ibid: 21-22]. E-payment can be defined as payment initiated, made and received electronically [European Central Bank 2010]. E-payments made with the use of pay cards have become a peculiar feature of today's economy [Arai 2004: 1-24]. The heaviest impact on economic growth can be attributed to all card payments, whereas transfer order and direct debit are the latterly mentioned economy stimulants. Moreover, the findings reveal that cheques slightly affect economic progression, consumption and trade. The hypothesis assuming that harmonization and integration of retail markets have a positive effect on consumption and trade development, was verified positively, mainly owing to the creation of a single euro payment area (SEPA). The particular studies also demonstrate that the subject impact of retail payments on economic growth is more visible in the eurozone states than in countries not belonging to the European monetary union. Analyzing positive aspects of non-cash transactions on domestic or world's economy, M. Cirasino and J.A. Garcia believe that this system facilitates executing trade transactions as well for consumers as for business entities, which is extremely beneficial for overall economy [Cirasino and others 2008: 1-78]. The major advantages of non-cash payment methods include: transaction speed and a sense of security [Ibid: 21]. O. Slozko and A. Pelo perceived a positive impact of non-cash payments on economy. In their explorations they proved there was a positive correlation between the rise in e-payments and gross domestic product increase. They concluded that using non-cash payments was strictly related to the extent a given country's economy was developed to [Slozko and Pelo 2014: 130-140]. On the one hand, greater welfare and rapid development of financial system in richer countries encourage consumers to make non-cash payments, on the other, this type of payments causes economy to significantly accelerate. O.S. Oyewole, El-Maude, J. Gambo, M. Abba and M.E. Onuh present a concurring opinion. Besides, they unanimously stated that only cash points influenced economy's development, while other electronic payment channels indicated harmful effects [Oyewole and others 2013: 913-918]. H. H. Tee and H. B. Ong analyzed the following consequences of accepting non-cash payments: cheque, pay card, telegraphic transfer – payment upon request in real time or offline mode, and e-money in the five EU countries such as: Austria, Belgium, France,

Germany and Portugal over the years 2000 – 2012 [Tee and Ong 2016: 1-9]. They concluded that impact of non-cash transactions on economic growth expressed by the proportion of gross domestic product (GDP) to the Consumer Price Index (CPI), could be observed only in a long-term perspective. It means that every single policy promoting non-cash payments does not influence economy immediately, but it proves its worth in the long run.

The latest findings on the discussed issue are published in annual reports of Moody's authors and analysts, that is V. Singh and M. Zandie [Zandie and others 2016: 1-31]. The research study based on macroeconomic data from 70 countries in the years 2011 – 2015 showed that retail payments contributed to trade and consumption increase, which consecutively succoured production and overall economy's development. On the sample analyzed, it was noticed that there was a positive relationship between penetration or using pay cards and economic growth. A considerable rise in using electronic payments, especially including credit cards or pre-paid debit cards caused an increase in consumption by 0,2% on the rising markets, by 0,14% in developed countries, additionally gross domestic product grew by accordingly 0,11% and 0,08%, which gave 297 billion dollars in total. The rise in using electronic payments makes economy more effective, reduces all transaction charges, and contributes to the improved flow of goods and services. As a consequence of rising popularity of non-cash payments in the tested period, overall employment growth by 2,6 mln could be observed in all of 70 countries. The greatest employability could be observed in China – averagely 427 thousands of new vacancies a year and India – 336 thousand. The investigation also revealed that the development and advancement of non-cash payments was not the only factor improving a country's welfare. To achieve the best possible result, a well-developed financial system and "healthy" economy are indispensable alike. In order to disseminate and promote non-cash turnover the report's authors encourage the state authorities to limit the regulations as possible, foster developing financial infrastructure and support consumption growth.

The above presented research results were mainly based on the analysis of influence of non-cash payments – mostly made by cards – on the components of global demand. A slightly different approach to economy's advancement and prosperity was exposed by other researchers – A. Jail or M. Idrees, who grounded their scrutiny of economic growth on studying a supply aspect and on transformations of Solow or Cobb-Douglas's production function [Jail and Idrees 2013: 383-388]. They attempted to assess or estimate the degree of education and technology advancement impact on producing domestic income in various economies. It is worth adding that not all researchers spotted a positive influence of non-cash transactions on economy. J. Park, with the use of macroeconomic data from 76 countries between 2002 and 2004, proved that the expansion of non-cash payments contributed to the repeated occurrences of corrupt dealings, which vastly lowered the quality of private investments and, which sequentially led to economic slowdown [Park 2012: 907-929].

On the example of Nigeria, C. N. Ezuwore-Obodoekwe, A. S. Eyisi, S. E. Emengini and A. F. Chukwubuzo discovered that citizens' greater activity in using non-cash payments led to the loss of the local central bank's autonomy [Ezuwore-Obodoekwe and others 2014: 30-42]. As a consequence of this, the central bank's monetary policy instruments are getting ineffective to control an interest rate and money supply. Velocity of money circulation causes prices to rocket. M. Allaham, H. Al.-Tarawneh and N. Abdallat thought likewise. Moreover, they unanimously believe that dissemination of e-money vastly reduces the central bank's demand for reserves declared by commercial banks, constrains the central bank's ability to control money supply and triggers the velocity of money circulation. It also entails the decline in international money supervision or the alteration of money multiplier [Al-Laham and others 2009: 339-349].

4. Non-cash payments as black economy deterrent

A very essential issue, which is relatively poorly studied, is an impact of non-cash payments on the volume of black economy. Grey zone is a common occurrence in almost each economy. It is basically defined as the segment of a country's economic activity that derives from sources that fall outside of the country's rules and regulations regarding commerce contributing to the official gross domestic product (GDP), but that is unrecorded [Schneider and Enste 2000]. The activities can be either legal or illegal depending on what goods and/or services are involved. It can be also defined as the part of a country's economic activity that is unrecorded, untaxed by its government and measured in percentage [Packard and others 2012]. A vast majority of research studies indicate that minimizing cash circulation in economy in favour of e-payments restricts black economy. This thesis is confirmed by periodic investigations performed by the professor F. Schneider and his research team from A.T. Kearney's consulting firm. According to Schneider's estimation in 2015 black economy in the EU-28 countries accounted for 18,3% of GDP [Schneider 2015: 6]. His explorations confirm the occurrence of strong correlation between the progression of e-payments and the volume of grey zone in economy of the states analyzed. In those countries where electronic payments are popularized within society such as: Great Britain or the Netherlands, black economy is not so prevalent in comparison with the states where this form of payment is not hugely promoted, like in Bulgaria or Romania. It is estimated that an increase in e-payments by 10% annually for at least four consecutive years may contribute to black money reduction by even up to 5%. Besides, on the example of different solutions applied in some countries, the report comes up with varied methods of promoting electronic payments [Schneider and Kearney 2001, 2013, Łapiński and others 2014: 15-16]:

- Italy – an obligation to make payments of over 1.000 euros online; tax allowances for e-payments (non-cash ones) in trade and service outlets, combined with fines for retailers who were proved not to give customers the purchase confirmation three times within five years;
- South Korea - an obligation to install a point-of-sale terminal in stores whose annual turnover exceeds 20.000 euros; VAT impairment for retailers applying e-payments and non-recurring tax deduction for citizens whose card expenses exceed 25% of their income (20% for credit cards);
- Singapore, Great Britain – acceptance of electronic payments by state institutions e.g. within employees' salaries, tax payments or fines;
- Columbia and Argentina – sales tax deduction on retail payments made with the use of pay cards.

The above examples confirm that non-cash transactions foster black economy reduction bringing its functioning limitations, which respectively translates into the rise in budget income and increased access to business entities' turnover. Taking into consideration that in economy public authorities are the predominant initiators and payees, non-cash transactions play an essential role. There are several recommendations: transferring public sector employees' remunerations, distributing unemployment benefits and pensions to individuals with the use of pre-paid cards, paying taxes and fines via the Internet, pay card or transfer [Schneider and Kearney 2013: 18].

In order to outline the possibilities of black economy reduction through promoting e-payments, grey zone resulting from unrecorded transactions was divided into an active and passive side. Within active black economy the parties do money transactions profitable for both of them. A good example of this can be a home improvement service without issuing an invoice in return for a lower price. However, in passive black economy only one party (vendor or service contractor) gains some profits due to undeclared income, but the other party (purchaser or service recipient) is either unaware of not declaring it or just accepts this

behaviour. An epitome here can be any unrecorded services by a proprietor of a restaurant, a hairdresser or a barber, where a customer pays for the given service in cash, however they do not ask for a receipt. The EY studies indicate that in case of the eight countries analyzed in Central and South Europe, that is: Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Poland, Serbia, Slovakia and Slovenia, passive black economy is responsible for a vast majority of unrecorded cash transactions. Implementation of any incentives and mechanisms promoting and disseminating electronic payments in case of active grey zone will not resolve the problem as both parties will use the cash saved. In this particular case cash is a consequence of grey market, but not the reason. It is different in the case of black economy's passive side as cash here fosters hiding transactions. Promotion of e-payments could vastly constrain the possibility of hiding transactions, which with time would lead to the reduction of passive black economy [Better Government EY Programme 2016: 1-3]. The EY report points out the actions which have already been implemented in several countries and which have become propitious for reducing the volume of passive black money [Ibid: 34-41]:

- obligation to pay salaries, including pensions and retirement benefits online (remunerations: Croatia, Slovenia; transfers: Denmark, Sweden, Uruguay),
- establishing the thresholds for consumer's maximum cash payments (Bulgaria, Slovakia, the Czech Republic),
- obligation to possess and use fiscal cash registers (Poland); fiscal printers and all fiscal devices are connected online through the Internet to the monitoring system (Croatia, Serbia, Slovakia, Hungary),
- development of payment infrastructure – obligation to possess and use point-of-sale terminals (POS) (South Korea),
- receipt lotteries (Poland, Slovakia, Croatia, Bulgaria, Taiwan, Brazil)
- tax incentives for consumers making e-payments (South Korea, Brazil – Sao Paulo, Columbia),
- tax deductions for vendors (South Korea, Uruguay),
- tax on cash withdrawals (Ireland).

A state making use of appropriate control and repression tools tries to combat black economy, however these actions refer to the places where illegal activity has already occurred. According to the Research Institute of Market Economy, in order to reduce the volume of black money transactions some preventive measures are much more effective. Prevention here means creating some economic regulations which will discourage entrepreneurs from hiding their business activity away from revenue office [Łapiński and others 2014: 16].

5. Non-cash charges

D. B. Humphrey, M. Willesson and others investigated the expenses of sending (or receiving) payments incurred by banks, vendors and other parties of transactions on the example of twelve European countries in the years 1987 – 1999 [Humphrey and others 2006: 1631-1652]. Their findings proved that a state which would fully switch its payment paper system to an electronic one could generate some gains up to 1% of GDP annually or even more. A thorough analysis also revealed that bank charges connected with payment service in twelve European countries had been lowered averagely by 45%, which is a consequence of an increase in online payment market share from 43% up to 79% in 1987 – 1999. Besides, transaction charges were reduced because of constantly decreasing market share of valuable cash payments, a well-developed electronic payment system, an increased volume of e-payments, and the reduction of telecommunication costs stemming from technology advancement or deregulation. In addition, lowering non-cash charges is caused by continually

rising competition on the telecommunication market as well. In another elaboration the above mentioned authors highlight that the cost of non-cash transactions in particular states may differ depending on: the kind of payment instrument used, frequency with which a given instrument is used and the degree to which e-payment technology is applied in paper form. Furthermore, their explorations show that the expansion of cash dispensers in the place of launching costly bank subsidiaries caused the proportion of bank operational costs in Europe to their total amount of assets to fall by 24% in the period analysed [Humphrey and others 2003: 159-174]. S. C. Valverde, D. B. Humphrey and R. L. del Paso reckon that increased use of ATMs related to their enlargement had a huge impact on lowering non-cash charges. As a result of investigations conducted over the years 1992-2000 in Spain, bank operational costs have dropped by 37%, which allowed to save approximately 4,5 mln euros constituting 0,7% of GDP [Valverde and others: 2004: 1-17].

S. Carbo, D. Humphrey, R. Lopez and others observed 1541 commercial banks in Spain in the 1992–2000 period. The outcomes of those observations displayed that incremental replacement of cash payments by non-cash, electronic transactions and the parallel development of cash dispensers or reduction of bank subsidiaries in the analyzed period allowed the Spanish bank sector to save 5 billion euros. In this period some limitations on costly cheque transactions, which are so popular in the Spanish payment system, were imposed. Moreover, in the above mentioned authors' view their findings were unequivocal in confirmation of the fall in bank operational unit costs by 35% and estimated transaction charges by 47%. All above dips were payment change-related consequences. This reduction was caused by an increase in non-cash payments by 85%, a rise in credit and debit cards spending by 78% and a fall in cheque payments by 18% [Carbo and others 2002].

Similar conclusions were drawn by O. Gresvik and G. Øwre [Gresvik and Øwre 2002: 125-133]. The aim of their research study was to identify the structure of transaction expenses and denote the correlation between payment system, product/ service price and costs. From the authors' point of view prices should reflect the product/ service value and the cost of producing it. The prices which mirror relative production costs of various payment services are inviting for their recipients to be able to choose services which will satisfy consumers' needs at the lowest possible costs. This approach leads to efficient resource exploitation and increased effectiveness of payment system. In this paper the results of research on cost formation were presented. Seven banks took part in the research study. As a consequence of disseminating non-cash transactions, the costs incurred by banks show a downgrading tendency during the 1988 – 2001 period from 1,93€ up to merely 0,73€, which means the costs were reduced by 62% but the volume of transactions doubled. A scale effect and decreased e-payment costs entailed the reduction of unit costs.

The European Central Bank (ECB) carried out a study on the social and private costs of different payment instruments with the participation of 13 national central banks in the European System of Central Banks (ESCB). Social costs of retail payment instrument are associated with the workload and capital incurred in favour of a given payment service [Brits and Winder 2005: 13-18, Bergman and Guibourg 2007: 4-6]. It shows that the costs to society of providing retail payment services are substantial. On average, they amount to almost 1% of GDP for the sample of participating EU countries. Half of the social costs are incurred by banks and infrastructures, while the other half of all costs are incurred by retailers. The social costs of cash payments represent nearly half of the total social costs, while cash payments have on average the lowest costs per transaction, followed closely by debit card payments. However, in some countries, cash does not always yield the lowest unit costs. Despite countries' own market characteristics, the European market for retail payments can be grouped into five distinct payment clusters with respect to the social costs of payment instruments, market development, and payment behaviour. The results from the present study

may trigger a constructive debate about which policy measures and payment instruments are suitable for improving social welfare and realising potential cost savings along the transaction value chain [Schmiedel and others 2012: 1–49]. The fact that the proliferation and dissemination of non-cash transactions contribute to the reduction of transaction fees and thereby improve the flow of goods and services, was acknowledged in the report prepared by the Moody's Analytics [Zandi and others 2016: 1-31]. D. D. Garcia-Swartz and others stated that resignation from cash and cheques in favour of non-cash payments is economically profitable. Their analysis indicates that some groups, especially consumers can benefit from this revolutionary change. In their findings they concluded that electronic payments were far cheaper for the society than paper forms of payment. In the case of stores accepting card payments, credit card payment is frequently linked with possessing a loyalty card, which means that such transactions have the lowest social limit net cost [Garcia-Swartz and others 2004: 199-288, Chande 2008]. The Dutch society was also scrutinized in terms of non-cash payment cost effectiveness [Bolt and others 2010: 1738-1744]. The study shows that in 2002 the most effective form of payment for the purchases below 11,63€ was cash. Applying extra charges by retailers led to the insufficient usage of debit cards. It shows that consumers are susceptible to price incentives as well. In the authors' view eliminating any charges for using debit cards should have a positive impact on cost effectiveness. Through positive scale effects or higher volumes of debit card payments, banks can introduce a lower charge on debit card transactions. The studies reveal that the withdrawal of charges on debit card transactions will lead to an increase in the number of debit card payments and reduce the use of cash. The simulations imply that debit card payment share in the total number of transactions will grow on average by 8%, which indicates the savings up to 50 mln €. The analysis carried out by K. Takala and M. Viren mainly focuses on the expenses and payment effectiveness on the example of Finland [Takala and Viren 2008]. Their investigations demonstrated that the total costs for providing retail payments in Finland accounted for merely around 0,3% of GDP. They also perceived that in Belgium, the Netherlands and Sweden unit costs of cash and card transactions seemed to be at the same level.

O. Gresvik and H. Haare conducted a comprehensive study on social costs of using pay cards and cash on the territory of Norway in 2007 [Gresvik and Haare 2009: 16-27]. They estimated the expenses of payment services at approximately 11 billion NOK being an equivalent of 0,49% of GDP, which is comparable to the total social cost of payment services in Sweden in 2002 that reached 0,4% of GDP [Bergman and others 2007]. The major reason for this lies in a relatively low proportion of cash transactions in comparison with the ratio of debit card usage. Furthermore, the decline in transaction fees was accompanied by the increase of banks' productivity and efficiency.

6. Conclusion

A vast majority of the studies conducted imply a positive impact of non-cash transactions on economic growth. It mainly stems from reducing transaction fees, improving the whole payment system and a positive influence of non-cash payments on overall consumption and investments. The expansion of electronic payments – through the increased transparency of funds flow – fosters limiting gray market in economies. The reports concentrate on promoting e-payments through diverse actions taken by most of countries in the world. In general, the key results of the studies show that a state which will fully switch to electronic payment system, leaving behind a paper one, may report the savings amounting to at least 1% of GDP annually. However, the development of payment system and consumers' choices of payment forms depend on many factors. The above choice is determined by the site, available infrastructure, and the costs of using the given funds. Demographic

determinants and out-of-price features of payment instruments like security, comfort or transaction speed influence this choice as well.

Analyzing the detailed conclusions related to the influence of non-cash turnover, it is worth pointing out that its impact on long-term expansion of the economy's capacity my differ depending on the form of making non-cash payments. In spite of the positive correlation proved, their range is not still known and it is hard to define it. Different models applied in particular research studies and investigations imply that non-cash payments boost a country's economy.

The findings also suggest that the impact of the above growth on economy be different according to a given country's economic advancement. There is still a question what determines the direction and leverage of the mentioned impact on economic growth in various countries. In this case the results are ambiguous.

Referring to limiting gray market, non-cash turnover seems to be a tool supporting a country's economic policy, nevertheless, it is not sufficient to eradicate untaxed transactions flow in economy. The outcomes of explorations pinpoint that in the case of every country overregulated, black economy allows to accelerate the actions or achieve extra and unintended results. In this field there are lots of loopholes depending on a region or a country.

Non-cash transactions costs are a crucial factor affecting the implementation of non-cash payments in economy. However, study-based disparities in the volume of these costs towards GDP and inability to compare the examinations (different countries, different sample periods) make the findings incomparable. It should be distinctively stated that the existing literature does not comprise studies on the cost-volume-profit analysis in strict dependence on a given country's economic development.

Implementation of non-cash transactions is connected with a number of challenges and implications for the society that is to be deprived of material funds, that is a conveyor of value which has been accompanying them for a few thousand years. Undoubtedly, social and demographic factors are meaningful here. Analyzing the determinants of implementation and effectiveness of non-cash turnover there are still lots of loopholes. There arises the question what social factors vastly constrain the employment of non-cash transactions – an attempt to formulate the recommendations.

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Low Price Anomaly And Capital Market Trends - Case of Warsaw Stock Exchange

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Abstract: *According to capital market efficiency theories, financial assets are priced correctly. Meanwhile, as research conducted in the area of behavioral finance, investors cannot properly evaluate assets, and the irrationality of their behavior is often collective. This results in a number of anomalies. Following article concentrates on low – price anomaly that describes the phenomenon in which the value of low – priced stocks grows faster comparing to high – priced stocks. The main aim of this study is to verify the phenomenon of low price anomaly on the Polish capital market. The author verifies the hypothesis: On the Polish stock capital market, low – priced stocks generate statistically higher returns than high – priced stocks but depending on the period and market conditions, the price range of the low price anomaly is different. Study was conducted on the example of the Polish capital market. The study covers the period from 1998 to 2013, where the sub-periods of decline and the upward trend of the market (bulls and bears) were set. Shares were split at face value of unit prices, taking into account the stock price structure, and then the low price anomaly was verified. Methodology is based on descriptive statistics, analysis of variance (ANOVA) and non – parametric tests. The results of the study partly confirm the research hypothesis.*

Keywords: behavioural finance, low price anomaly, investment decisions, Warsaw Stock Exchange

JEL codes: G02, G11

1. Introduction

By referring to capital market efficiency theories, financial assets are priced correctly, prices contain complete information available and provide the best approximation of the real value of securities. Under the assumptions of market efficiency hypothesis, according to Fama [1970], we can maintain that asset valuation by investors is rational and strives to maximize the utility of the investor through proper and rapid processing of all available information [Gajdka, 2013]. Meanwhile, as research conducted in the area of behavioral finance, investors cannot properly evaluate assets, and the irrationality of their behavior is often collective. It is possible to distinguish specific patterns of behavior and stimuli that condition them.

The low price anomaly describes the phenomenon in which the value of low unit price shares grows faster compared to stocks with relatively high unit price. Following the logic, the stock price should not affect investor decisions. If the market was an effective stock price market at all times, it would reflect their value and achieving an above-average return would not be possible. Meanwhile, the results of research in this area are not clear. Research shows both the lack of investors' reactions to attractive, low-cost shares, for example in the case of split, as well as reverse phenomena - where expensive shares generated higher returns than low-price shares.

The main aim of this study is to verify the phenomenon of low price anomaly on the Polish capital market. The author verifies the hypothesis: On the Polish stock capital market low – priced stocks generate statistically higher returns than high – priced stocks, but depending on the period and market conditions, the price range of the low price anomaly is different. According to the author, economic situation may be one of the factors determining the strength and range of occurrence of low price anomaly. With the change of the stock market period from prosperity to the downturn investor sentiment changes, what strongly affects the investment decisions of individual investors. In the case of the Polish capital market there are also changes in the price structure of shares and increase in the number of so-called penny stocks, which among both stock analysts and investors are perceived as junk.

Study was conducted on the example of the Polish capital market. The study covers the period from 1998 to 2013, where the sub-periods of decline and the upward trend of the market - bulls and bears - were set. Shares were split at face value of unit prices, taking into account the stock price structure, and then the low price anomaly was verified. Methodology is based on descriptive statistics, analysis of variance (ANOVA) and non – parametric tests. The results of the study partly confirm the research hypothesis.

The structure of the article takes into account theoretical considerations in the area of heuristics affecting investment decisions and price perception by investors, in particular price clustering and price rounding, and review of research results in this area. The study methodology was then discussed and conclusions were drawn. The study concludes with the discussion on the results and the direction of further research.

2. Price perception in the decision-making process

In the decision-making process, the psychological aspects of the process of evaluating people are fundamental. In the area of economic psychology there are many examples of limited usability models based on the rationality of decisions, such as sudden and impulsive shopping decisions, excessive risk aversion, overestimation or underestimation [Zaleśkiewicz, 2015].

One of the keystones underlying behavioral theories that try to explain the described phenomenon is Kahneman and Tversky's theory of perspectives (1979) with its main premiss: to determine whether something is positive or not, the decision-maker assumes some point of reference. At this point the most important are heuristics of anchoring and customizing, for example a simplified method of inference that relies on anchoring the mind on the selected information and then interpreting other data with respect to it.

Heuristics of anchoring and customization is widely used in marketing. In this area, a number of measures are taken to change the perception of the consumer in the manner

expected by the entity. A common example is the comparison of the current price with the earlier price of the same product or the price of the similar product (anchoring effect) or the treatment of the price as a multiple of lesser value, for example instead of PLN 1175, the price is given as 5 x 235 PLN [Falkowski, Tyszka, 2006].

Another phenomenon affecting consumers' perception of prices is the effect of price caps. This affects how the text is read - including the digits - from left to right with greater concentration on left rather than right side values, that are often ignored. As a result, for products whose price was ending with 99, more sales were recorded than in case of prices of products ending with 95 [Schindler, 2006]. Another example of this effect is the reaction of consumers to price reductions - a change in price from 2.50 to 2.19 will be less noticeable - both prices are still seen as over 2 PLN - than a change from 2.20 to 1.99 - where the price tip 0.99 is ignored and the price is perceived as closer to 1 PLN, although nominally the difference is higher in the first case. Even more powerful is the price that exceeds certain price levels, such as the value of coins, for example 0.99, less than 1 PLN, 4.99 PLN - less than 5, 99.99 PLN - less than 100.

The importance of price perception, widely explored and used in the consumer goods market, also seems to be important in the capital market.

3. Share price and behavior of stock market investors

The market price of shares is determined by the demand and supply of shares of a given entity, which is conditioned by both rational premises and unreasonable investor behavior [Wnuczek, Mielcarz, 2009]. A number of phenomena occur around the nominal stock prices.

Thaler [1985, 1999, 2008] was the author of the concept of mental accounting, derived from the perspective of Kahneman and Twersky. One of the four principles is the principle of distributing profits. It is understood that the investor gets more satisfaction from several smaller profits than from one larger, which is the sum of the smaller ones. In this case, at a lower unit price, the potential loss seems to be lower, even if there are multiple shares - the cost is considered separately for the individual shares.

The results of the Neiderhofer [1965, 1966], Neiderhoffer and Osborne [1966], Harris [1991] and others studies show that investors are more popular with stocks whose price ends with a whole or a half or less than quarters or eighths.

Goodhart and Currio (1990) observed the decimal price clustering phenomenon. The price clustering quoted by Harris [1991] and Grossman [1995] reflects implicit agreements in price negotiations. Rounding up prices speeds up and simplifies negotiations. The theory of Christie and Schultz [1994], developed by other authors (for example: Godek [1996], Kandel and Marx [1997]) refers to the use of price clustering as a way of maintaining a larger spread than would be the case in full competition. According to Kahn et al. [1999] indicate that sellers exploit the advantage of *memory-economizing* with investors who tend to cut the observed prices rather than memorize their full value or round off the price and only then remember it. Such behavior is also observed in other markets.

Kandel, Sarig and Wohl [2000] point out that, on the equity market, in the case of an IPO, investors prefer rounded prices. According to the authors, the demand for shares is conditioned by the last digit of share price. For prices ending with 0 and 5, demand for stocks

is relatively higher, while prices ending with 0 being used more often than prices with ending 5. Investors participating in IPO transactions tend to use higher prices. In the case of an IPO, pricing strategies or agreements that cannot be negotiated to reduce transaction costs, so the authors explain the inclusion of investors as more frequent use of rounds.

4. Anomaly of the low price on the capital market

There is a number of definitions in the literature on the term "anomaly". The simplest says that anomaly is a phenomenon different from the rule, deviation from the expected result. In the context of the capital market, anomaly means the possibility of reaching positive, above average rates of return [Czerwonka, Gorlewski 2012]

Hwang and Lu (2008) have shown that the stock price is significant and inversely proportional to the return rates. Low price shares, like penny stocks, with a price less than or equal to $ 5, achieve an average of higher returns than expensive shares valued above $ 20. According to the authors, the strategy of buying low-price shares can bring above-average returns. The profitability of this pricing strategy is consistent throughout the 2-year period, even after taking into account transaction costs, moreover it is independent of other parameters such as company size, liquidity, book value to market value, earnings per share and past performance.

The average rate of return typical for low-price shares, known as penny stocks, compared with relative high yields returns, Hwang (2008) explains as the phenomenon of nominal price illusion. If there are two values with the same characteristics and a significantly different nominal price, the same rate of return causes the absolute increase in share price to be higher for shares with a higher nominal price. Investors naively interpret this phenomenon, claiming that high priced shares are too expensive and expect low price shares to rise at a faster rate. In this perspective, if managers are aware of the preferences of investors, they will maintain low share prices to maximize their value.

Price illusion is one of the hypotheses justifying the splits. Brennan and Copeland [1988], as well as Ikenberry, Rankine and Stice, [1996] explain that managers perform split, signaling that the company is in good shape and are convinced of its profitability and ability to generate positive cash flows in the future. The hypothesis of the optimum-range indicates that the division of shares is aimed at attracting attention and gaining smaller shareholders. This is one of the most common explanations of the division of shares, but the results of research in this area are ambiguous. In some studies, there is an increase in the number of investors after splitting, for example described by Lamourex and Poon (1987), Amihud and Mendelson (1988). Other studies point to the lack of investor reaction to splits (Mukherji, Kim and Walker (1997) Shares with low nominal price are more accessible, especially for minority investors. If more investors are able to buy low priced shares, their liquidity is expected to increase, see further in Baker and Gallagher, 1980; Muscarella and Vetsuypens, 1996; Schultz, 2000.

On the Polish capital market research in the area of low price anomaly is conducted relatively rarely. The study of Zaremba, Zmudzinski [2014] and Zaremba and others [2015,242-260; 2016,163-174] were carried out on the Polish market and covered the period 2000-2014. The authors have divided the price share based on quintiles. In this way, it was verified whether stock-based strategies yield higher returns, taking into account factors such

as company size, value and growth companies, winners and losers. The study shows that on the Polish capital market there is a reversed effect of low prices and thus the situation in which high nominal companies record significantly higher rates of return than relatively low-cost companies.

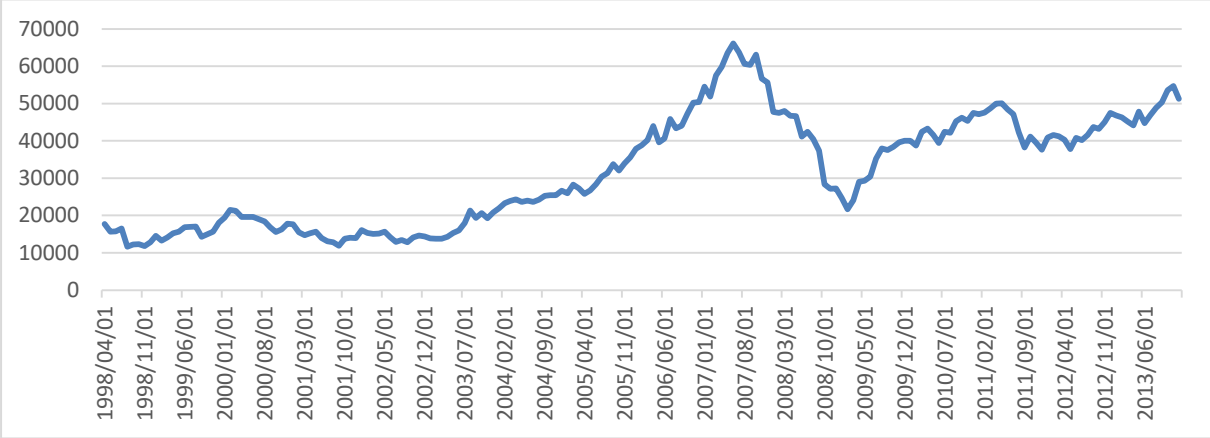
The study conducted under this article is based on studies by Zaremba and others. However, it presents a slightly different approach to how price ranges are estimated. According to the author, the phenomenon of low price anomaly occurs in defined price ranges, conditioned by the perception of prices by the investor. Analyzes carried out over the effect of anchoring in merger and acquisition transactions [Biegańska, Jasiniak, Pastusiak, Pluskota, 2016, 451-446] have shown that higher yields were obtained when buying the cheapest shares of the companies acquired 3 months before and during the merger. This study is a continuation of previous considerations.

The research uses the notes contained in stock exchange recommendations to identify companies that are expected to increase stock prices and companies of inheritance. This action was aimed at separating companies to verify the phenomenon from a profit perspective and the risk of loss.

5. Research Method

The study was conducted on the Polish capital market. The scope of the study covered the period starting from 1st of April 1998 and ending 1st June 2016. Basing on the Warsaw Stock Exchange Index chart covering these dates, intervals of ups and downs on the stock exchange were set.

Figure 1. Warsaw Stock Exchange Index graph from described period.



Source: stooq.pl, Access 20th May 2017

Based on the course of trading observed on the Warsaw Stock Exchange Index, the following periods of economic situation could be extracted:

1st period – between 1st April and 1st July 2007 – bull market;

2nd period – starting from 1st July, ending on 1st of January 2009 – bear market;

3rd period – from 1st January 2009 to 1st January 2013 – bull market.

Afterwards the rates of return in the individual price groups of shares were analyzed. Shares were split at nominal prices based on currency nominal values and by adjusting

thresholds to current market conditions, see: Table 1. In the case of the Polish capital market, changes in the stock price structure and the increase in the number of shares during so-called penny stocks, which both among stock analysts and investors are perceived as junk. In this perspective, the phenomenon of low price anomaly may be expected to be different, due to the fact that a certain price group of shares with the lowest nominal price will be perceived as the junk as too cheap to buy.

Table 1. Price groups of shares in described periods

Period	**Price groups**	**Size in subgroups**
1st period	Up to 5 PLN	261
	From 5 to 10 PLN	194
	From 10 to 100 PLN	2904
	From 100 to 200 PLN	678
	Above 200 PLN	272
2nd period	Up to 5 PLN	109
	From 5 to 10 PLN	127
	From 10 to 100 PLN	1139
	From 100 to 200 PLN	340
	Above 200 PLN	327
3rd period*	Up to 0,5 PLN	25
	From 0,5 to 1 PLN	45
	From 1 to 5 PLN	766
	From 5 to 10 PLN	557
	From 10 to 100 PLN	3194
	From 100 to 200 PLN	643
	Above 200 PLN	485

* in case of 3rd period results for both basic 5 unit and expanded 7 unit price groups were given.

Source: own elaboration

The rate of return analysis was carried out in annual and quarterly time horizons. Methodology is based on descriptive statistics, analysis of variance (ANOVA) and non – parametric tests.

Table 2. Low price anomaly from the perspective of annual rates of return

Price group [PLN]	**1st period bull market**		**2nd period Bear market**		**3rd period bull market**	
	Aver.	St. Dev.	Aver.	St. Dev.	Aver.	St. Dev.
< 5	0,0472127	0,49251	-0,289477	0,58664	-0,0298231	0,63759
5 - 10	-0,0971039	0,59564	-0,274827	0,75863	-0,0077894	0,49738
10 - 100	0,0381584	0,55544	-0,279174	0,68763	-0,0305803	0,45657
100 -200	-0,0648439	0,53963	-0,597842	1,0194	-0,0379007	0,44216
>200	-0,131812	0,68990	-0,621143	1,0407	0,0485163	0,53631
average	0,00568099		-0,387275		-0,0223594	

F - Stat	11,1927	18,41	3,01494
P-value	4,93e-009	7,15e-015	0,0170

Source: own elaboration

The results of ANOVA variance analysis show statistically significant difference in average return rates for particular price groups of shares and for particular time periods. The hypothesis about the low price anomaly on the Polish capital market from the perspective of annual return rates was confirmed.

In the 1st period, when the stock market booms, shares with a nominal value of up to PLN 5 generated positive, above average returns. During this period, shares with a transaction price of PLN 100 or more reported average negative returns. In the second period, stock market fluctuations were noted. The average rate of return at that time was negative and amounted to -0.3873. However, cheap shares - in the price up to 5 PLN less than expensive shares priced above 100 PLN. This difference is almost double. One can notice a tendency that the more expensive the shares, the greater the loss. Both in 1st and 2nd period, shares above PLN 200 generated more losses than shares with a nominal price ranging from PLN 100 to PLN 200.

In the 3rd period, with the division of shares as in the previous variants, the reverse phenomenon can be observed. High-price shares generate an average of higher returns than stocks with a low nominal price. This is confirmed by the conclusions observed by Zaremba and others [2015]. Nevertheless, it should be noted that the price structure of the shares has been somewhat fragmented and the proposal to extend the division of cheap shares to additional subgroups has increased. This division, as before, is dictated by the monetary denominator in the economy.

Table 3. Low price anomaly from the perspective of annual rates of return

Price group	**3rd period - bull market**	
	Aver.	Std. Dev.
Up to 0,5 PLN	-0,149766	0,71997
From 0,5 to 1 PLN	0,12798	0,78283
From 1 to 5 PLN	-0,0351789	0,62469
From 5 to 10 PLN	-0,00778941	0,49738
From 10 to 100 PLN	-0,0305803	0,45657
From 100 to 200 PLN	-0,0379007	0,44216
Above 200 PLN	0,0485163	0,53631
Overall average	-0,0223594	
Statistics F	3,02797	
Value p	0,0059	

Source: own elaboration

Based on the above data it can be stated that in the 3rd period the phenomenon of low price anomaly also occurs, however, concerns cheap shares in the range from PLN 0.50 to PLN 1. This group recorded an above average return rate, significantly higher than in the case of expensive shares. In the case of expensive shares, only those above PLN 200 were

characterized by a positive return. There is also a group of so-called junk stocks that generate above-average losses, which are shares up to 0.50 gr.

6. Discussion and conclusions

The aim of this article was to verify the phenomenon of low price anomaly on the Polish capital market. As the survey results show, on the Polish capital market cheap shares are growing faster than expensive shares and the relationship is statistically significant. This phenomenon occurs independently of the business cycle, although of course, in the case of economic downturn, the rate of price decline is lower than the upward tendency - here it is also noted that cheap shares are lower than slower than expensive shares. The precise area of division of the analyzed time period into periods of stock market rises and falls can be discussed here. The study carried out in this context is of a preliminary nature and is a proposition - the observed relationships justify further research in this area.

Another issue is the pre-determined criterion of price division. The proposal to divide the shares by denomination of money is sort of an alternative and has been taken from the results of research conducted on the market of consumer goods. Different solution would be dividing the sample into quartiles, which would be statistically justified, however, the sample distribution is not normal as in this perspective limiting inference and more detailed analysis of the phenomenon.

The additional conclusion that has arisen in the course of the analysis is the existence of a group of shares with the lowest price, which in the analyzed period generated average above average losses. It can therefore be assumed that there is a group of shares that are too cheap for an investor to buy, which suggests that there are psychological determinants of investment decisions based on the nominal value of the stock. Undoubtedly, it is worth conducting further research in this area.

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Centrality Measures In Network Analysis: Learning From The VCG Mechanism

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Abstract

In this work we show that some centrality measures in network analysis are exactly an application of the principles underlying the well-known Vickrey-Clarke-Groves (VCG) mechanism. In doing so, we stress that the centrality of any element partially depends on the positive and negative externalities which it generates on all other elements, where positive externalities arise when the centrality of other elements benefits from the presence of the element in the network, while negative externalities emerge in the case that the existence of the element reduces the centrality of other elements. We then present specific examples of completely different frameworks which highlights how these centrality measures à la VCG can indeed provide valuable information to fairly assess the importance of the analyzed network elements. They also point out how measures à la VCG could overcome traditional centrality measures in estimating the true importance that an element has in the overall network environment.

Keywords: Network analysis, Centrality measures, VCG mechanism, Externalities

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Introduction

In network analysis framework, several centrality measures have been defined in the literature with the aim of studying the structure of the network and, in particular, identifying the most important elements (e.g. nodes or links) of the network (see Koschützki et al. 2005, Newman 2010). These measures have been effectively applied in many different contexts, such as, for instance, in telecommunications, railways, air transport, postal services, social networks, organization theory and design, data networks. Depending on the specific context the centrality measures are referring to, they represent completely different meanings: independence, risk, power, consensus, competence, knowledge transfer, influence, leadership, value, employment opportunity, brokerage, innovation performance, reputation.

Any proposed measure is based on some criterion aimed to answer what is the concept of centrality, what centrality should represent, and which structural properties an effective centrality measure should have. For instance, Freeman (1977, 1979) observed that the properties of the center of a star-shaped network could be applied to define the characteristic of suitable centrality measures. Thus, he provided a formulation of the well-known betweenness centrality of a node, which gets its maximum value exactly for the center of a star-shaped network. In particular, betweenness centrality of a node is based on the assumption that shortest paths are the drivers of any consideration about the centrality of a node, since the resources of a network are most efficiently used when the content of the linkages (e.g. traffic, information) follows shortest paths. In fact, betweenness centrality measures the degree to which a node is on shortest paths connecting pairs of other nodes (it considers the number of shortest paths from any node to all others that pass through that node).[12]

Stephenson and Zelan (1989) relaxed the assumption that the content of the linkages have to spread exclusively along shortest paths, while providing propagation models where arbitrary paths can play a role. Newman (2005) shared such a point of view and defined a version of node betweenness centrality which includes further paths between nodes, although the shortest ones are considered more crucial than the others (in particular, it computes how often any given node falls on a random walk between another pair of nodes). In Borgatti (2005), a dynamic view of the centrality concept is proposed, in the sense that the importance of a node in a network is based on how traffic/information actually flows through the network. A weighted version of betweenness centrality is then introduced in Borgatti and Everett (2006), where all shortest paths are weighted inversely proportional to their length, as the authors assumed the principle that the longer a path, the less significant it is to determine the centrality of the elements. Furthermore, Gómez, Figueira and Eusébio (2013) observed that single dimensional metrics are not effective for dealing with many real-world problems and thus they extend some classical centrality measures to take into account several dimensions (e.g. flows between pair of nodes and cost associated with communications).

[12] Unfortunately, the computational effort to exactly determine the betweenness centrality can exponentially grows with the size of the network. In fact, identifying algorithms to compute effective approximations of betweenness centrality is a significant research topic in the network analysis framework. However, in this work we are not interested to computational aspects of the centrality measures.

An unlike centrality measure is proposed in Janssen and Monsuur (2013), where the criticality of a node depends on a subset of predefined essential nodes and on how the connections of the node to the essential ones relate to the connections of the other nodes to the essential ones.

Following a game theoretical approach to the concept of power, Gómez et al. (2003) applied the Shapley value to assess the power of any node within a given network and defined the centrality of each node as the marginal contribution of its power, namely, as the difference between the power of the node in a constrained game (which is generated by taking into account the restrictions in the communication due to the structure of the network) and the power of the same node in the original game.

In a later paper, the idea of considering the (somehow defined) marginal contributions of the elements as the linchpin of the centrality concept has been newly applied. In particular, Everett and Borgatti (2010) proposed a new paradigm to measure the centrality of the network elements, based on taking into account both a direct contribution of the element to the overall network centrality and an indirect contribution of the same element to the centrality of all other elements. By following the same principle of marginal contribution, in Saito et al. (2016) influential nodes in a social network are identified as those ones that, if removed, largely reduce the information spread.

In this work, our first contribute consists of analyzing and interpreting some basics of centrality theory by showing how the new centrality measures introduced by Everett and Borgatti (2010) are exactly an application of the well-known Vickrey-Clarke-Groves (VCG) mechanism (Ausubel and Milgrom 2002, Pekeč and Rothkopf 2003) to the context of centrality measures.[13] Second, we present some examples of completely different frameworks where applying the principle underlying the VCG rule indeed provides valuable information for a fair assessment of the actual centrality of the analyzed network elements.

This paper is organized as follows. Section 2 briefly illustrates those characteristics of the VCG mechanism which will be recalled later in the paper. Section 3 shows that the approach proposed in Everett and Borgatti (2010) is an application of the VCG mechanism. Section 4 presents some examples to point out how centrality measures à la VCG can provide valuable information. Finally, Section 5 concludes.

The VCG mechanism

In this section we illustrate how the VCG mechanism works in a setting which is very general and effective to introduce the main ideas in next sections. In particular, let us consider an auction framework, where:

[13] Vickrey-Clarke-Groves (VCG) mechanism (Vickrey 1961, Clarke 1971, Groves 1973), also known as the generalized Vickrey auction, is the generalization of the second-price Vickrey rule for single-item case and can be applied in the context of combinatorial auctions. It is largely studied by the economics, computer science and operations research communities.

- The auction is direct, namely the auctioneer sells items while the participants offer to buy them.

- $n \geq 2$ rival participants with independent and private valuations and with no budget constraints take part in the auction. Let T be the set of the n players.[14]

- $m \geq 1$ items are simultaneously auctioned off. Although some of the items on sale could be identical, each item is uniquely determined (thus, every possible copy of an object is identified separately). Let H be the set of the m items.

- Any bidder is allowed to submit offers for any set of items on sale (bundle). Bidding for a bundle means that if the bid is selected as winning, then all the items in the bundle must be allocated with the player who submitted the offer.

- The auctioneer has to choose the winning bids taking into account that some pairs of bids are incompatible, i.e. they cannot be both simultaneously selected as winning. In particular, every player can transmit information to the auctioneer on which bids (among the ones he has announced) are incompatible; moreover, the auctioneer himself consider as incompatible any pair of bids which share an item (both if submitted by the same player or by distinct players).

In the relevant literature, such a format is referred to as combinatorial auction format (Rothkopf, Pekeč and Harstad 1998, Pekeč and Rothkopf 2003, De Vries and Vohra 2003, Avenali 2009, Moulin 2010, Ashlagi and·Serizawa 2012). Submitting bids on bundles and signaling incompatibilities among these bids to the auctioneer allow the players to model and manage possible complementarity/substitutability relationships among items[15], and therefore to offer up to their valuations without running the risk of undergoing irrational allocations (Avenali and Bassanini 2007).

Under the so-called *first-price rule*, items are allocated to those players who offer for them at the most (winning bids are identified by maximizing the auctioneer's revenue[16]), and each player has to pay to the auctioneer exactly what he has offered in his winning bids.

As known, under the VCG rule, what players win depends on what they offer, while what they pay depends on what opponents offer. In particular, winning bids are identified by maximizing the auctioneer's revenue (as the first-price rule does), while any player $t \in T$ has to pay to the auctioneer an amount which reflects the *externality* generated on the other

[14] Assuming players with independent and private valuations means that no valuation changes across the auction course; therefore, for instance, a bidder does not alters his valuations even if he discovers opponents' valuations or in the case when some specific items are being won by other participants.

[15] Complementarity occurs when a player values a bunch of items more than the sum of the values of every single items, while substitutability when he values the set less than the sum.

[16] In general, alternative sets of winning offers that ensure the same (maximum) revenue can exist. If any, ties are broken randomly. In particular, the order in which these sets are found along the computation phase depends on an identifying label assigned to each submitted offer before starting the computation; such labels are randomly assigned.

bidders by player t's participation in the auction[17]. In fact, the VCG payment of bidder t (denoted by p_t^{VCG}) is equal to the summation of the externalities imposed on every player $j \in T - \{t\}$, each one equal to the difference between the value of the winning bids of player j when bidder t does not participate in the auction (let us denote it by $p_{j,-t}$) and the value of the winning bids of player j when player t takes part in the auction (denoted by p_j), that is, $p_t^{VCG} = \sum_{j \in T-\{t\}} (p_{j,-t} - p_j)$. By letting p_t be the value of the winning bids of player t when all players take part in the auction, and by setting $p_{-t} = \sum_{j \in T-\{t\}} p_{j,-t}$ and $p = p'_t + \sum_{j \in T-\{t\}} p'_j$, then we can rearrange the expression of p_t^{VCG} as difference between the total value of the winning bids of the other players when bidder t does not participate in the auction (i.e. p_{-t}) and the total value of the winning offers of the other players when player t takes part in the auction (which is equal to $p - p_t$,), namely, $p_t^{VCG} = \sum_{j \in T-\{t\}} (p_{j,-t} - p_j) = p_{-t} - (p - p_t)$. Moreover, since $p_t^{VCG} = p_{-t} - (p - p_t) = p_t - (p - p_{-t})$ and p_t is the summation of the prices offered by player t for his winning bids, the VCG rule imposes a discount equal to $\dot{p}_t = p - p_{-t}$ on the overall offered price p_t , that is, $\dot{p}_t = p - p_{-t} = p_t - p_t^{VCG}$. By construction, p_t^{VCG} is nonnegative for any $t \in T$. Definitively, the revenue the auctioneer obtains by means of the VCG rule is $p^{VCG} = \sum_{t \in T} p_t^{VCG}$.[18]

Let us consider the following example with 3 bidders and 2 items; player a is interested in the pair of items Y and Z, and values them at 50, while bidder b values item Y at 60, and player c values item Z at 40. For simplicity, let us assume that they offer up to their valuations. It easy to verify what follows ($p = 100$ as b offers 60 for Y and c bids 40 for Z):

$p_a^{VCG} = \sum_{j \in T-\{a\}} (p_{j,-a} - p_j) = (60 - 60) + (40 - 40) = p_{-a} - (p - p_a) = 100 - (100 - 0) = 0,$

$p_b^{VCG} = (50 - 0) + (0 - 40) = 50 - (100 - 60) = 10,$

$p_c^{VCG} = (0 - 0) + (60 - 60) = 60 - (100 - 40) = 0,$

$p^{VCG} = 0 + 10 + 0 = 10.$

Thus, the discounts allowed with respect to the offered prices are respectively:

[17] In an economic system, a positive (negative) externality is a revenue (cost) which is imposed to an agent a by a decision/action of another agent b because of the absence of a market where b can sell to (buy from) a a specific item at a price that balances such a revenue (cost). For instance, let us consider a firm which pollutes a river by dumping waste material. All the houses in the neighborhood will lose value and thus every private house owner will be deemed to bear a negative externality (measured by the depreciation cost of his own house). By designing a specific market where the firm must acquire the right to pollute from the house owners, the externality turns into a fair compensation which balances the market value decrement of the houses. In the auction context, the externality is generated by the fact that there no exist a market where the players' participation in the auction can be negotiated and priced (obviously, if we does not consider collusion among participants).

[18] Incidentally, let us recall that, assuming players with independent and private valuations and with no budget constraints, the VCG mechanism has the significant property of making truthful bidding a dominant strategy for every player (it is strategy-proof); this means that it is able to extract from the players all the information concerning their valuations and thus to induce maximum allocative efficiency (Milgrom 2004).

$\dot{p}_a = (p - p_{-a}) = 100 - 100 = 0,$

$\dot{p}_b = 100 - 50 = 50,$

$\dot{p}_c = 100 - 60 = 40,$

$\dot{p} = 0 + 50 + 40 = 90.$

Note that bidder b generates a negative externality of 50 on player a and a positive externality of 40 on player c, therefore according to the VCG rule his overall payment is 10. On the contrary, payers a and c induce no externality on the other bidders and thus their VCG payments are both equal to 0.

It is important to remark that p_t^{VCG} represents an aggregated measure of the externalities generated on the other players by bidder t's participation, in the sense that if ties among the winning bids of t's opponents occur when t does not take part to competition, then there can be alternative scenarios in terms of generated externalities.[19] For instance, let us extend the previous example by introducing one more player, say d; player d is interested in item Y and values it at 10. For simplicity, let us assume again that all bidders offer up to their valuations. Now when bidder b does not take part in the auction there are two alternative scenarios: (i) both items are allocated to a and thus b generates a negative externality of 50 on player a and a positive externality of 40 on player c ($p_b^{VCG} = \sum_{j \in T-\{b\}} (p_{j,-b} - p_j) = (50 - 0) + (0 - 40) + (0 - 0) = 10$); (ii) else item Y and Z are allocated respectively to d and c, and therefore b generates only a negative externality of 10 on player d ($p_b^{VCG} = (0 - 0) + (40 - 40) + (10 - 0) = 10$). Summarizing, the overall net externality generated by player b is equal to 10 ($p_b^{VCG} = p_{-b} - (p - p_b) = 50 - (100 - 60) = 10$), while the externality generated by player b on every opponent is not uniquely determined.

The relevance of externalities in centrality measures

Everett and Borgatti (2010) studied some theoretical aspects of centrality measures in network analysis.[20] In particular, given any network W and set V of the analyzed network elements (e.g. nodes or arcs), they observed that by selecting any metric C to measure the centrality, and considering the sum of the centrality scores of the elements in V, it is possible to define the total centrality of any element $t \in V$ as $c_t^{tot} = \sum_{j \in V} c_j - \sum_{j \in V-\{t\}} c_{j,-t} = c - c_{-t}$, where c_j is the centrality score of element j given network W, $c_{j,-t}$ is the centrality measure of element j after removing t from network W, $c = \sum_{j \in V} c_j$ represents the overall centrality of all elements, and $c_{-t} = \sum_{j \in V-\{t\}} c_{j,-t}$ is the overall centrality of the residual

[19] When $m = 1$ (just one item is auctioned off), the VCG mechanism collapses into the so-called *second-price rule* or Vickrey auction (Milgrom 2004), where the winning player generates only negative externalities on the rivals and his payment is always equal to second highest bid.

[20] Since the structure of a network is usually modeled as a graph, in the following we will speak indifferently of networks and graphs.

elements after removing t from W. Therefore, Everett and Borgatti (2010) remarked that the total centrality of any element reflects the element's direct contribution to the network overall centrality but also the indirect contribution of the element to the centrality of the other elements of the network. Moreover, they call c_t the endogenous centrality of the element, and $\sum_{j\in V-\{t\}}(c_j - c_{j,-t})$ the exogenous centrality of the element; thus, the total centrality c_t^{tot} of t is the sum of the endogenous and exogenous centralities of t, that is, $c_t^{tot} = c_t + \sum_{j\in V-\{t\}}(c_j - c_{j,-t})$.

Everett and Borgatti (2010) defined total, endogenous and exogenous centrality concepts by taking inspiration from an approach used in last decades to study the resilience or robustness of a network (Koschützki et al. 2005, Snediker, Murray and Matisziw 2008, Zobel 2011, Gisches and Rapoport 2012), which consists of measuring the degradation of the network performances (in terms of some specific properties) after the removal/insertion of nodes and/or arcs.[21]

It easy to verify that such centrality concepts are exactly an application of the generalized Vickrey principle, as stated by the following proposition.

Theorem. Let us assume a network W, a set V of network elements, and a metric C to measure the centrality of the elements in V. Let us also consider the VCG rule where the metric of the offered price is replaced by the assumed metric C and the players in T represents the network elements in V. Then, the total centrality c_t^{tot} of any element $t \in V$ by Everett and Borgatti (2010) is equal to the discount $\dot{c}_t$ imposed by the VCG rule under the metric C.

Proof. By Everett and Borgatti (2010), the total centrality c_t^{tot} of t is the sum of the endogenous and exogenous centralities of t, that is, $c_t^{tot} = c_t + \sum_{j\in V-\{t\}}(c_j - c_{j,-t})$. Let us observe that the exogenous centrality is the "payment" returned by the VCG rule (with the opposite sign) applied to the new metric, that is, $\sum_{j\in V-\{t\}}(c_j - c_{j,-t})$ for $t \in V$ corresponds to $-\sum_{j\in T-\{t\}}(p_{j,-t} - p_j) = -p_t^{VCG}$ for $t \in T$, which turns into $-\sum_{j\in T-\{t\}}(c_{j,-t} - c_j) = -c_t^{VCG}$ for $t \in T$ under the metric C. Moreover, the endogenous centrality is the "value of the winning bids", that is, c_t for $t \in V$ matches with p_t for $t \in T$, which turns into c_t for $t \in T$ under the metric C. Let us now consider the "discount" of the VCG rule $\dot{p}_t$ for $t \in T$, which turns into $\dot{c}_t$ for $t \in T$ under the metric C. Since $T = V$, the total centrality is equal to the

[21] In general, the removal of nodes and/or arcs disrupts the paths between the nodes and thus making the communication between nodes harder or impossible. There are several ways of measuring the degradation of the network performance after the removal (see Koschützki et al. 2005). For instance, a simple way to measure the performance degradation it is to calculate the decrease in size of the largest connected component in the network (a connected component is any set of nodes of the network such that a path exists between any two nodes of the set), where the size can be modelled, for example, in terms of cardinality of the connected component, or as weighted sum of the nodes of the connected component.

resulting "discount" under the VCG rule: $c_t^{tot} = c\ \ - c_{-t} = c_t\ + \sum_{j \in V-\{t\}} (c_j\ - c_{j,-t}) = c_t\ - c_t^{VCG} = \dot{c}_t\ .$

In other words, the exogenous centrality is the externality (with the opposite sign) generated by the presence of element t on the other elements of the network.[22] The main difference with respect to the auction framework (apart from the strategic interaction among the players, obviously) lies in the fact that the VCG payment under the metric of the offered price is always nonnegative, while under other metrics for the centrality measures the overall net externality generated by an element can also be negative.

Moreover, centrality measures based on the application of the principle underlying the VCG rule have a natural interpretation; in fact, in the Vickrey's language, the total centrality of an element reflects the sum of its centrality and of the positive and negative externalities which it generates on all other elements (positive externalities when the centrality of other elements benefits from its "presence" in the network, while negative externalities in the case that its "presence" reduces the centrality of other elements). Since Everett and Borgatti' total centralities (each one associated with a different metric C) follow the VCG paradigm of analyzing the marginal contribute of an element per time in a given context, in the following we will refer to these centrality measures also as the *VCG centralities*.[23]

Some examples

In this subsection we show through simple examples that there are cases where the centrality score of an element v of a network could be misleading if we apply centrality measures which do not take into account the potential role of the other elements in the network, namely, the contribution to the network of the other elements in the case that the network should operate without v. In other words, it can be useful to study the centrality of an element of a network by also investigating how much the other elements of the network would value the miss of v. In particular, if we look at the externalities which the elements generate on the other ones, some elements could be considered much more or less crucial than they appear at first sight. To better clarify such ideas, let us consider the following different cases.

Case 1

As a first example, let us focus on the betweenness centrality of a node v in a network, which is normally defined as the share of shortest paths from any node of the network to all others that pass through node v (from now on denoted by bc_v)[24]. In particular, let us consider two transport networks represented by the weighted directed graphs $\check{G}$ and $\bar{G}$ in Figure 1.

[22] In the network context, the externality represents the sum of the negative and positive effects, as measured by some metric, which are imposed upon the other elements of the network.

[23] In some cases it could be useful to define and apply centrality measures which reflects only negative (only positive) externalities generated by an element of the network on the other ones. Further research could be focused on this issue.

[24] Classical definition of betweenness centrality focuses only on shortest paths which pass through nodes and thus arcs are excluded from the set of shortest paths which determine betweenness centrality.

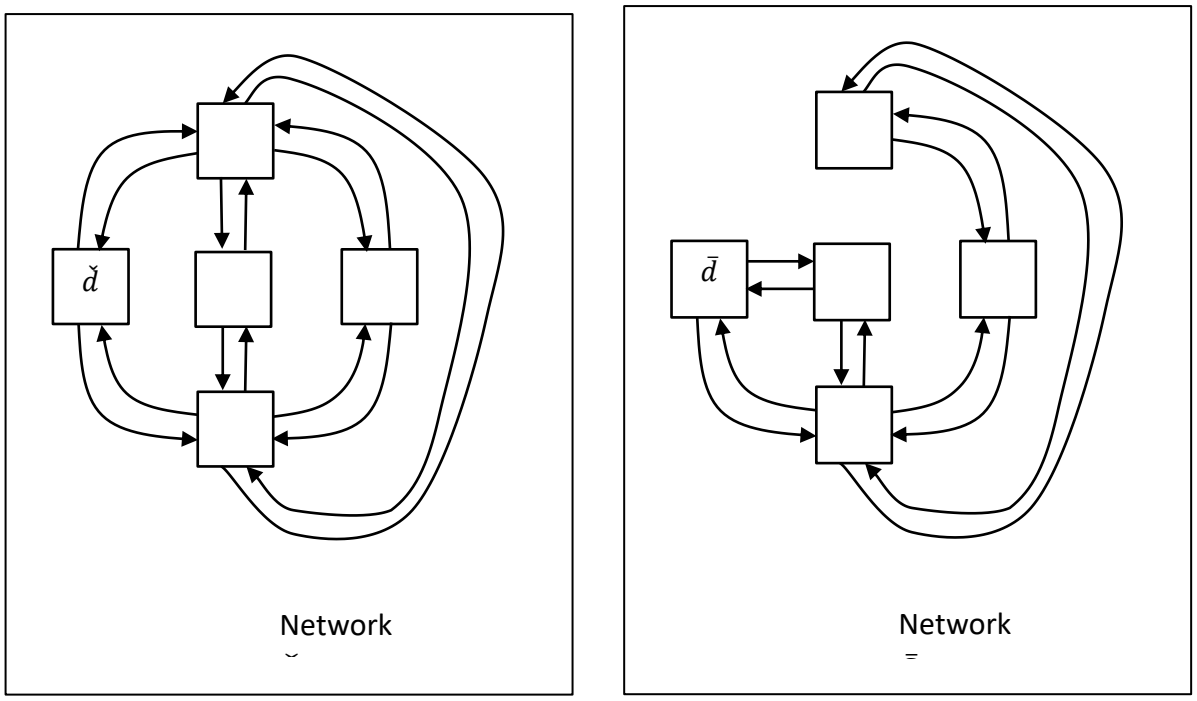


Figure 1. Weighted directed networks $\breve{G}$ and $\bar{G}$.

More formally, graphs $\breve{G} = \left(\breve{N}, \breve{A}, \breve{c}\right)$ and $\bar{G} = (\bar{N}, \bar{A}, \bar{c})$, where $\breve{N} = \{\breve{d}, \breve{e}, \breve{f}, \breve{h}, \breve{k}\}$ and $\bar{N} = \{\bar{d}, \bar{e}, \bar{f}, \bar{h}, \bar{k}\}$ are the node sets, $\breve{A} = \{\breve{a}_1 = (\breve{d}, \breve{h}), \breve{a}_2 = (\breve{d}, \breve{k}), \dots\}$ and $\bar{A} = \{\bar{a}_1 = (\bar{d}, \bar{b}), \bar{a}_2 = (\bar{d}, \bar{h}), \dots\}$ are the arc sets, $\breve{c} = (\breve{c}_1 = 1, \breve{c}_2 = 3, \dots)^T \in \mathbb{R}_+^{|\breve{A}|}$ and $\bar{c} = (\bar{c}_1 = 3, \bar{c}_2 = 1, \dots)^T \in \mathbb{R}_+^{|\bar{A}|}$ are the vectors of costs associated with the arcs[25] (where $\mathbb{R}_+$ is the set of positive reals and zero).

By direct inspection of $\breve{G}$, it easy to verify that totally there are 12 shortest paths and everyone enters and exits exclusively node $\breve{h}$; therefore, $bc_{\breve{h}} = \frac{12}{12} = 1$ while $bc_{\breve{d}} = bc_{\breve{e}} = bc_{\breve{f}} = bc_{\breve{k}} = \frac{0}{12} = 0$. Equally, we see that $bc_{\bar{h}} = \frac{12}{12} = 1$ and $bc_{\bar{d}} = bc_{\bar{e}} = bc_{\bar{f}} = bc_{\bar{k}} = \frac{0}{12} = 0$. However, is indeed appropriate to state that nodes $\breve{h}$ and $\bar{h}$ are equally crucial in their respective network? It easy to verify that node $\breve{h}$ generates much more externalities on the other nodes of $\breve{G}$ than $\bar{h}$ does on the other nodes of $\bar{G}$. In fact, node $\breve{h}$ prevent node $\breve{k}$ from being a crossroads of the shortest paths from any node of the network to all others, while node $\bar{h}$ do not "subtract" shortest paths from any other node of $\bar{G}$. In particular, by removing node $\breve{h}$ from the network, we see that betweenness centrality of node $\breve{k}$ increases from 0 up to $\frac{6}{6} = 1$ (while the other ones are still 0); instead, if we remove $\bar{h}$ from $\bar{G}$, the betweenness centrality of the remaining nodes does not change (they are still 0). Economically speaking, we can say that $\breve{h}$ generates a (negative) externality on node $\breve{k}$, while $\bar{h}$ induces no externality

[25] For instance, if nodes represent cities, a cost can represent the physical length of the corresponding link between a pair of cities, or the monetary cost that must be supported to travel along that route, or the required time to move from a city to another.

on any other node. In other words, node $\check{h}$ can be substituted by its node competitors in terms of rearranging shortest paths, while the removal of node $\bar{h}$ would be ruinous for network $\bar{G}$ as several connections cannot be restored. For instance, in a transport network, node $\check{h}$ can be somehow bypassed, while node $\bar{h}$ is a bottleneck and thus pivotal, although both nodes have the same betweenness centrality.

To take into account such theoretical considerations, the centrality of these nodes could be represented by a measure of the marginal contribution of the node in terms of betweenness centrality, by subtracting to its betweenness centrality the generated externalities. We refer to it as *VCG betweenness centrality* of a node. In particular, the VCG betweenness centrality of nodes $\check{h}$ and $\bar{h}$ is, respectively, equal to $\dot{bc}_{\check{h}} = 1 - \big((0-0) + (0-0) + (0-0) + (1-0)\big) = 0$ and $\dot{bc}_{\bar{h}} = 1 - \big((0-0) + (0-0) + (0-0) + (0-0)\big) = 1 > \dot{bc}_{\check{h}}$; such centrality measures effectively reflects that node $\check{h}$ seems to be less critical in the context of $\check{G}$ than node $\bar{h}$ in the context of $\bar{G}$.

Case 2

In many cases, networks have to be designed and protected in such a way to be robust with respect to an intelligent link attack (Bravarda, Charroinc and Touati 2017). Thus, it is really important to identify how critical any link is to the network as a whole. Therefore, as a second example, let us consider a case where the overall flow in the network be the selected metric, and the flow-based centrality of any arc be the core of the network analysis. To do this let us first introduce a few notation. We denote by $G = (N, A, u, uo, ut)$ a capacitated directed network where N is the node set, A is the arc set, u is the vector of the arc capacities, $uo \in \mathbb{R}_+^{|N|}$ is the vector of upper bounds on the flow that can be generated by (or originated from) any node (in addition to the incoming flow), $ut \in \mathbb{R}_+^{|N|}$ is the vector of upper bounds on the flow that can be consumed by (or terminated to) each node (in addition to the outgoing flow). Moreover, $uo_k ut_k = 0$ for any node $k \in N$, that is, any node k is an origination node ($uo_k > 0$ and $ut_k = 0$) or a termination node ($uo_k = 0$ and $ut_k > 0$) or a transport node ($uo_k = ut_k = 0$).[26]

The overall flow maximization problem Υ over G can be compactly formulated as follows (see Bertsimas and Tsitsiklis 1997 for basic formulations of network flow problems):

$$\begin{cases} \max \sum_{r \in A} f_r & & \\ -uo_k \le \sum_{r \in A: r=(i,k)} f_r - \sum_{r \in A: r=(k,j)} f_r \le ut_k \quad k \in N & (1) \\ 0 \le f_r \le u_r \quad r \in A & (2) \\ f_r \in \mathbb{R} \quad r \in A & (3) \end{cases}$$

where f_r is the flow on arc $r \in A$ in any feasible solution. Constraints (1) simultaneously require that: (i) for any termination node k the incoming flow minus the maximum flow that

[26] In other words, the upper bounds associated with origination and termination nodes operate to balance the incoming and outgoing flow at any node. In a termination node, the incoming flow which exceed the outgoing flow will be consumed inside the node (but not beyond the related upper bound). In an origination node the outgoing flow which exceed the incoming flow will be provided by the node (but not beyond the corresponding upper bound).

can be consumed by k is lower than or equal to the outgoing flow, (ii) for any termination node k the incoming flow is larger than or equal to the outgoing flow, (iii) for any origination node k the incoming flow plus the maximum flow that can be generated by k is larger than or equal to the outgoing flow, (iv) for any origination node k the incoming flow is lower than or equal to the outgoing flow, (v) for any transport node k the incoming flow is exactly equal to the outgoing flow. Constraints (2) and (3) require that the flow on any arc has to be a nonnegative real lower than and equal to the arc capacity.

Let $\bar{f} \in \mathbb{R}_+^{|A|}$ be an optimal solution to problem Υ. The quantity $\sum_{r\in A} \bar{f}_r$ is the optimal overall flow of the problem and $\bar{f}_r$ is the optimal flow on arc $r \in A$. Moreover, the flow that is consumed by any termination node k is equal to $\sum_{r\in A: r=(i,k)} \bar{f}_r - \sum_{r\in A: r=(k,j)} \bar{f}_r \geq 0$, while the flow that is generated by any origination node k is equal to $\sum_{r\in A: r=(k,j)} \bar{f}_r - \sum_{r\in A: r=(i,k)} \bar{f}_r \geq 0$.

In particular, let us consider the two transport networks represented by the capacitated directed graphs $\check{G}$ and $\bar{G}$ in Figure 2, with no origination/termination node.

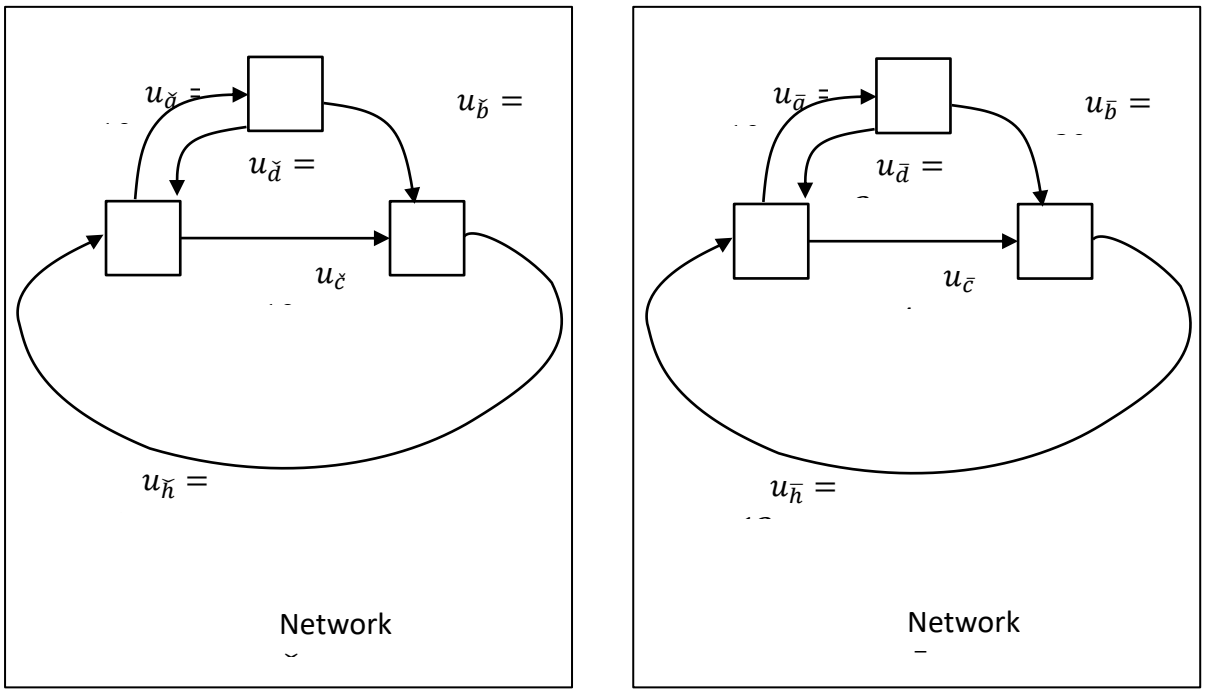


Figure 2. Capacitated directed networks $\check{G}$ and $\bar{G}$.

By solving the corresponding flow maximization problems, it is easy to verify that the optimal overall flow of both networks is equal to 36 (with $f_{\check{a}} = 10$, $f_{\check{b}} = 8$, $f_{\check{c}} = 4$, $f_{\check{d}} = 2$, $f_{\check{h}} = 12$ and $f_{\bar{a}} = 10$, $f_{\bar{b}} = 8$, $f_{\bar{c}} = 4$, $f_{\bar{d}} = 2$, $f_{\bar{h}} = 12$) and that arcs $\check{b}$ and $\bar{b}$ transport the same flow equal to 8. Although optimal flow on arcs $\check{b}$ and $\bar{b}$ is the same as well as the optimal overall flow in $\check{G}$ and $\bar{G}$, may we claim that arcs $\check{b}$ and $\bar{b}$ are equally central in their

respective network? It easy to verify that arc $\check{b}$ generates lower positive externalities and higher negative externalities on the other arcs of $\check{G}$ (the overall net externalities are equal to 4) than $\bar{b}$ does on the other arcs of $\bar{G}$ (the overall net externalities are equal to 16). In fact, by removing arc $\check{b}$ from the network, we see that the optimal overall flow drops down to 24, the flow transported through arc $\check{c}$ increases from 4 up to 10 while the one on arcs $\check{a}$ and $\check{h}$ drops, respectively, from 10 down to 2 and from 12 down to 10. Instead, if we remove $\bar{b}$ from $\bar{G}$, the optimal overall flow falls down to 12, the flow on arc $\bar{c}$ does not change, while that on arcs $\bar{a}$ and $\bar{h}$ drops, respectively, from 10 down to 2 and from 12 down to 4. Economically speaking, we can say that the existence of $\check{b}$ generates a negative externality on arc $\check{c}$ and positive externalities on arcs $\check{a}$ and $\check{h}$, while the presence of $\bar{b}$ induces exclusively positive and larger externalities on the arcs of its network (in particular, on arcs $\bar{a}$ and $\bar{h}$). Thus, the removal of arc $\check{b}$ can be partially cushioned by exploiting the capacity of the arcs of $\check{G}$ affected by the negative externalities generated by $\check{b}$, that is, the capacity of the arc $\check{c}$.

This aspect would be clearly highlighted by measuring the centrality of the arcs in terms of marginal contribution of any arc to the optimal overall flow of the network, namely, computing for any arc the difference between the optimal overall flow when the arc is in the network and the optimal overall flow when the arc is removed from the network. We refer to this measure as the *VCG flow-based centrality* of an arc. In particular, the VCG flow-based centrality of arcs $\check{b}$ and $\bar{b}$ is, respectively, equal to $\dot{c}_{\check{b}} = 36 - 24 = 12 = 8 - \big((2-10) + (10-4) + (2-2) + (10-12)\big)$ and $\dot{c}_{\bar{b}} = 36 - 12 = 24 = 8 - \big((2-10) + (4-4) + (2-2) + (4-12)\big) = 24 > \dot{c}_{\check{b}}$; such centrality measures clearly show that arc $\check{b}$ has to be considered as less crucial in the context of $\check{G}$ than node $\bar{b}$ in the context of $\bar{G}$.

As shown through examples $\check{G}$ and $\bar{G}$, the externalities generated by any arc can be both positive and negative. However, as stated in the following theorem, the VCG flow-based centrality of any arc is always nonnegative in the considered framework.

Theorem. Given a capacitated directed network $G = (N, A, u, uo, ut)$ and the related overall flow maximization problem Υ. The VCG flow-based centrality of any arc is always nonnegative.

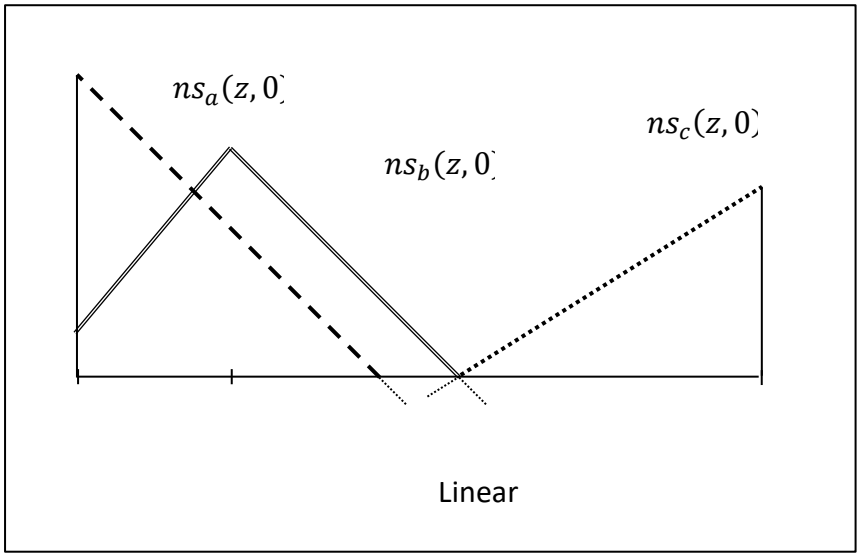
Proof. Removing an arc r from G is equivalent to adding the constraint $f_r = 0$ to the problem Υ (let us call Υ_{-r} the resulting flow maximization problem); thus, the optimal overall flow of problem Υ_{-r} can only decreases or remains unchanged. Let $\bar{f}^{\Upsilon} \in \mathbb{R}_{+}^{|A|}$ and $\bar{f}^{\Upsilon_{-r}} \in \mathbb{R}_{+}^{|A|}$ be optimal solutions to problem Υ and Υ_{-r}, respectively. Therefore, for any arc $r \in A$ we have that $c = \sum_{j \in A} \bar{f}_j^{\Upsilon} \geq c_{-r} = \sum_{j \in A-\{r\}} \bar{f}_j^{\Upsilon_{-r}}$ and thus $\dot{c}_r = c - c_{-r} \geq 0$.

Case 3

Let us now focus on a different context, namely, a stylized scenario where economic agents (consumers and firms) interact with each other and aim at maximizing their own net

surplus[27]. In such a case, economists are usually interested in maximizing the welfare, that is, the summation of the net surplus of any economic agent; therefore, a measure of centrality of the economic agents is represented by their contributions to the welfare. In particular, let us consider a so-called linear city (Tirole 1988), where (i) consumers are uniformly distributed within the segment $[0,18]$ and have unit demand, and (ii) there are three firms a, b and c placed in 0, 4 and 18, respectively. Each firm is single-product and three products a, b, c are perceived by consumers as horizontally differentiated (i.e., even when they are offered at the same price, there can be consumers who purchase product a, other consumers who demand b and other consumers who buy c). Let the maximum willingness to pay of a consumer $z \in [0,18]$ for product a be equal to $8 - z$ (when it gets negative it means that consumer z would require a subside to buy the product); therefore, when z purchases from firm a, z's net surplus is $ns_a(z, p_a) = 8 - z - p_a$, where $p_a \geq 0$ is the price required by firm a. Similarly, the net surplus of a consumer $z \in [0,4]$ who buys from firm b is $ns_b(z, p_b) = 6 + \frac{6}{5}(z - 4) - p_b$, where $p_b \geq 0$ is the price required by firm b, while net surplus of a consumer $z \in [4,18]$ who buys from firm b is $ns_b(z, p_b) = 6 + (4 - z) - p_b$. Finally, the net surplus of a consumer $z \in [0,18]$ who buys from firm b is $ns_c(z, p_c) = 5 + \frac{5}{8}(z - 18) - p_c$, where $p_c \geq 0$ is the price required by firm c. If a consumer z does not buy any product his net surplus is zero. Consumers want to maximize their net surplus.

Figure 3 shows the graphic representation of the willingness to pay of all consumers for any product (the dashed line represents the willingness to pay for product a, the double line represents the willingness to pay for product b, the dotted line represents the willingness to pay for product c). For any firm, the net surplus is equal to the multiplication of the share of consumers who buy its product and the required price (all costs are assumed to be zero).



[27] The net surplus of a consumer is the difference between his willingness to pay for the purchased products and the prices paid to buy them, while the net surplus of a firm is the difference between revenues and costs (also referred to as profit or payoff).

Figure 3. Linear city with firms a, b and c placed in 0, 4 and 18, respectively.

Incidentally, let us note that a naïve graph-based representation of the considered scenario is the weighted directed graph EG in Figure 4. Weights on arcs of graph EG represent capacities, some of which are definitively determined (the ones equal to infinity) while the others depends on the prices p_a, p_b and p_c; in particular, $\pi_k(p_a, p_b, p_c)$ is firm k's net surplus and $CS_k(p_a, p_b, p_c)$ is the net surplus of consumers buying from firm k, for $k = a, b, c$. It is easy to verify that, given the prices p_a, p_b and p_c and thus the arc capacities, the welfare induced in the scenario at issue is equal to determining the maximum flow between origin s and destination t of graph EG.

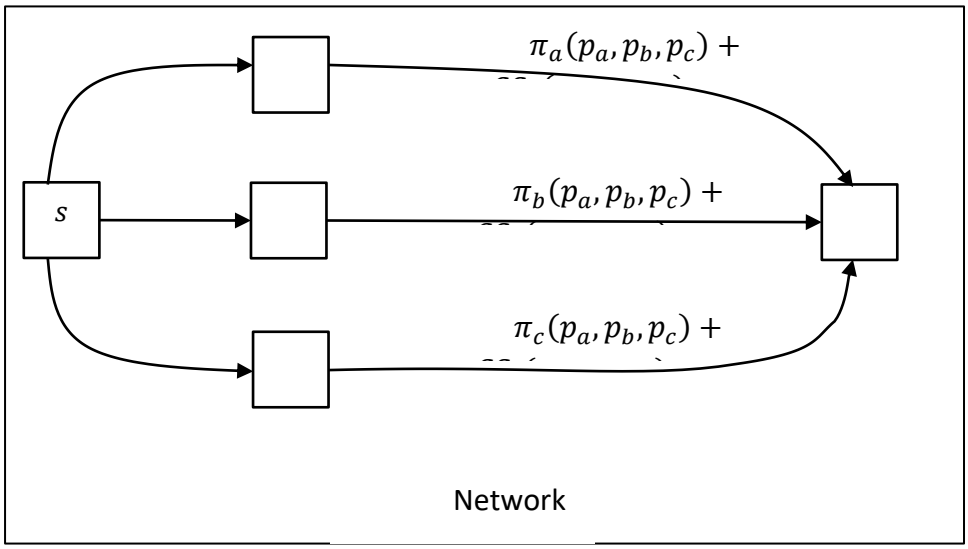


Figure 4. Graph-based representation of the competitive scenario described through the linear city.

Note that, the maximum welfare which could be generated in the considered scenario would be equal to 74.9 (obtained by setting $p_a = p_b = p_c = 0$). Observe also that, the maximum contribution to the welfare which firms a and b could generate is equal to 32, while firm c's potential contribution would be at the most 20 (such possible contributions to the welfare would be obtained by setting any product price at zero). However, any firm strategically sets the product price in order to maximize its net surplus. By applying Nash equilibrium methodology to determine the outcome of the strategic interaction among firms in the considered linear city (Tirole 1988), it is easy to verify that the net surplus of consumers buying from firms a, b, c is respectively equal to 4.3, 7.2, 5 (therefore, net surplus of all consumers $CS = CS_a + CS_b + CS_c$ is equal to 16.5), while the net surplus of firms a, b, c is respectively 11.3, 14.5, 10; therefore, the welfare is $W = 52.3$. In terms of contribution to the welfare, the price decided by firm a induce a firm a's net surplus equal to

$\pi_a = 11.3$ and a consumers' net surplus equal to $CS_a = 4.3$, and thus firm a's impact on welfare is $W_a = 15.6$. Analogously, the contribution of firms b, c is respectively $W_b = \pi_b + CS_b = 14.5 + 7.2 = 21.7$, $W_c = \pi_c + CS_c = 10 + 5 = 15$. Therefore, should we conclude that firm b is the most important element in the given context? This analysis only restricts the attention on the absolute value of the impact of the firm, while it does not investigate on the marginal contribution of the firm to welfare, which in fact depends on the contribution which could be offered by the other firms. In order to analyze also this aspect, Table 1 reports the firms' contributions in different scenarios, namely, when all firms enter the market, and when one firm per time exits the market.

	firms a, b, c	firms b, c	firms a, c	firms a, b
W_a	$11.3 + 4.3 = 15.6$		$16 + 8 = 24$	$11.3 + 4.3 = 15.6$
W_b	$14.5 + 7.2 = 21.7$	$16.5 + 8.3 = 24.8$		$14.5 + 7.2 = 21.7$
W_c	$10 + 5 = 15$	$10 + 5 = 15$	$10 + 5 = 15$	
W	52.3	39.8	39	37.3

Table 1. Firms' contributions to the welfare under different competitive scenarios.

By inspecting the table we can observe that firm a generates a negative externality of $3.1 = 24.8 - 21.7$ on firm b, firm b induces a negative externality of $8.4 = 24 - 15.6$ on firm a, and firm c generates no externality. Therefore, by taking into account both the absolute contribution to the welfare and the generated externality on the opponents, it results that the *VCG welfare centrality* of firms a, b, c is respectively equal to $\dot{W}_a = 15.6 - 3.1 = 12.5$, $\dot{W}_b = 21.7 - 8.4 = 13.3$, $\dot{W}_c = 15$. Now, the role of firm b does not seem so crucial anymore, since the strong competition with firm a induces a partial substitutability between a and b (namely, firm a's contribution to the welfare could partially offset firm b's one). On the other hand, firm c results the most important agent in the given context.

For instance, let us assume that the illustrated case model a wide common catchment area of three competing airports in a country, such as, for instance, the international airports Malpensa (firm a), Linate (firm b) and Orio al Serio (firm c) in the north-west of Italy (respectively close to Busto Arsizio, Milan and Bergamo cities). The proposed centrality analysis, based also on a measure of externalities, would suggest a public authority to have much more consideration for the Orio al Serio international airport which serves a bordering but important territory of the catchment area instead of further promoting competition between Malpensa and Linate which mainly serve the metropolitan area of Milan (in other words, the drawback for the users in the considered catchment area due to a possible absence of firm c would be worse than the lower level of competition in the metropolitan area which the absence of firm b, or else of firm a, would induce.

Conclusion

In this work we have shown how some proposals in the literature related to the centrality measures (Everett and Borgatti 2010) are an application of the well-known generalized Vickrey mechanism.

Moreover, we have provided examples to show how a proper measure of the centrality of an element should take into account the marginal contribution of the element to the network (for instance, in terms of connectivity or welfare generated). In so doing, we advise that centrality measures à la VCG (i.e. the Everett and Borgatti' total centralities) should be more widely applied in the practice. Indeed, the presented examples point out how measures à la VCG could overcome traditional centrality measures in estimating the true importance that an element has in the overall network environment.

Finally, our work suggest a possible bridge between network analysis and auction design, which could be crossed in both directions to fruitfully transfer ideas, issues and results from one framework to the other.

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TÜRKİYE'DE EMEK PİYASASI ETKİLEŞİMLERİNİN ANALİTİK BİR İNCELEMESİ

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Özet

Üretim mikro düzeyde bireyler makro düzeyde ekonomiler açısından önemli bir ekonomik faaliyettir. İktisat politikalarının temel amacının bireylerin ve nihai tahlilde toplumların refahını artırmak olduğu dikkate alındığında, günümüz rekabet koşullarında hem ekonomilerinin birbirleriyle rekabetini hem de firmalarının birbirlerine üstünlük sağlamaları önemli hale gelmiştir. Bu bağlamda üretim girdilerin bir üretim teknolojisi yardımıyla insan ihtiyaçlarını karşılayacak ürünlere dönüşmesi sürecidir. Diğer bir ifadeyle katma değer yaratmadır. İktisat teorisinin en fazla tartışma yapılan alanlarından birisi olarak emek, üretim sürecinin en önemli girdilerinden birisidir. Bu çalışmada Türkiye özelinde emek piyasası etkileşimlerinin analitik açıdan analiz edilmesi amaçlanmıştır. Analiz sonuçlarına göre, 2015 yılında kullanabilir fert gelirleri içerisinde en yüksek pay % 49.7 ile maaş ve ücret gelirlerine ait iken, ikinci sırayı % 20 ile sosyal transferler, üçüncü sırayı ise % 18.8 ile müteşebbis gelirleri almıştır. Ayrıca sosyal transferlerin % 92'sini emekli ve dul-yetim aylıkları oluştururken, müteşebbis gelirlerinin % 73.4'ü tarım dışı gelirlerden meydana gelmiştir. Hane halkı fertlerinin esas işteki iktisadi faaliyet kollarına göre yıllık ortalama esas iş gelirleri baz alındığında, 23724 TL ile hizmet sektörü birinci sırada yer alırken, 20757 TL ile sanayi sektörü ikinci, 18159 ile inşaat sektörü üçüncü ve 14064 TL ile tarım sektörü dördüncü sıradadır. 2010-2015 dönemi dikkate alındığında, toplam gelir içerisinde en yüksek payın maaş ve ücret gelirlerine ait olduğu ve oranların % 43.7, % 44.8, % 46.5, % 48.3, % 49.1 ve % 49.7 olarak gerçekleştiği tespit edilmiştir.

Anahtar kelimeler: Emek, Emek Piyasası, Ücret, Türkiye

ANALYTICAL INVESTIGATION OF LABOR MARKET INTERACTIONS IN TURKEY

Abstract

Production is an important economic activity at micro level for individuals and at macro level for economies. Considering that the main purpose of economic policies is to increase the prosperity of individuals and finally the societies, it is important that both economies compete with each other and firms have superiority with each other in today's competitive conditions. In this context, production is the period that inputs are transformed into products that meet human needs with the help of a production technology. In other words, it creates added value. Labor as one of the most controversial areas of economic theory is one of the most important inputs of the production process. In this study, it is aimed to analyze analytically the labor market interactions in Turkey. According to the results of the analysis, the highest share of the individual income that can be used in 2015 belonged to the wage and wage income with 49.7%, while the second order received social transfers with 20% and the third order received entrepreneurial income with 18.8%. In addition, while 92% of social transfers constitute pensions and widows' orphans' pensions, 73.4% of entrepreneurs' incomes have come from non-agricultural incomes. When service sector is in the first place with 23724 TL, the industry sector is the second with 18,757 TL, the construction sector with 18,159 is the third, and the agricultural sector is the fourth with 140,600 TL, while the households are based on the annual average main business revenues according to the basic economic activities of the household members. When the period 2010-2015 is taken into consideration, it is determined that the highest share in total income is salary and wage income, and the proportions are 43.7%, 44.8%, 46.5%, 48.3%, 49.1% and 49.7%, respectively.

Key words: Labor, Labor Market, Wage, Turkey

1. Giriş

Üretim mikro düzeyde bireyler makro düzeyde ekonomiler açısından önemli bir ekonomik faaliyettir. İktisat politikalarının temel amacının bireylerin ve nihai tahlilde toplumların refahını artırmak olduğu dikkate alındığında, günümüz rekabet koşullarında hem ekonomilerinin birbirleriyle rekabetini hem de firmalarının birbirlerine üstünlük sağlamaları önemli hale gelmiştir. Bu bağlamda üretim girdilerin bir üretim teknolojisi yardımıyla insan ihtiyaçlarını karşılayacak ürünlere dönüşmesi sürecidir. Diğer bir ifadeyle katma değer yaratmadır. İktisat teorisinin en fazla tartışma yapılan alanlarından birisi olarak emek, üretim sürecinin en önemli girdilerinden birisidir. Bu çalışmada Türkiye özelinde emek piyasası etkileşimlerinin analitik açıdan analiz edilmesi amaçlanmıştır.

2. Faktör Piyasaları ve Emek Piyasası

Faktör, iktisadi anlamda, üretimle ilişkili bir kavramdır ve bir üretimin gerçekleştirilebilmesi için gerekli olan herhangi bir kaynağı ifade eder. Faktör, bir başka deyişle, girdi olarak da

ifade edilebilir. Girdi ise bir üreticinin çıktı (ürün) elde edebilmek için ihtiyaç duyduğu kaynak olarak tanımlanmaktadır. Üretim faktörleri ise üretimin gerçekleştirilebilmesi için ihtiyaç duyulan girdi türlerini ifade eder. Esas itibariyle üretim faktörleri, emek, sermaye, doğal kaynaklar ve girişimci olarak dört faktörden oluşmaktadır. Ancak, bu başka üretim faktörlerinin olmadığı anlamına gelmez. Literatürde zaman zaman teknoloji de üretim sürecinde kullanılabilecek diğer faktörler arasına dahil edilmektedir. Buna göre üretim faktörlerinin alınıp satıldığı ve bu anlamda ilgili faktörün fiyatının oluştuğu piyasalar faktör piyasası olarak adlandırılmaktadır.

Üretim faktörlerinden birisi olan emek ise, üretim sürecinde kullanılan bedensel ve zihinsel çabaların bütünü olarak açıklanmaktadır. Bu kapsamda üretime kas gücü ile katkı sağlayanlar mavi yakalı, zihinsel güç ile katkı sağlayan ise beyaz yakalı şekliden sınıflandırılmalara tabi tutulmaktadır.

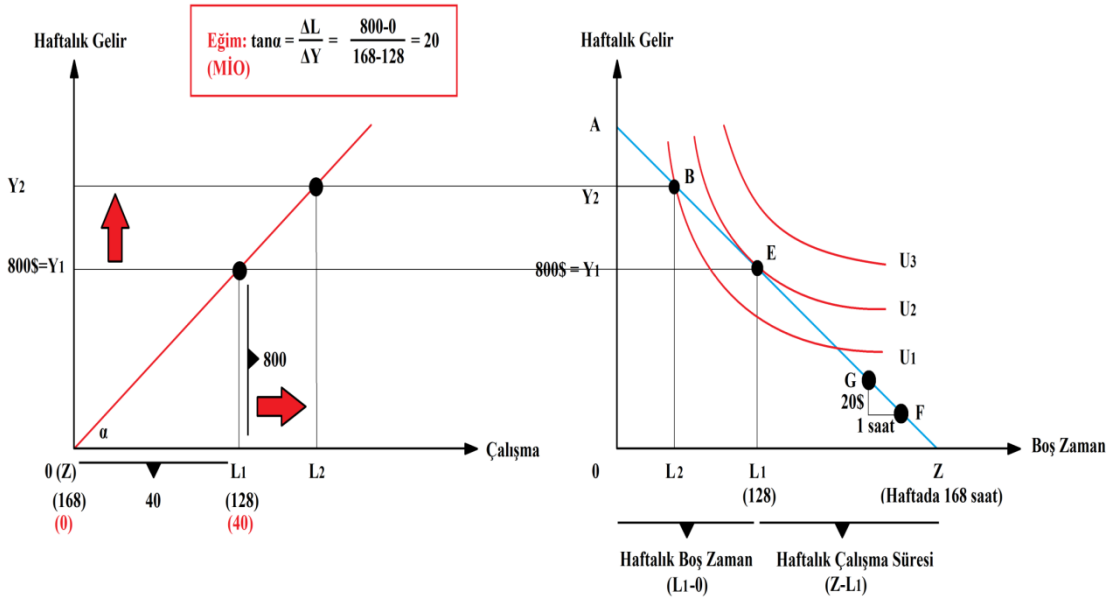
2.1. Emek Piyasasında Gelir-Boş Zaman İlişkisi

Gelir, bir üretim faktörünün, üretime yapmış olduğu katkının getirisidir. Boş zaman ise çalışan bireyin herhangi bir işverenden bir karşılık elde etmediği zaman dilimidir. Şekil-1'de emek piyasasında çalışan bir bireyin haftalık gelir ve boş zaman tercihine yönelik davranışları analitik olarak ele alınmıştır.

Şekil-1'de dikey eksen, kişinin çalışması (emek arzını gerçekleştirmesi) sonucunda elde ettiği parasal tutarı (ücret) gösterirken, bireyin çalışmadan geçirdiği boş zaman yatay eksende yer almaktadır. Bir hafta içerisinde 7 gün ve her günün 24 saat olduğu düşünüldüğünde 0Z 168 saatten oluşan zaman aralığını temsil etmektedir. Yatay eksenin boş zamanı temsil etmesi sebebiyle, eksen üzerinde orjine doğru gidildikçe çalışma süresi (emek arzı) artarken, orjinden uzaklaşıldıkça bireyin çalışma süresi (emek arzı) azalacaktır. Yani birey daha çok boş zaman geçirmeyi, belli bir parasal tutar karşılığında daha çok çalışmaya tercih edecektir. Burada U1, U2, ve U3, farklı fayda düzeylerini temsil eden farksızlık eğrilerini gösterirken, AZ doğrusu ise bireyin bütçe doğrusunu temsil etmektedir.

Bireyin emek arzını gerçekleştirme süreci analiz edildiğinde; birey başlangıçta L1 kadar emek arzı gerçekleştirerek Y1(800$) kadar gelir elde etmektedir. Bu bileşim (L1-Y1) onun E noktasında dengeye geldiğini göstermektedir. Haftalık toplam zaman dilimi (168 saat) ve bu zaman dilimi içerisinde L1 düzeyindeki emek arzının orijine göre uzaklığı (128 saat) düşünüldüğünde, bireyin bir hafta içerisinde gösterdiği emek arzı 40 saattir (168-128). Yani birey, bir haftada ZL1 (40 saat) kadar çalışarak Y1 (800$) düzeyinde bir gelir elde etmektedir.

Şekil- 1: Çalışan Bir Bireyin Gelir-Boş Zaman Seçimi

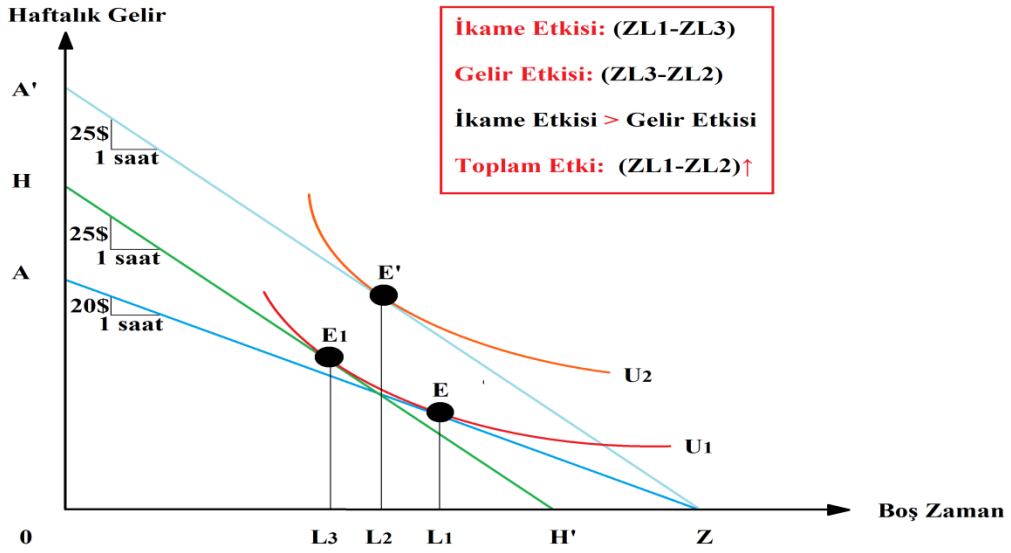


Bireyin daha fazla mı gelir (Y1) daha fazla mı boş zaman (0L1) sorusuna yönelik yaptığı bu tercihe göre ulaşacağı fayda düzeyi U2 farksızlık eğrisinin gösterdiği kadar olacaktır. Eğer birey emek arzını belli bir miktar artırarak (boş zamandan belli bir miktarda vazgeçerek) haftalık gelirini artırmak isterse, yeni durumda denge noktası B'de gerçekleşebilecektir. Yani emek arzı, L1L2 kadar bir artış göstererek ZL2 düzeyine yükselecektir. Gelir ise Y1Y2 kadar bir artış göstererek 0Y2 düzeyine yükselecektir. Bir başka ifadeyle, birey, Y1Y2 kadar daha fazla gelir elde edebilmek için L1L2 kadar boş zamandan vazgeçmiştir. Bireyin emek arzını artırıp artırmayacağına yönelik bir diğer ipucu ise marjinal ikame oranı yolu ile ortaya koyulabilir. Buna göre, bireyin boş zamandan bir birim daha vazgeçmesi halinde gelirini ne kadar artırabileceği görebilir. Marjinal ikame oranı ise bütçe doğrusunun (AZ) eğimine bakılarak hesaplanabilir. Yapılan hesaplamalar çerçevesinde eğim 20 olarak bulunacaktır. Bu değerin anlamı bireyin vazgeçtiği her 1 saatlik boş zamana karşılık olarak 20$ kadar bir gelir elde edeceğidir. Şekle göre birey için en elverişli olan denge noktası ise E noktası olacaktır. Çünkü, belli bir miktarda boş zamanından vazgeçerek daha yüksek bir getiri elde ettiği B noktasındaki faydayı temsil eden farksızlık eğrisi (U1), daha düşük bir gelir düzeyinde, ancak daha çok boş zaman geçirdiği denge noktasındaki (E) fayda düzeyini temsil eden farksızlık eğrisinden (U2) daha alt bir konumdadır. Yani B noktasında ulaşılan fayda düzeyi (U1), E noktasındaki fayda düzeyinden (U2) daha düşüktür. Çünkü B noktasında, boş zaman geçirmenin marjinal değeri, boş zamanın fırsat maliyetinden daha yüksektir. Bu halde birey, boş zaman geçirmenin marjinal değeri ile boş zaman geçirmenin fırsat maliyeti (gelir) birbirine eşit oluncaya kadar daha yüksek gelir elde etmek yerine daha çok boş zaman geçirmeye devam edecektir.

2.2. Emek Piyasasında Gelir ve İkame Etkileri

Emek piyasasında işgücünün gelir ve boş zaman tercihleri çerçevesinde ortaya çıkan gelir ve ikame etkileri Şekil-2'de analitik olarak gösterilmiştir.

Şekil- 2: Çalışma Saatleri Cinsinden Emek Arzı: İkame Etkisi & Gelir Etkisi



Şekil-2'de yatay eksende boş zaman değişkeni bulunmaktadır ve orijine doğru yaklaşıldıkça emek arzının arttığı (geçirilen boş zamanın azaldığı), orijinden uzaklaşıldıkça emek arzının azaldığı (geçirilen boş zamanın arttığı) görülmektedir. Dikey eksende ise bireyin boş zamandan vazgeçerek arttırdığı emek arzının karşılığında elde ettiği parasal gelir görülmektedir. AZ doğrusu, bireyin 20$ düzeyinde bir ücret haddi ile çalıştığı bütçe doğrusunu göstermektedir. Birey, bu ücret haddinde, ZL1 kadar emek arzı gerçekleştirerek U1 fayda düzeyine ulaşmıştır. Bu durumda birey, ilk aşamada, belli bir parasal tutar karşılığında gerçekleştireceği çalışma (emek arzı) ile boş zaman geçirme arasındaki seçiminde E noktasında dengeye gelmiştir. A'Z doğrusu, ücret haddinin 25$ düzeyine yükseldiği bütçe doğrusunu göstermektedir. Dikkat edilirse, ilk ücret haddini (20$) temsil eden AZ doğrusu, Z noktası üzerinde sabit kalarak yukarı yönlü bir kayma göstermiştir. Yani AZ doğrusunun eğimi artmıştır. Söz konusu artış ise, ücret haddinin 20$'dan 25$ düzeyine yükselmesi biçiminde kendini göstermiştir. Burada HH' doğrusu telafi edici bütçe doğrusu olup, A'Z bütçe doğrusuna paraleldir. Bu durumda HH' doğrusunun eğimi ile A'Z doğrusunun eğimi birbirine eşittir ve 25$ olduğu görülmektedir.

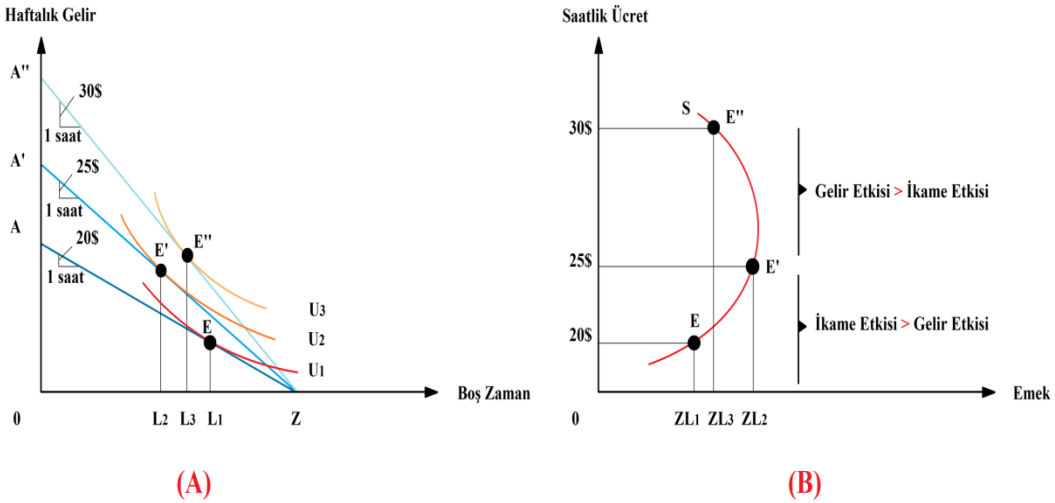
Yukarıdaki bilgiler doğrultusunda birey, ilk aşamada saat başına 20$ ücret karşılığında ZL1 kadar emek arzı gerçekleştirerek U1 fayda düzeyine ulaşmıştır. Bu bağlamda ilk denge, E noktasında gerçekleşmiştir. İkinci aşamada, ücret haddi 25$ düzeyine yükselmiştir. Saat başına alınan ücretin 25$'a yükselmesinin anlamı, çalışma saatini artırmaktan vazgeçmenin (boş zaman geçirmeyi tercih etmenin) maliyetinin 20$ düzeyinden 25$'a yükselmesidir. Yani, birey açısından çalışarak gelir elde etmek yerine boş zaman geçirmenin maliyeti artmıştır. Bu durumda, bireyin boş zamandan vazgeçerek gelirini artırma yoluna gitmesi halinde elde edebileceği fayda düzeyi de artış gösterebilecektir. İşte bu açıklamalar ışığında, ücret haddindeki yükselmeye bağlı olarak, bireyin daha yüksek gelir düzeyini, geçirebileceği daha çok boş zamana tercih etmesine ***ikame etkisi*** denilmektedir. Ücret haddinin saat başına 25$'a yükselmesinin etkisi, telafi edici bütçe doğrusu (HH') ile gösterilmiştir. Buna göre ücretin saat başına 25$'a yükselmesi ile bu artıştan istifade edebilmek için emek arzı ZL3 seviyesine

yükseltilmiştir. Böylelikle ilk duruma göre L1L3 kadar bir emek arzı artışı söz konusu olmuştur. Ücret haddindeki bu artışa bağlı olarak emek arzında görülen L1L3 kadar artış (boş zamandan L1L3 kadar vazgeçme) ise ikame etkisini yansıtmaktadır. Yeni denge noktası, HH' üzerinde, E1 noktasında gerçekleşmiştir. Bu nokta, daha az boş zamana karşılık daha yüksek gelir düzeyini temsil etmektedir. Ücret haddinin 25$'a yükselmesi, bireyin gelirinin arttığı anlamına gelmektedir. Bu, daha yüksek bir bütçe düzeyini temsil edeceğinden yeni durumda bütçe doğrusu da HH' doğrusunun paralelinde yer alan A'Z bütçe doğrusu olarak ele alınmıştır. Bu bütçe doğrusu üzerinde bireyin seçimi artık daha az emek arzı ile daha fazla boş zaman olarak değişiklik göstermiştir. Çünkü, birey, ücret düzeyindeki artışa paralel olarak belli bir gelir düzeyine ulaşmıştır ve artık aynı ücret haddi ile daha yüksek bir gelir elde etmek için emek arzını artırmak yerine, ulaşmış olduğu gelir düzeyi ile daha çok boş zaman geçirmesi halinde ulaşılabileceği fayda düzeyini de artırabilecektir. Bu bağlamda ***gelir etkisi***, ücret haddindeki artışa bağlı olarak ulaşılan belli bir gelir düzeyinden itibaren bireyin daha fazla çalışmak yerine daha fazla boş zaman geçirmeyi tercih etmesini ifade etmektedir. Gelir etkisine bağlı olarak, emek arzı ZL3 düzeyinden ZL2 düzeyine çekilerek L3L2 kadar bir azalma göstermiştir. Emek arzındaki bu azalma, bir diğer ifadeyle gelir etkisine bağlı olarak geçirilmek istenen daha çok boş zamanı ifade etmektedir. Yeni durumda, saat başına 25$'lık bir ücret haddi ile ZL2 kadar emek arzı gerçekleştirilerek U2 gibi daha yüksek bir fayda düzeyine ulaşılmıştır. Son durumda denge, E' noktasındadır. Son olarak, ücret haddindeki artışa bağlı olarak açığa çıkan ikame etkisi ve gelir etkisi ile bunlara bağlı olarak görülen toplam etki ise şu şekilde özetlenebilir: ikame etkisi, ücret haddindeki artışla daha yüksek gelir elde etmenin bireyi daha çok emek arz etmeye teşvik etmesi ile L1L3 kadar gerçekleşmiştir. Gelir etkisi ise, bireyin, ulaşmış olduğu yüksek bir gelir düzeyinin ardından, daha yüksek bir gelir düzeyi elde etmek için emek arzını artırmak yerine daha çok boş zaman geçirmeyi (emek arzını düşürmeyi) tercih etmesine bağlı olarak L3L2 düzeyinde gerçekleşmiştir. Toplam etkiye bakıldığında, ücret haddinin değişmesiyle artış gösteren emek arzı (L3L1) ile ulaşılan daha yüksek bir gelir düzeyinden itibaren artık daha çok boş zaman geçirmek için düşüş gösteren emek arzı (L3L2) arasındaki fark kadar (L2L1) gerçekleşmiştir.

2.3. Emek Piyasasında Tersine Dönene Emek Arz Eğrisi

Emek piyasasına yönelik analizlerde ücret haddindeki değişikliklere karşı emek arzının nasıl tepki verdiği tersine dönen emek arz eğrisi ile açıklanmaktadır (Şekil-3).

Şekil- 3: Tersine Dönen Emek Arz Eğrisi



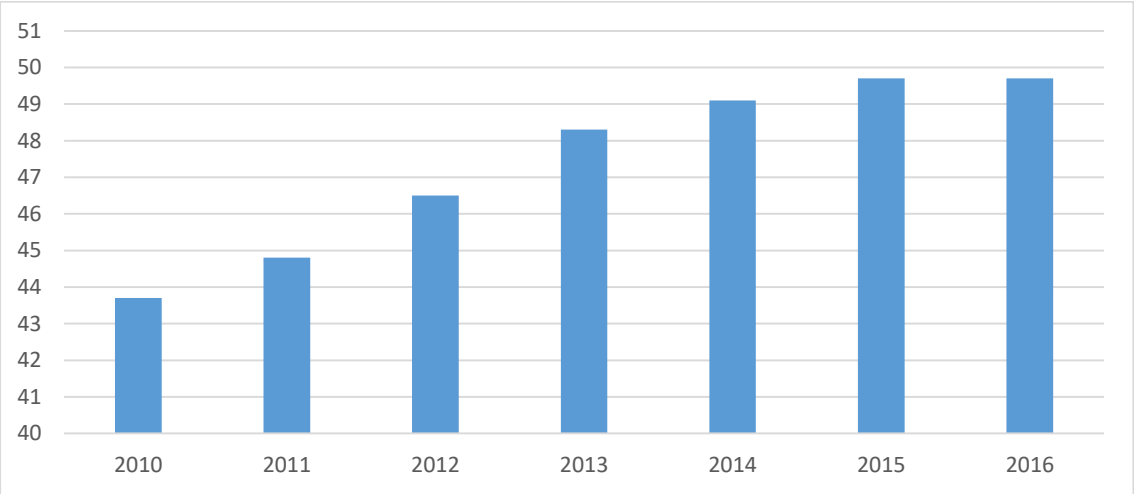
Şekil-3'de ilk durumda saat başına ücret düzeyi 20$ iken ZL1 kadar emek arzı gerçekleştirilmiştir ve E noktası, bu bileşeni sağlayan denge noktası olmuştur. İkinci durumda saat başına ücret düzeyinde bir artış söz konusudur. Yeni durumda ücret haddi 20$ düzeyinden 25$'a yükselmiştir. Birey, saat başına ücret düzeyindeki bu artışa bağlı olarak daha fazla çalışmak isteyecektir. Çünkü iki ücret haddi arasında kalan bu bölgede ikame etkisinin gelir etkisinden daha büyük olduğu görülmektedir. Yani, yeni ücret haddinde boş zaman geçirmenin maliyeti yükselmiştir. Saat başına ücret düzeyinin 25$'a yükselmesi ile emek arzı da ZL1 düzeyinden ZL2 seviyesine yükselmiştir. Bu bileşeni sağlayan denge noktası ise E' olarak görülmektedir. Son durumda, ücret haddinde bir artış daha gerçekleşmiş ve 30$ düzeyine yükselmiştir. Ancak bu kez ücret haddindeki yükselişe rağmen emek arzında bir azalma görülmektedir. Çünkü ücret haddi, 25$ düzeyinden itibaren artık ne kadar yükselirse yükselsin gelir etkisi, ikame etkisine ağır gelmektedir. Böylece birey, ücret haddi 30$'a yükselmiş olsa da daha fazla boş zaman geçirmek için emek arzını düşürmektedir. Son durumda, ücret haddi 30$ olarak gerçekleşirken, emek arzı ise ZL2'ye düşmüştür. Emek arzı eğrisi, ücret haddinin 20$ ile 25$ arasında seyrettiği bölgede, ikame etkisinin gelir etkisinden daha büyük olması sebebiyle pozitif yönlü bir seyir halindedir. Yani ücret düzeyinin artışı, bireyi daha çok emek arz ederek bu ücret düzeyinden yararlanmaya teşvik etmiştir. Bu sebeple ücret ile emek arzı arasında doğru yönlü bir ilişki söz konusudur. Ancak ücret düzeyi, 25$ seviyesinden itibaren ne kadar artış gösterirse göstersin, birey daha fazla boş zaman geçirmeyi tercih etmektedir. Yani, ücret haddinin 25$ ile 30$ arasında gerçekleştiği yerde, bu defa da gelir etkisinin ikame etkisinden daha büyük olduğu görülmektedir. Emek arz eğrisinin 25$ düzeyinden itibaren tersine dönerek seyrine devam etmesinin sebebi de budur. Grafikten de anlaşılacağı gibi, emek arz eğrisinin tersine döndüğü yerde, eğri üzerindeki her noktada, artık ücret düzeyi ne kadar artarsa artsın, emek arzı düşürülerek boş zaman miktarı artırılacaktır.

3. Türkiye Emek Piyasasında Ücret-Milli Gelir İlişkisi

Bir ekonomide milli gelirin dağılımı farklı şekillerde ele alınabilmektedir. Bunlardan fonksiyonel gelir dağılımında milli gelirin üretime katkı sağlayan faktörler arasında dağılımı

esas alınmaktadır. Bu kapsamda Türkiye'de yıllar itibariyle emeğin maaş ve ücret olarak milli gelirden aldığı pay Şekil-4 yardımıyla özetlenmiştir.

Şekil- 4: Maaş ve Ücret Gelirlerinin Gelirden Aldığı Pay (%)



Kaynak: TÜİK, 2017.

Şekil-4'e göre 2010 yılında maaş ve ücret gelirlerinin milli gelirden almış olduğu pay %43 düzeylerinde iken, zaman içerinde artmış, 2013 yılında %48'e ve son olarak 2016 yılında %50 düzeylerine yaklaşmıştır.

Şekil-4'de yer alan oranlar ayrıntılı olarak analiz edildiğinde; 2016 yılında kullanabilir fert gelirleri içerisinde en yüksek pay % 49.7 ile maaş ve ücret gelirlerine ait iken, ikinci sırayı % 20 ile sosyal transferler, üçüncü sırayı ise % 18.8 ile müteşebbis gelirleri almıştır. Ayrıca sosyal transferlerin % 92'sini emekli ve dul-yetim aylıkları oluştururken, müteşebbis gelirlerinin % 73.4'ü tarım dışı gelirlerden meydana gelmiştir. Hane halkı fertlerinin esas işteki iktisadi faaliyet kollarına göre yıllık ortalama esas iş gelirleri baz alındığında, 23724 TL ile hizmet sektörü birinci sırada yer alırken, 20757 TL ile sanayi sektörü ikinci, 18159 ile inşaat sektörü üçüncü ve 14064 TL ile tarım sektörü dördüncü sıradadır. Toplam eşdeğer hanehalkı kullanılabilir fert gelirleri içerisinde en yüksek pay, bir önceki yıl ile değişim göstermeyerek %49,7 ile maaş ve ücret gelirlerine ait olmuştur. İkinci sırayı 2015 yılına göre 1 puan artış ile müteşebbis gelirleri (%19,8), üçüncü sırayı ise 0,4 puan azalış ile (%19,6) sosyal transfer gelirleri almıştır. Müteşebbis gelirlerinin %74,7'sini tarım dışı gelirler, sosyal transferlerin ise %91,8'ini emekli ve dul-yetim aylıkları oluşturmuştur (TÜİK, 2017).

4. Sonuç

Bu çalışmada Türkiye özelinde emek piyasası etkileşimlerinin analitik açıdan analiz edilmesi amaçlanmıştır. Bu kapsamda faktör piyasaları kapsamında emek piyasasının yeri, emek piyasasında gelir-boş zaman seçiminin yanı sıra, gelir-ikame etkileri, tersine dönen emek arz eğrisi ve Türkiye'de fonksiyonel gelir dağılımı çerçevesinde ücret ve maaşların milli gelirden aldığı paylar incelenmiştir.

Analiz sonuçlarına göre, 2015 yılında kullanabilir fert gelirleri içerisinde en yüksek pay % 49.7 ile maaş ve ücret gelirlerine ait iken, ikinci sırayı % 20 ile sosyal transferler, üçüncü sırayı ise % 18.8 ile müteşebbis gelirleri almıştır. Ayrıca sosyal transferlerin % 92'sini emekli ve dul-yetim aylıkları oluştururken, müteşebbis gelirlerinin % 73.4'ü tarım dışı gelirlerden meydana gelmiştir. Hane halkı fertlerinin esas işteki iktisadi faaliyet kollarına göre yıllık ortalama esas iş gelirleri baz alındığında, 23724 TL ile hizmet sektörü birinci sırada yer alırken, 20757 TL ile sanayi sektörü ikinci, 18159 ile inşaat sektörü üçüncü ve 14064 TL ile tarım sektörü dördüncü sırada yer almıştır. Türkiye'de ortalama yıllık eşdeğer hanehalkı kullanılabilir fert geliri bir önceki yıla göre %15,9 artarak 16 bin 515 TL'den 19 bin 139 TL'ye yükselmiştir.

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