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THE INVESTIGATION OF THE RELATIONSHIP BETWEEN SOCIAL AND ECONOMIC INDICATORS BY CANONICAL CORRELATION AND PARTIAL CANONICAL CORRELATION ANALYSIS FOR EU AND OTHER DEVELOPED COUNTRIES INCLUDING TURKEY

AB VE DİĞER GELİŞMİŞ ÜLKELER İLE TÜRKİYE İÇİN SOSYAL VE EKONOMİK GÖSTERGELER ARASINDAKİ İLİŞKİNİN KANONİK KORELASYON VE KISMİ KANONİK KORELASYON ANALİZİ İLE ARAŞTIRILMASI

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Abstract
Canonical correlation analysis, which is one of the multivariate statistical methods, is an alternative to multivariate regression analysis and it reveals the relationship between the variable sets. In this study, Canonical Correlation Analysis and Partial Canonical Correlation Analysis are studied practically. In the application part, various data of 31 countries including EU Countries in 2015 are used. Considering that there is a multidimensional relationship between human investments and economic indicators of the countries, the Canonical Correlation Analysis (CCA) is applied in order to reveal these relationships. In addition to variable sets of human investments and economic indicators, a new variable set which is expressed to investments for development is added to application for Partial Canonical Correlation Analysis (PCCA). Afterwards, the study is terminated with detailed interpretations.

Keywords: Canonical Correlation Analysis, Partial Canonical Correlation Analysis, Human Investments, Economic Indicator, Investments for Development

Öz
Çok değişkenli istatistiksel yöntemlerden biri olan kanonik korelasyon analizi çok değişkenli regresyon analizinin alternatifi olup, kümeler arasındaki ilişkiyi ortaya koymaktadır. Yapılan bu çalışmada, kanonik korelasyon analizi ve kısmi kanonik korelasyon analizi teorik ve uygulamalı olarak incelenmiştir. Uygulama kısmında Avrupa ülkeleri dâhil olmak üzere 31 ülkenin 2015 yılına ait çeşitli verileri kullanılmıştır. Ülkelerin insana yaptıkları yatırımları ile ekonomik göstergeleri arasında çok boyutlu ilişkinin olduğu düşünülerek bu ilişkilerin ortaya çıkarılması amacıyla kanonik korelasyon analizinden (KKA) yararlanılmıştır. Çalışmanın devamında ise insana yapılan yatırımlar ile ekonomik göstergelere ek olarak kalkınmaya yönelik yatırımlara ait değişken kümesi analize eklenerek kısmi kanonik korelasyon analizi (KKKA) uygulanmıştır. Çalışma ayrıntılı yorumlamalar yapılarak sonlandırılmıştır.

Anahtar Kelimeler: Kanonik Korelasyon Analizi, Kısmi Kanonik Korelasyon Analizi, İnsana Yapılan Yatırım, Ekonomik Gösterge, Kalkınmaya Yönelik Yatırım

GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı: Bu çalışmanın amacı, ülkelerin insana yaptıkları yatırımları ile ekonomik göstergeleri arasında olduğu düşünülen çok boyutlu ilişkinin ortaya çıkarılmasıdır.

Araştırma Soruları:

- Literatürde insana yapılan yatırımlar ile ekonomik göstergeler arasındaki ilişki nasıl konu edilmiştir?

- Ülkelerin insana yaptıkları yatırımları ile ekonomik göstergeleri arasında çok boyutlu ilişki olduğu düşünülmektedir. Bu çok boyutlu ilişkinin yapısı nasıldır?

- Ülkelerin insana yaptıkları yatırımları ile ekonomik göstergelerine ek olarak, ülkelerin kalkınmaya yönelik yaptıkları yatırımların çok boyutlu ilişkiye etkisi nedir?

Literatür Araştırması: Ulusal ve uluslararası literatür incelendiğinde, çalışmada yer verilen değişkenlere benzer değişkenler kullanılarak farklı analizlerin yapıldığı çalışmalar görülmektedir. Bu çalışmalardan ihracat miktarı ile toplam sabit sermaye birikimi arasında ve reel GSMH, sağlık harcamaları ile doğuşta beklenen yaşam süresi arasında nedensellik analizi uygulanmıştır. Yapılan ulusal çalışmalarda, GSYİH ile sağlık harcamaları arasındaki ilişki panel regresyon analizi ile eğitim harcamaları, bebek ölüm oranı, sağlık harcamaları ile kadın işgücüne katılım oranı arasındaki ilişki kümeleme analizi ile; sağlık harcamaları ile bebek ölüm oranı arasındaki ilişki ise çok boyutlu ölçekleme ile incelenmiştir. Özçomak ve Demirci (2010) çalışmasında, benzer olarak kanonik korelasyon analizinden yararlanılmış ve bebek ölüm oranı ile elektrik tüketimi değişkenleri arasındaki ilişki araştırılmıştır.

Yöntem: Bu çalışmada, ülkelerin insana yaptıkları yatırımları ile ekonomik göstergeleri arasında çok boyutlu ilişkinin ortaya çıkarılması için kanonik korelasyon analizinden yararlanılmıştır. AB ve diğer gelişmiş ülkeler dâhil olmak üzere toplamda 31 ülkenin 2015 yılına ait çeşitli verilerinden yararlanılmıştır. Ülkelerin insani yatırımlarını gösteren bebek ölüm oranı, beklenen eğitim yılı süresi, sağlık harcamaları ve kadın işgücü oranı değişkenlerinden yararlanılmıştır. Bu değişkenlere ait veriler ise sırasıyla Dünya Bankası (World Bank), Birleşmiş Milletler Kalkınma Programı (UNDP) ve Ekonomik İşbirliği ve Kalkınma Örgütü (OECD)'nden toparlanmıştır. Ülkelerin gelişmişlik göstergeleri olan tüm değişkenler ise Avrupa Komisyonu – Ekonomik ve Mali İşler (European Commission – Economic and Financial Affairs) kısmından elde edilmiştir. Çalışmanın ilerleyen kısmında ise belirlenen göstergelerin yanı sıra ülkelerin kalkınmaya yönelik yatırımlarına ait göstergeler de ele alınarak kismi kanonik korelasyon analizi uygulanmıştır. Bu kısımda tüm göstergelere ek olarak ülkelerin araştırma ve geliştirme harcamaları, enerji kullanımı ve yenilenebilir enerji tüketimi değişkenleri kalkınmaya yönelik yatırımlar adı altında çalışmaya eklenmiştir. Araştırma ve geliştirme harcamaları ile enerji kullanımı değişkenlerine ait veriler Dünya Bankası'ndan; yenilenebilir enerji tüketimine ait veriler ise Uluslararası Yenilenebilir Enerji Ajansı (IRENA)'ndan elde edilmiştir.

Sonuç ve Değerlendirme: Günümüze kadar bir çok alanda kanonik korelasyon analizi uygulanmıştır. Ancak bu durum kısmi kanonik korelasyon analizi için geçerli değildir. Bu çalışmada ise belirlenen değişkenler için ilk kez kanonik ve kismi kanonik korelasyon analizi birlikte uygulanmıştır. Bu sebeple bu çalışmanın literatüre önemli bir katkı sağlayacağı ve benzer araştırmalarda çok boyutlu ilişkinin uygulanmasında önem teşkil edeceği düşünülmektedir.

Yapılan bu çalışmanın ilk aşamasında AB ve diğer gelişmiş ülkelere ait değişken kümelerinin kendi içindeki ilişki miktarlarına bakılmıştır. Devamında ise, ülkelerin insana yaptıkları yatırımları ile ekonomik göstergeleri arasındaki ilişki kanonik korelasyon analizi ile incelenmiş ve en yüksek kanonik korelasyon katsayısı 0.951 olarak bulunmuştur. İncelenen insana yapılan yatırım ve ekonomik göstergelere ek olarak, belirlenen ülkelerin kalkınmaya yönelik yatırımlarını temsil eden değişken kümesi çalışmaya eklenmiş ve kısmi kanonik korelasyon analizi tamamlanmıştır. Bu analiz ile kanonik korelasyon analizinde bulunan ilişki miktarında artış gerçekleşerek 0.9692 sonucu elde edilmiştir. Ayrıca kismi kanonik korelasyon analizi ile, bebek ölüm oranı ve beklenen eğitim yılı süresindeki artışın, ekonomik göstergeler değişken kümesinde yer alan toplam mal ihracatı, cari fiyatlarla kişi başına özel nihai tüketim harcamaları, ulusal tüketici fiyat endeksi ve net ulusal tasarruflar üzerinde pozitif etkisi olduğu görülmektedir. Bunun yanı sıra insana yapılan yatırım göstergelerinden sağlık harcamaları ve kadın işgücü değişkenlerindeki artışın ise sabit fiyatlarla GSYİH başına net sermaye stoku, toplam mal ithalatı ve cari piyasa fiyatlarıyla kişi başına düşen GSYİH üzerinde olumlu etkisi olduğu sonucuna ulaşılmıştır.

INTRODUCTION

In the developing world, the economic differences between the countries have become apparent and the problem of economic development has come to the forefront. Economic development has begun to associate with human investments as a result of the inadequate of the economic growth indicator which is included in economic development. Among all invests on human beings such as education, health etc. are preferential. The improvements in these areas is thought to lead to a recovery in the economic indicators of the countries. It follows from this that many variables are related to each other. Since it does not reflect the sphere relationship, examination of these variables by simple relationship analysis is not suitable. It is thought that there is a multidimensional relationship between the investments and the economic indicators of the countries. In this study, the purpose is to reveal the multidimensional relationship between human investments and economic indicators of the countries. For this reason, Canonical Correlation Analysis is used.

A lot of canonical correlation analyzes have been applied until today. However, there is no similar situation for partial canonical correlation analysis. For the variables which is mentioned in this study, Canonical Correlation and Partial Canonical Correlation Analysis are applied together for the first time in the literature. For this reason, it is thought that this study will make a significant contribution to the literature. It sets an example for the application of the sphere relationship analysis in similar research.

The rest of the paper is organized as follows. First of all in the Section 2, we give a general information about the economic development, human investment etc. In Section 3, Canonical Correlation Analysis (CCA) and Partial Canonical Correlation Analysis (PCCA) are examined theoretically, respectively. To the purpose of this study, the results of the application are presented in Section 4. Lastly, the study is terminated with detailed interpretations in Section 5. In the Appendix part of this study, we give a data set.

1. GENERAL INFORMATION

Economic development is based on the concepts of national income and industrialization per capita for many economists. Although, the recovery in economic indicators of countries expresses more at the present time. The deficiencies in these concepts was seen and it is begun to arise that there are indications of investment indicators such as education, health, labor, equality, as well as valid criteria (Gürses, 2009: 340). For that reason, it has begun to talk about the importance of human investments in economic development by going beyond the concept of income (Ranis et., 2000: 197).

The studies in the literature making different analyzes by using variables similar to the variables in our study are examined. Some of these studies, Altıntaş and Çetintaş (Altıntaş et., 2010) applied causality analysis using exports and fixed capital accumulation among variables. Çetin and Ecevit (Çetin et., 2010) investigated the impact of health spending on economic growth for OECD countries by using panel regression analysis. In their study, variables of gross domestic product and public health expenditure (% total health expenditure) are given. For similar purpose, Yumuşak and Yıldırım (Yumuşak et., 2009) applied causality analysis with variables of gross national product, life expectancy at birth and health expenditure in their study. Öz et. al (Öz et., 2009) applied cluster analysis using health expenditure (% of GDP), infant mortality rate, education expenditure (% of GDP) and labor force female among their variables. Ersöz (Ersöz, 2008) is conducted multidimensional scaling analysis using health expenditures (% GDP) and infant mortality variables. Lastly, Özçomak and Demirci (Özçomak et., 2010) analysed the relationship between the social and economic indicators of African Union countries by using canonical correlation analysis. Variables of infant mortality rate and energy use are used in their study.

In the light of information, some variables are determined in order to demonstrate the multidimensional relationship between the human investments and economic indicators of countries. Considering these studies which is mentioned above, many variables are used for both human investments

and economic indicators in our study and canonical correlation and partial canonical correlation analysis are performed with these variables for the first time in literature.

In this study, first variable set $\left(X_i^{(1)}; i=1,2,3,4\right)$ is evaluated as a human investments. In these variables, the infants' mortality rate represents the rate of deaths per 1,000 live births. This rate is an important indicator of the level of health systems in countries. In countries where this rate is low, it is understood that the human investments are more. Health expenditures (% of GDP) made by countries are also considered as a contribution to human beings. The increase in that expenditures is thought to cause a decrease in the infants' mortality rate which is determined as another variable in first variable set. One of the best human investments is education. For this reason, the expected years of schooling (years) variable is added to the first variable set. Women's participation in the labor force is considered as an important indicator of sustainable development (Karabıyık, 2015: 232). Thus, the female labor force in the total labor force is also included in the first variable set.

Second variable set $\left(X_j^{(2)}; j=1,2,3,4,5,6,7\right)$ is evaluated as an economic indicators of countries. For these indicators, we use the Main Economic Indicators document of Republic of Turkey Ministry for EU Affairs (Avrupa Birliğine Üye ve Aday Ülkelerde Temel Ekonomik Göstergeler, 2011). Some of the variables that represent the capital stock, foreign trade, consumption, saving and manufacture of the countries are handled in this study. In these variables, net capital stock per unit of GDP at constant price is given in percent. This value is obtained by dividing the net capital stock value of the total economy by constant prices into the GDP value at constant prices (Economic and Financial Affairs, 2018). Total exports and imports of countries are also included in this study in Billion EUR denominated. Private final consumption expenditure at current prices per head of population (1,000 Euro) and national consumer price index based on 2010 are taken into study as a consumption indicators (Economic and Financial Affairs, 2018). Private final consumption expenditure at current prices per head of population is obtained by dividing private final consumption expenditure at current prices by total population firstly and then this value is multiplied by 1000. Another variable, national consumer price index (CPI), is defined as a measure of the price change over time of a basket of goods and services that reflects average consumption patterns of individuals in a given reference period. This index covers all the consumption expenditures of countries. One of its most important objectives is to measure inflation, comparing inflation with the other countries' inflation and determine the economic policies of governments (Türkiye İstatistik Kurumu, 2008). Lastly, net national savings (Billion EUR) and GDP per head of population at current prices (1,000 National Currency) are included in this study to represent the saving and manufacture of the countries, respectively. Net national savings is one of the conditions of sustainable development of the countries. In this sense, countries are able to reduce their dependence on foreign countries by financing national savings to an adequate level, finance their investments and provide sustainable growth and development (Sancak and Demirci, 2012). GDP per head of population at current prices, which denote manufacture indicator, is obtained firstly by dividing GDP at current prices by total population and then this value is multiplied by 1,000.

While multidimensional relationship between two variable sets are examined, it is expected that the economic development indicators of countries' will improve as a result of human investments. In consequence, a third variable set $\left(X_k^{(3)}; k=1,2,3\right)$ is considered with the idea that countries would increase in their investment towards development. The first variable included in this variable set is the expenditure on research and development (R & D) of the countries (% of GDP). To the Frascati Guide published by TUBITAK, R&D are creative works to carried out on a systematic basis for increasing the knowledge store consisting of people, culture and society and to design new applications (TÜBİTAK, 2002). With the R&D investment expenditures, the competitiveness of the countries internationally is increased and

thereby this allows that foreign capital to invest in the country. This situation is a great contribution to the growth and development of the country. For this reason, the R&D expenditures of the countries are important. Moreover, considering the use of energy (Kg of oil equivalent per capita) belonging to economically developed countries and consumption of renewable energy (TJ), these variables are also placed in third variable set.

2. METHOD

There are many factors in the events which investigated in scientific researches. In the analysis of these events, instead of univariate methods, multivariate statistical analyzes, which are an important branch of statistical analysis, are used. In multivariate statistical analysis, there are a number of variables which are related to each other and the dependency structure of the variables is explained by considering the examined event as a whole. In similar cases, Canonical Correlation Analysis (CCA) method was introduced by Hotelling in 1936 as a multivariate statistical method that analyzes the relationship structure (Hotelling, 2005). Canonical Correlation Analysis is an alternative to multivariate multiple regression analysis and there are at least two variables in the variable sets. There isn't any condition for the variable numbers in these variable sets to be equal. The variables which are involved in the analysis are transformed into canonical variables and canonical relationships are investigated between the canonical variables. Another point, there are some assumptions for CCA. These assumptions are stated as normality, linearity and no outliers (Kalkan et., 2017: 13). If these assumptions are provided, linear CCA is applied. Otherwise, nonlinear CCA is applied. In nonlinear CAA, the relationships between variable sets are analyzed without any assumption.

The purposes of CCA is ordered as testing whether the two sets of variables obtained from the same subject are statistically independent from each other and to determine the variables which are the most contributing to the relationship between the variable sets and proportion of variance of variable set explained by another variable set etc. (Çankaya, 2005). In CCA, there are two variable sets. But, the first and second variable sets as well as the third variable set are added in Partial CCA. Partial CCA which is measure of the relationship between first and second variable sets when the third variable set is pegged (Rao, 1969: 211-219). That analysis was introduced by Rao in 1969. Theoretical review of the CCA and Partial CCA will examine in this following part, respectively.

2.1. Canonical Correlation Analysis (CCA)

$X^{(1)}$ and $X^{(2)}$ variable sets have p and q variables, respectively, in X random variable set $(p<q)$. Mean and variance-covariance matrices is written for $X^{(1)}$ and $X^{(2)}$ variable sets as

$$\mu=\begin{pmatrix}\mu^{(1)}\\ \mu^{(2)}\end{pmatrix} \quad \sum=\begin{pmatrix}\Sigma_{11} & \Sigma_{12}\\ \Sigma_{21} & \Sigma_{22}\end{pmatrix}. \tag{3.1}$$

$U=a'X^{(1)}$ and $V=b'X^{(2)}$ are linear combination for $X^{(1)}$ and $X^{(2)}$. p number of canonical variable pairs are calculated because of $p=\min(p,q)$. Purpose of CCA is to provide maximum correlation between the U and V canonical variables (Özçomak et., 2010: 264). Therefore, this combination has to be unit variance (Johnson et., 2007).

For this reason, the following features are required.

$$\begin{aligned} Var(U)&=E\left[U-E(U)\right]\left[U-E(U)\right]',\\ Var(V)&=E\left[V-E(V)\right]\left[V-E(V)\right]', \end{aligned} \tag{3.2}$$

Thus, the correlation is given by

$$Kor(U,V)=\frac{Kor(U,V)}{\sqrt{Var(U)Var(V)}}=\frac{a'\Sigma_{12}b}{\sqrt{\left(a'\Sigma_{11}a\right)\left(b'\Sigma_{22}b\right)}}=a'\Sigma_{12}b. \quad (3.3)$$

In order to maximize the existing correlation, Lagranj Function which is given in Equation (3.4) must be expressed as function to be maximized (Tatlıdil, 2002).

$$L=a'\Sigma_{12}b-\frac{1}{2}\lambda_1\left(a'\Sigma_{11}a-1\right)-\frac{1}{2}\left(b'\Sigma_{22}b-1\right). \quad (3.4)$$

If we take a derivative by a and b in Equation (3.4), we obtain the equations as

$$\begin{aligned}\frac{\partial L}{\partial a}&=\Sigma_{12}b-\lambda_1\Sigma_{11}a=0,\\ \frac{\partial L}{\partial b}&=\Sigma_{21}a-\lambda_2\Sigma_{22}b=0.\end{aligned} \quad (3.5)$$

By making the required mathematical operations, we obtain $\lambda_1=a'\Sigma_{12}b$ and $\lambda_2=b'\Sigma_{21}a$. These equation are same as correlation coefficient which is given in Equation (3.3). Also, Equation (3.5) is written as

$$\begin{pmatrix}-\rho\Sigma_{11} & \Sigma_{12}\\ \Sigma_{21} & -\rho\Sigma_{22}\end{pmatrix}\begin{pmatrix}a\\ b\end{pmatrix}=\begin{pmatrix}0\\ 0\end{pmatrix}.$$

The determinant value of the first matrix must be zero in order to ensure the equation. This solution which is obtained give a relationship between $U=a'X^{(1)}$ and $V=b'X^{(2)}$ linear combinations (Tatlıdil and İçen, 2013). Also, control of the importance of partial canonical correlation coefficients is made with Roy's largest root and Bartlett Test (1941) in canonical correlation analysis (Uurtio et., 2017:9).

2.2. Partial Canonical Correlation Analysis (PCCA)

$X^{(1)}$ and $X^{(2)}$ variable sets have p and q variables, respectively. In this Partial Canonical Correlation Analysis, $X^{(3)}$ variable set which has r variables is added to analysis. Mean and variance-covariance matrices is written for $X^{(1)}$, $X^{(2)}$ and $X^{(3)}$ variable sets as

$$\mu=\begin{pmatrix}\mu^{(1)}\\ \mu^{(2)}\\ \mu^{(3)}\end{pmatrix}\quad \sum=\begin{pmatrix}\Sigma_{11} & \Sigma_{12} & \Sigma_{13}\\ \Sigma_{21} & \Sigma_{22} & \Sigma_{23}\\ \Sigma_{31} & \Sigma_{32} & \Sigma_{33}\end{pmatrix}. \quad (3.6)$$

When the $X^{(3)}$ variable set is pegged, canonical variables are demonstrated as $U=a'X^{(1)}$ and $V=b'X^{(2)}$ which are obtained from $X^{(1)}$ and $X^{(2)}$ variable sets and the equation is written with $t'=(U,V)$ vector as (Tatlıdil, 2002)

$$Var\left(t/X^{(3)}\right)=Var(t)-Kov\left(t,X^{(3)}\right)\left[Var\left(X^{(3)}\right)\right]^{-1}Kov\left(X^{(3)},t\right).$$

Similar to CCA, system of equations is written as

$$\begin{pmatrix}-\rho_3\Sigma_{11.3} & \Sigma_{12.3}\\ \Sigma_{21.3} & -\rho_3\Sigma_{22.3}\end{pmatrix}\begin{pmatrix}a\\ b\end{pmatrix}=\begin{pmatrix}0\\ 0\end{pmatrix}.$$

Partial canonical correlation coefficients are obtained by obtaining the required $\rho_{.3}$ value for the determinant value can be $a_{i.3}$ and $b_{i.3}$ and $U_{i.3} = a_{i.3}^{'} X^{(1)}$ and $V_{i.3} = b_{i.3}^{'} X^{(2)}$ variables are called as partial canonical variables (Tatlıdil and İçen, 2013). Alike CCA, control of the importance of partial canonical correlation coefficients is made with Roy's largest root and Bartlett Test.

3. APPLICATION

In this study, various data are used for 31 countries including European Countries for the year of 2015. The data are given in Appendix part. The main aim here is to reveal the multidimensional relationship between human investments and economic indicators of the countries with CCA. In this part we apply CCA and Partial CCA, respectively. It is seen that the normality and linearity assumptions are provided for CCA. Outlier's assumption is checked for all variables. Even though, Turkey is found as outliers for some variables. Turkey is the country which we would like to make comparisons. So we don't ignore for both analysis. Since some data are published for the last year of 2015, the data are used in application for this year. We have used IBM SPSS v. 20 - 23 and SAS Enterprise Guide 6.1 statistical packages for Canonical Correlation Analysis (CCA) Partial Canonical Correlation Analysis (CCA).

3.1. Application of Canonical Correlation Analysis

In application, while the first four variables is included in the first variable set $\left(X_i^{(1)}; i = 1,2,3,4\right)$, the latter seven variables is included in the second variable set $\left(X_j^{(2)}; j=1,2,3,4,5,6,7\right)$. Mortality rate (The World Bank, 2018), expected years of schooling (UNDP, 2018), health expenditure (OECD, 2018) and labor force of female (The World Bank, 2018) are evaluated as a human investments. Also, Net capital stock per unit of GDP, total imports and exports of goods, private final consumption expenditure per head of population, national consumer price index, net national savings and GDP per head of population (Economic and Financial Affairs, 2018) are evaluated as an economic indicators. These variables, which are described in details in the Section 2, are listed in Table 1.

Table 1. Variables for the first and second variable sets

Human Investments $X_i^{(1)}; i = 1,2,3,4$	$X_1^{(1)} = MR$	Mortality Rate (Per 1000 Live Births)
	$X_2^{(1)} = ES$	Expected Years of Schooling (Years)
	$X_3^{(1)} = HE$	Health Expenditure (% of GDP)
	$X_4^{(1)} = LF$	Labor Force Female (% of Total Labor Force)
Economic Indicators $X_j^{(2)}; j = 1,2,3,4,5,6,7$	$X_1^{(2)} = CS$	Net Capital Stock per unit of Gross Domestic Product at Constant Prices (%)
	$X_2^{(2)} = IG$	Total Imports of Goods (Billion EUR)
	$X_3^{(2)} = EG$	Total Exports of Goods (Billion EUR)
	$X_4^{(2)} = FCE$	Private Final Consumption Expenditure at Current Prices per head of Population (1000 EUR)
	$X_5^{(2)} = CPI$	National Consumer Price Index (Base Period = 2010)
	$X_6^{(2)} = NS$	Net National Savings (Billion ECU/EUR)
	$X_7^{(2)} = GDP$	Gross Domestic Product at Current Prices per head of Population (1000 National Currency)

Firstly, bivariate correlations between human investments (MR, ES, HE, LF) and economic indicators (CS, IG, EG, FCE, CPI, NS, GDP) are presented in Table 2.

Table 2. Bivariate correlations between human investments and economic indicators

	MR	ES	HE	LF	CS	IG	EG	FCE	CPI	NS	GDP
MR	1.00										
ES	-0.279	1.00									
HE	-0.455	0.2445	1.00								
LF	-0.771	0.4121	0.4880	1.00							
CS	-0.661	0.2383	0.5803	0.5703	1.00						
IG	0.0339	-0.096	0.4180	-0.025	0.0398	1.00					
EG	-0.002	-0.077	0.5024	-0.014	0.1105	0.9497	1.00				
FCE	-0.315	0.2146	0.5951	0.3387	0.2874	0.3523	0.3130	1.00			
CPI	0.7812	-0.165	-0.514	-0.747	-0.555	-0.092	-0.151	-0.351	1.00		
NS	0.2528	0.0578	0.4892	-0.179	0.0991	0.6469	0.6839	0.4036	-0.049	1.00	
GDP	-0.357	-0.027	0.2635	0.1799	0.0774	0.0797	0.0745	0.7217	-0.288	0.149	1.00

In the human investments variable set $\left(X_i^{(1)}; i = 1,2,3,4 \right)$, we observe that the highest correlation is predicted between MR and LF (-0.77). Especially, the MR has a negative relation with all other variables in the first variable set and ES, HE and LF have a positive relationship with each other. In the economic indicators variables $\left(X_j^{(2)}; j = 1,2,3,4,5,6,7 \right)$, highest correlation is found between IG and EG as 0.9497. This positive correlation is followed by a correlation between FCE and GDP variables (0.7217). When the relationship between two variable sets are examined, we observe that the highest correlation is 0.7812 between the MR and CPI. While ES is not highly correlated with the other economic indicators, HE is highly correlated except for the IG and GDP variables. The HE is positively correlated with all variables except for CPI in these relationship. Moreover, the LF variable is negatively correlated with all variables in both variable sets except for CS, FCE and GDP variables.

In CCA, four canonical correlation coefficients is estimated to explain the multidimensional relationship between variable sets of human investments and economic indicators. The results are given in Table 3.

Table 3. Summary results for the CCA

Canonical Correlations	Eigenvalue	Wilks Statistics	Chi-SQ	Total Variance Explanation	DF	F	Sig.
0.951	9.4543	0.021	77.650	%78.37	28	4.086	0.000
0.828	2.1720	0.215	30.725	%18	18	1.947	0.031
0.521	0.3742	0.684	7.588	%3.10	10	0.752	0.669
0.245	0.0638	0.940	1.241	%0.53	4	0.304	0.871

Based on these results, first and second canonical correlation coefficients (0.951, 0.828) are significant among all estimated canonical correlation coefficients ($p<0.05$) (Table 3). This suggest that we summarize for all two pairs. The total variance explanation of significant canonical correlations is found 96.37% (78.37%+18%) using the values in the Table 3.

Considering the correlation coefficients which are significant, the standardized partial canonical coefficients for canonical variables are given in Table 4 and Table 5 for human investments and economic indicators variable sets, respectively. The values which in this table represent the change in canonical variable in terms of standard deviation versus one standard deviation increase in original variables.

Table 4. Standardized canonical coefficients for canonical variables in first variable set

	MR	ES	HE	LF
U_1^*	-0.854	-0.244	-0.129	0.305
U_2^*	-0.323	-0.183	-1.087	0.105
U_3	0.988	0.426	-0.343	1.292
U_4	-0.847	0.970	-0.174	-1.050

$$U_1^* = -0.854MR - 0.244ES - 0.129HE + 0.305LF$$

$$U_2^* = -0.323MR - 0.183ES - 1.087HE + 0.105LF$$

U_1^* and U_2^* linear canonical variables which is found significant can be written in the above form, respectively. Regardless of the signs of the coefficients in the equations, MR (-0.854) provides the most contribute to U_1^* canonical variable. Using these canonical coefficients, they are interpreted as the decrease in the MR, ES and HE variables and the increase in the LF variable cause an increase in the U_1^* canonical variable. HE (1.087) provides the most contribute to U_2^* canonical variable. This contribution is followed by a MR (-0.323), ES (-0.183) and LF (0.105) variables. In a similar way to the comments which is made to the U_1^* canonical variables, the decrease in the MR, ES and HE variables and the increase in the LF variable cause an increase in the U_2^* canonical variable.

Table 5. Standardized canonical coefficients for canonical variables in second variable set

	CS	IG	EG	FCE	CPI	NS	GDP
V_1^*	0.389	0.390	-0.129	-0.167	-0.588	-0.579	0.336
V_2^*	-0.186	0.972	-1.048	-0.808	-0.028	-0.416	0.474
V_3	-0.453	0.053	-0.778	1.142	-0.509	0.012	-1.310
V_4	0.644	-1.313	0.513	0.225	0.672	0.125	0.198

$$V_1^* = 0.389CS + 0.390IG - 0.129EG - 0.167FCE - 0.588CPI - 0.579NS + 0.336GDP$$
$$V_2^* = -0.186CS + 0.972IG - 1.048EG - 0.808FCE - 0.028CPI - 0.416NS + 0.474GDP$$

Similarly, linear canonical variables is obtained using the coefficients in Table 5 for the second variable set. Regardless of the signs of the coefficients in the equations, CPI (-0.588) and NS (-0.579) provide the most contribute to V_1^* canonical variable, respectively. In addition to this, the least contributing variable is EG (-0.129). Using these canonical coefficients, they are interpreted as the increase in the CS, IG and GDP variables and the decrease in the EG, FCE, CPI and NS variables cause a decrease in the V_1^* canonical variable. Also, EG (-1.048) and IG (0.972) provide the most contribute to V_2^* canonical variable. It is inferred that the decrease in the CS, EG, FCE, CPI and NS variables and the increase in the IG and GDP variables cause an increase in the V_2^* canonical variable. When the U_1^*, U_2^*, V_1^* and V_2^* canonical variables are considered together, it is concluded that MR, ES and HE variables are positively correlated with EG, FCE, CPI and NS variables. They are also negatively correlated with IG and GDP. Moreover, there are a positive correlations between the LF, IG and GDP variables.

Table 6. Canonical and cross loadings for first variable set

	MR	ES	HE	LF
Canonical Loadings $\left(U_1^*\right)$	-0.963	0.088	0.349	0.800
Canonical Loadings $\left(U_2^*\right)$	0.142	-0.317	-0.933	-0.252
Cross Loadings $\left(V_1^*\right)$	-0.915	0.084	0.332	0.761
Cross Loadings $\left(V_2^*\right)$	0.117	-0.262	-0.773	-0.208

When the canonical loadings between the canonical variables and their original variables in the human investments variable set are examined, the largest canonical loading values for the U_1^* canonical variable set are -0.963 and 0.800, respectively, with the MR and LF variables. For the U_2^* canonical variable set, the maximum loading value belongs to the HE variable with -0.933. When canonical loadings between the canonical variables of the first variable set (human investments) and the original variables of the second variable set (economic indicators) are examined, the largest canonical loading values are -0.915 and -0.773 with the MR and HE variables for the V_1^* and V_2^* canonical variable sets, respectively.

Table 7. Canonical and cross loadings for second variable set

	CS	IG	EG	FCE	CPI	NS	GDP
Canonical Loadings $\left(V_1^*\right)$	0.636	-0.071	-0.051	0.256	-0.830	-0.365	0.350
Canonical Loadings $\left(V_2^*\right)$	-0.485	-0.544	-0.643	-0.662	0.311	-0.776	-0.178
Cross Loadings $\left(U_1^*\right)$	0.605	-0.067	-0.048	0.244	-0.789	-0.347	0.332
Cross Loadings $\left(U_2^*\right)$	-0.401	-0.450	-0.532	-0.548	0.257	-0.642	-0.147

In Table 7, when the canonical loadings between the canonical variables and their original variables in the economic indicators variable set are examined, the largest canonical loading values for the V_1^* canonical variable set are -0.830 and 0.636, respectively, with the CPI and CS variables. Especially, the effect of IG (-0.071) and EG (-0.051) on the canonical variable formation of the V_1^* variable set is low. For the V_2^* canonical variable set, the maximum loading values belong to the NS, FCE, EG and IG variables, respectively. The minimum loading value belongs to the GDP (-0.178) variable. When the cross loadings are examined, the largest canonical loading values for the U_1^* canonical variable set are -0.789 and 0.605, respectively, with the CPI and CS variables. Whereas the EG has the minimum loading value for the U_1^* canonical set. For the U_2^* canonical variable set, the maximum loading values belongs to the NS (-0.643), FCE, EG and IG variables, respectively.

The loading values which are obtained in Table 6 and Table 7, indicate the relationship between the original variables and the canonical variables comprise of these variables (Tatlıdil and İçen, 2013). Also, the proportion of variance explanation and the redundancy indexes for the variable sets are calculated one by one by taking advantage of these loading values (Stewart and Love, (1968). This analysis is calculated to determine how much of the variance in a variable set is explained by the other set of variables (Kalkan et., 2017: 15). As a result of these calculations, the results of the variable sets are summarized in Table 8.

Table 8. Variance and redundancy analysis for both variable sets

	$X_i^{(1)}$ (First Variable Set)					$X_j^{(2)}$ (Second Variable Set)				
Canonical Variable	Proportion of Variance Explanation	Additive Proportion of Variance Explanation	Redundancy Index	Additive Redundancy Index	Canonical Variable	Proportion of Variance Explanation	Additive Proportion of Variance Explanation	Redundancy Index	Additive Redundancy Index
U_1^*	0.424	0.424	0.184	0.184	V_1^*	0.203	0.203	0.383	0.383
U_2^*	0.264	0.688	0.207	0.391	V_2^*	0.302	0.505	0.181	0.564
U_3	0.163	0.851	0.023	0.414	V_3	0.083	0.588	0.044	0.608
U_4	0.149	1.000	0.009	0.423	V_4	0.156	0.744	0.009	0.617

From Table 8, it is observed that 42.4 and 26.4% of total variation of first variable set is explained by U_1^* and U_2^* canonical variables, respectively. Proportion of total variance explained is found 100% and redundancy index is 0.423. Also, it is found that 38.34 and 18.07% of total variation of first variable set is explained by canonical variables V_1^* and V_2^*, respectively. Besides, the maximum proportion of variance

explanation for the first variable set are 0.424 and 0.383, respectively, with the U_1^* and V_1^* canonical variables.

Similarly, it is found that 20.3 and 30.2% of total variation of second variable set is explained by canonical variables V_1^* and V_2^*, respectively. It is calculated that the proportion of total variance explained is 74.4% and redundancy index is 0.617. Moreover, it is observed that 18.4 and 20.7% of total variation of second variable set is explained by canonical variables U_1^* and U_2^*, respectively. Besides, the maximum proportion of variance explanation for the second variable set are 0.302 and 0.207, respectively, with the V_2^* and U_2^* canonical variables.

According to these results, 42.3% of total variation in the first variable set is explained by second variable set and 61.7% of total variation in the second variable set is explained by first variable set. Also, we investigate the relationship between U_1^*, U_2^*, V_1^* and V_2^* canonical variables, which are significantly found in explaining the relationship between the first and second variable sets, with study which is done in this part.

3.2. Application of Partial Canonical Correlation Analysis

The multidimensional relationship between countries' human investments and their economic indicators has been studied with CCA. Considering that this relationship will also affect the investments for development of the countries, the third variable set $\left(X_k^{(3)}; k=1,2,3\right)$ is added in addition to the variables shown in Table 1. When the effect of the third variable $X_k^{(3)}; k=1,2,3$ set is fixed, we apply Partial CCA with the aim of the revealing the relationship between variable sets. This variable set is named as investments for development and it includes R & D expenditures for the year of 2015 (The World Bank, 2018), energy use and renewable energy consumption (IRENA, 2018) for countries.

Table 9. Variables for the third variable set

Investments for Development $X_k^{(3)}; k=1,2,3$	$X_1^{(3)} = RD$	Research and Development Expenditure(%of GDP)
	$X_2^{(3)} = EU$	Energy Use (Kg of Oil Equivalent Per Capita)
	$X_3^{(3)} = REC$	Renewable Energy Consumption (Tera Joule (TJ))

Before the results of PCCA, the correlations between the variables which is in the first and second variable sets and the third variable set are given in Table 10.

Table 10. The correlations between the third variable set and other variables

	MR	ES	HE	LF	CS	IG	EG	FCE	CPI	NS	GDP
RD	-0.11	0.135	0.766	0.045	0.206	0.377	0.405	0.486	0.003	0.348	0.261
EU	-0.32	0.269	0.207	0.290	-0.003	0.044	-0.002	0.363	0.108	-0.254	0.307
REC	0.212	0.099	0.491	-0.06	0.242	0.648	0.639	0.330	0.113	0.623	-0.15

Using Table 10, we observe that the highest correlation between the human investments and indicators for development variable sets is 0.766 with HE and RD variables. All variables which is included in the investments for development set are positively correlated with the ES and HE.

When the correlations between economic indicators and investments for development variable sets are examined, the highest correlations are sorted as between REC and IG (0.648), EG (0.639) and NS (0.623). Whereas the lowest correlations are observed between EU and CS (-0.003) and EG (-0.002). RD has the lowest correlation with the CPI (0.003).

In partial canonical correlation analysis, when the effect of the third variable $\left(X_k^{(3)}; k=1,2,3\right)$ set is fixed, the correlations between the first and second variable sets are given in Table 11.

Table 11. Correlations between human investments and economic indicators when the effect of the third variable ($X_k^{(3)}; k=1,2,3$) set is fixed

	CS	IG	EG	FCE	CPI	NS	GDP
MR	-0.778	-0.115	-0.184	-0.256	0.868	0.098	-0.210
ES	0.198	-0.220	-0.174	0.092	-0.193	0.094	-0.108
HE	0.528	0.152	0.304	0.466	-0.715	0.328	0.360
LF	0.603	-0.023	0.014	0.243	-0.821	-0.131	0.062

According to the results, the highest correlation is found 0.868 between the MR and CPI. This correlation is followed by a negative correlation (-0.778) which is between MR and CS. Similar to the results in CCA, the ES is not highly correlated with the other economic indicators variable set. Also, CPI variable has negatively correlated with human investments variable set except the MR variable.

Table 12. Summary results for the PCCA ($X_k^{(3)}; k=1,2,3$ set is fixed)

Canonical Correlations	Eigenvalue	Wilks Statistics	Total Variance Explanation	DF	F	Sig.
0.9692	15.5343	0.0196	%91.05	28	3.41	<0.0001
0.7147	1.0444	0.3239	%6.12	18	1.09	0.3952
0.5429	0.4181	0.6623	%2.45	10	0.69	0.7286
0.2465	0.0647	0.9392	%0.38	4	0.26	0.9000

In Partial CCA, four canonical correlation coefficients are estimated to explain the multidimensional relationship between variable sets. From Table 12, only first canonical correlation coefficient is found significantly ($p<0.05$). This suggest that we summarize for only one pair. Total variance explanation of significant canonical coefficient if found 91.05%. Hereunder, the relationship between human investments and economic indicators is calculated 0.9692 in case the effect of third variable set $\left(X_k^{(3)}; k=1,2,3\right)$ is fixed.

Considering the correlation coefficient which is significant, the standardized partial canonical coefficients for canonical variables are given in Table 13 and Table 12 for human investments and economic indicators variable sets, respectively.

Table 13. Standardized partial canonical coefficients for canonical variables in first variable set ($X_k^{(3)}; k=1,2,3$ set is fixed)

	MR	ES	HE	LF
U_1^*	-0.7481	-0.1430	0.0866	0.2758
U_2	-0.5874	-0.4722	-1.1754	0.3560
U_3	0.8200	0.4295	-0.4212	1.2312
U_4	-0.9806	0.8487	-0.3979	-0.9582

$$U_1^* = -0.7481MR - 0.1430ES + 0.0866HE + 0.2758LF$$

Regardless of the signs of the coefficients in the equation, using these partial canonical coefficients, MR (-0.7481) provides the most contribute to U_1^* linear canonical variable. Whereas HE (0.0866) provides the least contribution to U_1^* when the effect of the third variable set is eliminated on the first variable set.

Table 14. Standardized partial canonical coefficients for canonical variables in second variable set ($X_k^{(3)}; k=1,2,3$ set is fixed)

	CS	IG	EG	FCE	CPI	NS	GDP
V_1^*	0.3818	0.1583	-0.0016	-0.1485	-0.7169	-0.1712	0.1444
V_2	0.0517	1.4332	-1.2450	-0.8183	-0.0274	-0.7725	0.7102
V_3	-0.4863	0.1220	-0.8092	0.5860	-0.6521	0.1783	-1.0460
V_4	1.1025	0.1884	-0.3906	-0.2197	0.6869	0.4520	-0.2703

The following equation is obtained by using the partial canonical coefficients for the second variable set in Table 14.

$$V_1^* = 0.3818CS + 0.1583IG - 0.0016EG - 0.1485FCE - 0.7169CPI - 0.1712NS + 0.1444GDP$$

Using this equation, regardless of the signs of the coefficients in the equation, CPI (-0.7169) and CS (0.3818) provide the most contribute to V_1^* linear canonical variable, respectively, in case the effect of the third variable set is eliminated on the second variable set. In addition to this, alike CCA, the least contributing variable is EG (-0.0016).

Table 15. Canonical and cross loadings for first variable set ($X_k^{(3)}; k=1,2,3$ set is fixed)

	MR	ES	HE	LF
Canonical Loadings $\left(U_1^*\right)$	-0.9756	0.1380	0.6854	0.8360
Cross loadings $\left(V_1^*\right)$	-0.9456	0.1338	0.6643	0.8104

Canonical and cross loadings for variable set of human investments is given in Table 15 in case the effect of third variable set ($X_k^{(3)}; k=1,2,3$) is fixed. When the canonical loadings between the canonical variables and their original variables in the variable set of human investments are examined, the largest canonical loadings values are -0.9756 and 0.8360, respectively, with the MR and LF variables for the U_1^* canonical variable set. On the other hand, the canonical loadings between the canonical variables of the first variable set and the original variables of the second variable set are examined, the largest canonical loading values are -0.9495 (MR) and 0.8104 (LF) for the V_1^* canonical variable set when the effect of the third variable set is fixed. This result is similar with the results of U_1^* canonical variable set. For canonical and cross loadings for variable set of economic indicators, see the Table 16 below.

Table 16. Canonical and cross loadings for second variable set ($X_k^{(3)}; k=1,2,3$ set is fixed)

	CS	IG	EG	FCE	CPI	NS	GDP
Canonical Loadings $\left(V_1^*\right)$	0.7886	0.1276	0.1985	0.2944	-0.9385	-0.0996	0.2277
Cross loadings $\left(U_1^*\right)$	0.7644	0.1237	0.1924	0.2854	-0.9097	-0.0966	0.2207

The largest canonical loading values for the V_1^* canonical variable set are -0.9385 and 0.7886, respectively, with the CPI and CS variables. For the U_1^* canonical variable set, the largest canonical loading value belongs to the CPI (-0.9097) variable. The minimum loading values belong to the NS variable for U_1^* and V_1^*. All results is obtained under the condition that effect of investments for development variable set ($X_k^{(3)}; k=1,2,3$) is eliminated on the other two variable set.

The proportion of variance explanation and the redundancy indexes for these variable sets are calculated by using canonical and cross loadings. The results are given in Table 17.

Table 17. Variance and redundancy analysis for both variable sets ($X_k^{(3)}; k=1,2,3$ set is fixed)

$X_i^{(1)}$ (First Variable Set)					$X_j^{(2)}$ (Second Variable Set)				
Canonical Variable	Proportion of Variance Explanation	Additive Proportion of Variance Explanation	Redundancy Index	Additive Redundancy Index	Canonical Variable	Proportion of Variance Explanation	Additive Proportion of Variance Explanation	Redundancy Index	Additive Redundancy Index
U_1^*	0.5349	0.5349	0.2291	0.2291	V_1^*	0.2438	0.2438	0.5025	0.5025
U_2	0.1657	0.7005	0.0725	0.3016	V_2	0.1419	0.3857	0.0846	0.5872
U_3	0.1633	0.8638	0.0459	0.3474	V_3	0.1556	0.5413	0.0481	0.6353
U_4	0.1362	1.000	0.0090	0.3565	V_4	0.1488	0.6901	0.0083	0.6436

From the results which in Table 17, it is observed that 53.49 and 50.25% of total variation of first variable set is explained by U_1^* and V_1^* canonical variables, respectively, when the effect of investments for development variable set is eliminated on the other first and second variable set. Proportion of total variance explained is found 100% and redundancy index is 0.3565. Moreover, the maximum proportion of variance explanation for the first variable set are 0.5349 and 0.5025, respectively, with the U_1^* and V_1^* canonical variables.

It is found that 24.38 and 22.91% of total variation of economic indicators variable set is explained by canonical variables V_1^* and U_1^*, respectively, in case the effect of third variable set ($X_k^{(3)}; k=1,2,3$) is fixed. Besides, it is calculated that the proportion of total variance explained is 69.01% and redundancy index is 0.6436.

The maximum proportion of variance explanation for the first variable set are 0.2438 and 0.2291, respectively, with the V_1^* and U_1^* canonical variables.

According to the these results, 35.65% of total variation in the first variable set is explained by second variable set and 64.36% of total variation in the second variable set is explained by first variable set when the effect of the set of investments for development ($X_k^{(3)}; i=1,2,3$) is fixed.

RESULTS

In the first part of this study, we have investigated the relationship between human investments and economic indicators of countries with CCA. In this analysis, first two canonical correlation coefficients are found significant and necessary interpretation are made. The highest canonical correlation between the variable sets of human investments and economic indicators is obtained 0.951.

In the second phase of application, variable set of investments for development is added for Partial CCA. Only first canonical correlation is found significant in this analysis. According to the CCA result, this correlation is found increasingly as 0.9692.

According to the results of canonical variables U_1^* and V_1^*, we observe that variables of MR and ES have a positive effect on the EG, FCE, CPI and NS. Likewise, variables of the HE and LF have a positive effect of the CS, IG and GDP variables.

Considering all of CCA and PCCA results, U_1^* and V_1^* canonical variables are found significantly. While the contribution direction of the HE has changed in the positive direction from the negative direction on U_1^* canonical variable, other variables has no changed. Contribution direction of all variables

has not changed on V_1^* canonical variable. Moreover, we find that 42.4 and 53.49% of total variation is explained by canonical variable U_1^* for CCA and Partial CCA, respectively. In both analysis, proportion of total variance explained is found 100%. Also, it is found that 20.3% of total variation is explained by canonical variable V_1^* for CCA. This proportion is observed 24.38% for Partial CCA. Proportion of total variance explained is obtained 74.4 and 69.01% for CCA and PCCA, respectively.

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APPENDIX

APPENDIX 1: Used Data in Study

Countries	MR	ES	HE	LF	CS	IG	EG	FCE	CPI	NS	GDP	RD	EU	REC
Belgium	3.2	16.6	8	46.09	2.67	338.13	357.74	18.68	108.62	1.19	34.18	2.46	4687.79	5.22
Czech Rep	2.5	16.8	6	44.06	2.91	127.48	142.36	7.48	107.57	0.95	25.43	1.95	3860	5.25
Denmark	3.6	19.2	8.7	47.32	2.42	77.17	86.06	22.55	107.14	1.52	36.59	3.01	2816.61	5.34
Germany	3.3	17.1	9.5	46.21	2.85	947.63	1195.82	19.96	106.9	2.49	35.97	2.88	3817.55	6.19
Estonia	2.5	16.5	5.1	48.46	2.95	13.1	11.57	8.05	111.48	0.29	21.75	1.5	4173.33	4.58
Ireland	3.1	18.6	5.5	44.4	2.08	69.02	111.7	18.81	104.73	1.44	52.38	2.03	2835.62	4.66
Greece	3.1	17.2	4.8	43.46	4.31	43.57	25.89	11.36	100.77		19.75	0.96	2182.07	5.1
Spain	2.8	17.7	6.3	46.04	3.64	281.22	254.6	13.5	106.51	1.62	26.04	1.22	2571.18	5.84
France	3.2	16.3	8.7	47.16	3.09	516.81	455.87	18.12	105.59	1.76	30.77	2.23	3687.82	5.94
Italy	2.9	16.3	6.7	42.06	3.32	370.48	412.29	16.58	107.5	1.07	27.93	1.33	2481.75	6.07
Latvia	4.3	16	3.2	49.59	1.04	13.06	10.94	7.42	107.56		18.58	0.63	4179.69	4.83
Luxembourg	2.1	13.9	5.3	44.15	2.17	21.02	15.47	27.49	109.21	0.77	77.49	1.29	6548.41	4.06
Hungary	4.6	15.6	5.2	45.68	2.17	82.95	88.85	5.56	111.32	0.97	19.94	1.38	2432.75	5.11
Netherlands	3.3	18.1	8.5	45.65	2.85	461.8	514.31	17.92	109.21	1.91	37.4	2.01	4233.04	5.21
Austria	3	15.9	7.8	46.73	3.55	140.7	137.76	21.01	110.72	1.43	37.42	3.07	3804.49	5.64
Poland	4.2	16.4	4.4	45.14	2.04	177.18	179.53	6.54	108.15	1.6	19.81	1	2490.21	5.58
Portugal	2.9	16.6	5.9	48.75	3.07	60.35	49.63	11.37	107.04		22.21	1.28	2131.68	5.33
Slovenia	1.9	17.3	6.1	46.02	2.1	26.89	28.79	10.07	106.01	0.11	24.04	2.21	3174.87	4.65
Slovakia	5	15	5.5	44.79	1.66	66.17	67.85	7.97	108.71	0.38	22.4	1.18	3003.66	4.83
Finland	2	17	7	48.13	3.07	54.49	53.95	21.14	108.84	0.29	31.57	2.9	5924.7	5.67
Sweden	2.4	16.1	9.2	47.45	3.47	124.81	126.26	20.61	103.6	1.76	35.87	3.26	5102.79	5.89
UK	5.7	16.3	7.7	46.41	2.71	564.55	414.74	26.21	111.86		31.47	2.79	2763.98	5.8
Iceland	1.7	19	7.1	47.75	2.64	4.79	4.27	22.78	117.84	0.18	35.61	2.21	17478.89	5.32
Turkey	11.7	14.6	3.4	31.06	0.97	186.78	129.65	5.97	146.07	1.89	17.98	2.03	1656.8	5.82
Norway	2.2	17.7	8.9	47.01	2.85	65.8	93.12	29.14	108.54	1.81	46.33	1.93	5817.64	5.71
Switzerland	3.6	16	7.9	46.4	2.86	226.68	261.23	39.49	98.18	1.91	47.26	2.03	2960.07	5.36
US	3.7	16.5	8.5	45.91	2.34	2020.4	1356.07	34.61	108.69	2.78	42.13	2.79	6800.65	6.79
Japan	2	15.3	9.1	42.69	2.85	584.03	563.13	17.66	103.6	2.24	30.5	3.28	3428.56	5.27
Canada	4.5	16.3	7.4	47.17	2.4	401.05	367.97	22.43	108.67	1.55	32.93	2.03	7600.32	6.28
Australia	3.2	20.4	6.5	45.73	2.75	191.93	169.87	26.93	112.04	1.78	35.25	2.03	5489.96	5.54
New Zealand	4.6	19.2	7.4	47.47	2.71	32.94	30.96	19.75	107.94	1.78	28.44	2.03	4444.73	5.54