INCOME INEQUALITY IN SOME MAJOR EUROPEAN UNION ECONOMIES A DISCRIMINANT ANALYSIS

JYOTIRMAYEE KAR [*]

ABSTRACT: *This exercise is an attempt to assess the importance of some social, economic, demographic and infrastructural factors which account for the prevailing income inequality across some of the EU countries. Using discriminant analysis the study suggests that crime recorded by police is the most important predictor in discriminating between the group of countries with relatively more equitable distribution of income from those with less. This variable is followed by number of students in the country. Reduction in the level of crime and improvement in the student strength could help in reducing income inequality. Quite intuitively, improvement in all the economic factors like GDP per capita and agricultural index will help to reduce income inequality. Identical is the case of the demographic factors. This calls for implementation of developmental policies towards improvement in these areas.*

KEY WORDS: *income inequality; GDP per capita; EU countries.*

JEL CLASSIFICATION: *C82, E66, E69, O22, O29, O52.*

1. INTRODUCTION

The European Union (EU) is an economic and political union or a confederation of 27 states, located primarily in the Europe. The Union was originated from the European Coal and Steel Community (ECSC) and the European Economic Community (EEC). Started by six countries, in 1958 the membership has increased to 27. In the intervening years the EU has grown in size by inclusion of new member states, and in power by the addition of policy areas to its remit. The Maastricht treaty established the European Union under its prevailing name, EU in 1993. The latest amendment to the constitutional basis of the EU, the Treaty of Lisbon, became operative in 2009.

The European Union is composed of 27 sovereign Member States: Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France,

[*] *Prof., Ph.D., ICFAI Business School, Bhubaneswar, Orissa, India, jyotirmayee.k@gmail.com*

Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain Sweden and The United Kingdom.

The Union's membership has grown from the original -Belgium, France, (then-West Germany, Italy, Luxembourg and the Netherlands-to the present day 27 by successive enlargements as countries acceded to the treaties and by doing so, pooled their sovereignty in exchange for representation in the institutions.

The EU operates through a system of cross national independent institutions and negotiated decisions by the member states. The European Commission, the Council of the European Union, the European Council, the Court of Justice of the European Union and the European Central Bank are some of the major institutions of the EU. The European Parliament is elected every five years by the EU citizens.

Within the Schengen Area (which includes EU and non-EU states) passport controls have been abolished. EU policies aim to ensure free movement of people, goods, services and capital and enact legislation in justice and home affairs, and A monetary union, the Eurozone, using a single currency, was established in 1999. As of January 2012, it is composed of 17 member states. Through the Common Foreign and Security Policy, the EU has developed a limited role in external relations and defense. EU is represented as a unified body at the United Nations, the WTO, the G8 and the G 20.

With a total population of over 500 million, which comprises 7.3% of the world total the EU had a nominal GDP of 16,242 billion US dollars in 2010, which represents an estimated 20% of global GDP, measured in terms of purchasing power parity. This made EU, the largest economy in the world.

The EU has developed a single market through a standardized system of laws which apply in all member states. It is the largest exporter, the largest importer of goods and services, and the biggest trading partner to several large countries such as China, India and the United States.

As declared by the Fortune Global 500, in 2010, of the top 500 largest corporations measured by revenue, 161 have their headquarters in the EU. In May 2007 unemployment in the EU was 7%, while investment was at 21.4% of GDP. Inflation stood at 2.2% and public deficit at −0.9% of GDP.

Though member of a single union, there exist wide disparity in the income across the EU countries. GDP per capita is often used as an indicator of countries' level of welfare. But this does not reflect the extent of income disparity across the countries. Often an alternative welfare indicator is adapted to better reflect the situation of households. It is the Actual Individual Consumption (AIC) per capita. Generally, levels of AIC per capita are more homogeneous than those of GDP. In this respect also, the Member States of EU exhibited substantial differences across themselves. In 2010, AIC per capita, expressed in terms of purchasing power parity, in the member states, ranged from 42 per cent to 150 percent of the EU 27 average. It ranged between 50% above the EU 27 average in Luxembourg and nearly 60% below average in Bulgaria.

Another factor, which can reflect comparative welfare condition across the EU economies, is the extent of income inequality. Present study has incorporated this variable. Inequality of income ranges from a low of 3.2 in Slovenia to the high of 7.3 in

Latvia. The correlation between GDP per capita and the extent of inequality of income is negative, but insignificant (-0.395). High per capita income reflecting high growth does not indicate greater development. Developed economy like UK has a high extent (5.3) of income inequality (figure 1.).

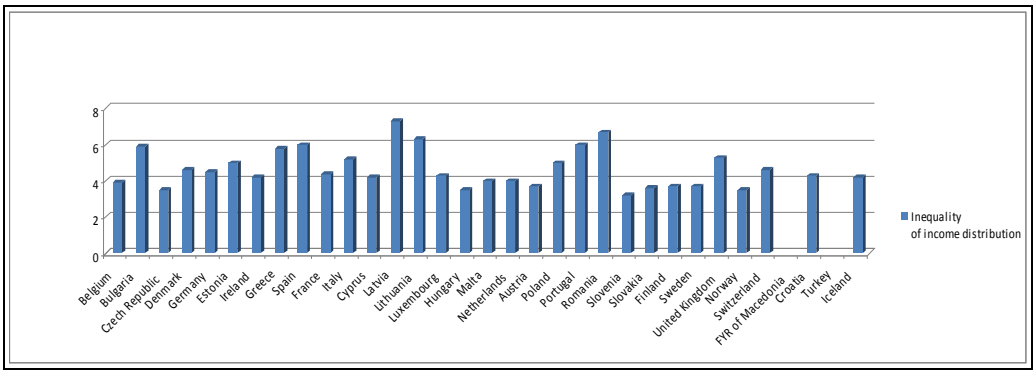

Figure 1. Inequality of income distribution

Then what explains development and equitable distribution of income across the EU countries? Is it a political factor like membership of EU or other socio-economic factors? To explore this, present exercise has segregated the economies on the basis inequality of income and using Discriminant Analysis, has attempted to explain which of the 12 selected factors could be the most important in defining inequality.

2. SOME EARLIER STUDIES

Decade's worth of scholarship has examined the inequality issue. Tárki european social report (2008) presents the scenario in detail.

Niehues (2009) has examined income inequality within and between European countries. The study concludes that inclusion of new EU member countries has significantly increased inequality. Overall trend in EU-15 observes changing within-country inequality but there has been no significant reduction of the inequality between countries. The study records contradiction of convergence process of mean incomes across the EU-15 member states. It also explains that lower mean incomes of new member countries are responsible for substantial increase in overall EU income inequality.

Checch et al (2010), observe the extent of income inequality and opportunity inequality in 25 European countries. Their work contributes to understanding the origin of standard income inequality, which helps to identify potential institutional setups that are associated with opportunity inequality. They have distinguished between ex ante and ex post opportunity inequality. They find that ex ante equality of opportunity exhibits positive correlation with public expenditure in education, whereas ex post equality of opportunity is positively associated with union presence and to fiscal redistribution.

Atkinson et al (2010), highlight financial dimensions of poverty and inequality in the European households. They have examined the distribution of income in the 27 Member States of the EU to assess the magnitude of difference within and across the countries. Examining changes overtime in income inequality and poverty, they have concluded in which countries the differences are the largest. They have highlighted those households, which according to the EU definition are 'at-risk-of-poverty'.

Aaberge et al (2010) have evaluated the effects of the value of education and health care services on estimates of income inequality and poverty in the EU countries and Norway. They have examined whether and eventually to what extent, estimates of inequality and poverty will be affected by extending the definition of income to include basic in-kind transfers, and whether the ranking of countries, according to the level of inequality and poverty, changes.

An M Sc thesis guided by Dr. Tom van Veen (2009) examines the relationship between economic freedom and income inequality, across the 27 European Union Member States over a time-period from 1975 to 2006. The study has made a distinction between 15 old and 12 new Member States of the European Union to investigate whether the recent changes in the new Member States have any impact on the level of economic freedom, political freedom, and their relation to income inequality. Results of the study show that economic freedom positively influences income inequality. This was most evident for the 12 new Member States. Political freedom is observed to positively influence economic freedom as well as income inequality. However, in the case of the 15 old member states the relationship between political freedom and income inequality is found to be negative. Overall, for the 27 EU Member States the level of income inequality in a country is highly influenced by the governmental role in the economy.

Biewen (2001) develops a discrete variant of the semi-parametric methodology to measure the effects of socio-economic variables on the income distribution. This method is based on the calculation of hypothetical income distributions by reweighting the original population. The study has applied this framework to examine the distributional effects of rising unemployment, decreasing female labor market participation, and widening income structure in East Germany following the reunification with West Germany in 1990. The empirical results suggest that these factors contributed considerably to the recent increase in income inequality in East Germany.

Večerník (2010) has studied the simultaneous changes in earnings disparities, inequality of household income, and the connections between them. The work presents various data on four Central and East European (CEE) countries and, for the sake of comparison, partially on Austria and Germany. First, the study compares the changes in both the distributions over time since the communist period and seeks to answer how much did disparities and inequalities increase during the transition? Second, it examines how should the association between personal and household earnings be analyzed? Third, it observes how strong was and currently is the association in CEE countries and how do they differ in packaging family income? The study categorizes income under two perspectives: employed persons (examining the association between their earnings and the income of the households they live in) and employee households

(examining the sources of their income by decomposing their inequality). The findings that, earnings disparities and income inequalities rose more or less in all four CEE countries after 1989, are confirmed by various sources. This is visible in the individual countries in various phases of their transition. However, as reveled by the the EU-SILC surveys, no increase occurred from 2004 to 2007.

Rodríguez-pose and Tselios (2009) have considered regional disparities using microeconomic data aggregated at the regional level. They have not only used the average, but also inequality levels of individual incomes within regions. The study maps regional personal income distribution in Western Europe, using data from the European Community Household Panel (ECHP) data survey covering more than 1,00,000 individuals, for 102 regions, and over the period 1995–2000. The study observes a strong U-shaped relationship between income per capita and inequality. It also observes that regions with similar income conditions tend to cluster within and across the national borders. It is interesting to record that there exists a North-South and an urban-rural divide in terms if inequality. The northern regions and city-regions have the highest economic development, as well as the lowest levels of inequality.

Directorate-General for Research Report (2010) containing the results of the EU Framework Programme projects found that poverty and intergenerational transmission of inequality is considerable in all countries studied, but its levels vary among EU Member States. This highlights the role of the welfare state in reducing inequality. The study prescribes policies facilitating generation of good quality and well rewarding jobs. This will effectively redistribute resources in favour of the poor and facilitate children with education and care. The study highlights that education and learning policies can contribute to overcome intergenerational transmission of inequality in addition to policies combating poverty. However, education and learning should be viewed in connection with other social factors like employment, economy, youth, healthcare, justice, housing and social services, related to exclusion.

Harjes (2007) examines the impact of globalization on high and evenly shared living standards. Measures of income distributions, based on household disposable income suggest that inequality has increased in most of the industrialized countries. But this development was very uneven and much less pronounced in euro-area countries, suggesting that broad phenomena such as trade liberalization and technological change may not be major drivers of inequality. His paper analyzes the evolution of income distributions based on household data across industrialized countries over the past decades to identify stylized facts that could help discriminate between competing hypotheses for the evolution of income inequality. The paper presents more detailed measures of income distributions than Gini coefficients.

Present exercise, however, attempts to explain income inequality by using some socio-economic factor. The objective is to find out which socio-economic factor help in reducing income inequality so that policy measures could be chalked out accordingly. It is also expected to add value to the existing literature.

After the introductory note and review of some earlier studies the next two sections present broad objectives and limitations of the study. The fourth examines the factors included to explain the extent of inequality. The fifth section conducts a discriminant analysis to determine the influence of these factors. This section also

discusses the results and summarizes the issue. The last section contains concluding remarks and policy prescription.

3. OBJECTIVES

Broad objectives of the study are:

- to segregate the EU countries on the basis of prevailing income inequality,
- to find out which social, economic, demographic or infrastructural factor contributes to this inequality.
- to come up with necessary policy suggestions on the basis of the results

4. METHODOLOGY AND LIMITATIONS

The 27 EU countries are segregated into two groups applying Beta analysis. This method is widely used for developmental studies. The calculation has been done in Excel. Then the study uses discriminant analysis to identify which factor contributes to income inequality across EU countries. The disscriminant score of the independent variables are estimated by using SPSS.

Due to missing variables all the 27 members could not be considered in the analysis, which has included 20 cases.

5. DATA AND VARIABLE SPECIFICATION

Inequality of income measures the ratio of total income received by the 20 % of the population with the highest income (top quintile) to that received by the 20 % of the population with the lowest income (lowest quintile). This means a high value of the ratio reflects more inequality. Disposable income is considered as income for the analysis.

The study has incorporated some economic variables like GDP per capita as per Purcasing Power Standard (PPS), index of agricultural income, annual growth rate of retail trade; demographic factors like population (65+), total life expectancy at birth, number of students; social development indicators like number of persons with a second job, number of crime recorded by police and infrastructal development representing inland freight by rail, energy prices and domestic expenditure on R & D by businesses.

In 2010, the Gross Domestic Product (GDP) per capita in Luxembourg, expressed in purchasing power standards (PPS), was more than two and a half times the EU27 average, while that of the Netherlands was one third above the average. Ireland, Denmark, Austria and Sweden had GDP per capita between 20% and 30% above the EU27 average, while Belgium, Germany and Finland had that between 15% and 20% above average. The United Kingdom and France registered GDP per capita around 10% above the EU27 average, while Italy, Spain and Cyprus were very close to the average.

Greece, Slovenia, Malta, Portugal and the Czech Republic were between 10% and 20% lower than the EU27 average, while Slovakia was around 25% below.

Hungary, Estonia, Poland, Lithuania and Latvia, with a low per capita income were place between 35% and 50% lower, while Romania and Bulgaria were around 55% below the EU27 average.

There exists a significant variance for annual per capita income within individual EU states, which ranges from €11,000 to €70,000 (about US$14,000 to US$90,000) (figure 2).

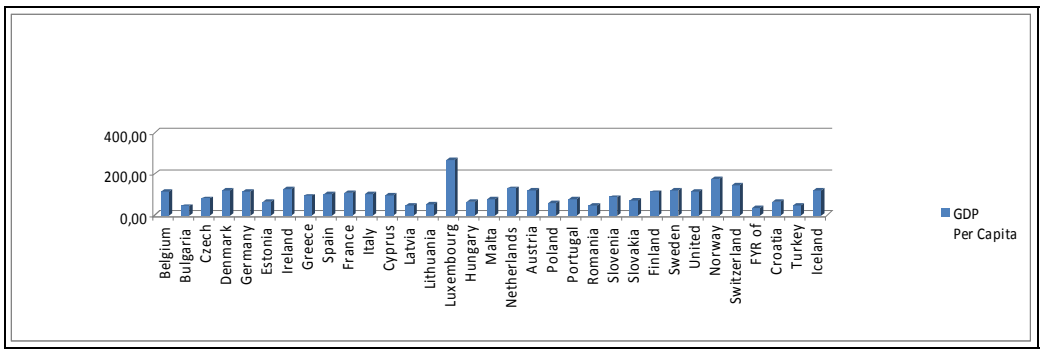

Figure 2. GDP Per Capita

The study has incorporated GDP per capita as one of the determining variables of income inequality. It is expected that per capita GDP will well explain higher and lower income inequality. Agriculture does not contribute much to the GDP of the EU countries, despite 31% of the total budget expenditure. This is reflected by Gross value Added by Agriculture (% share of total value added) (figure 3).

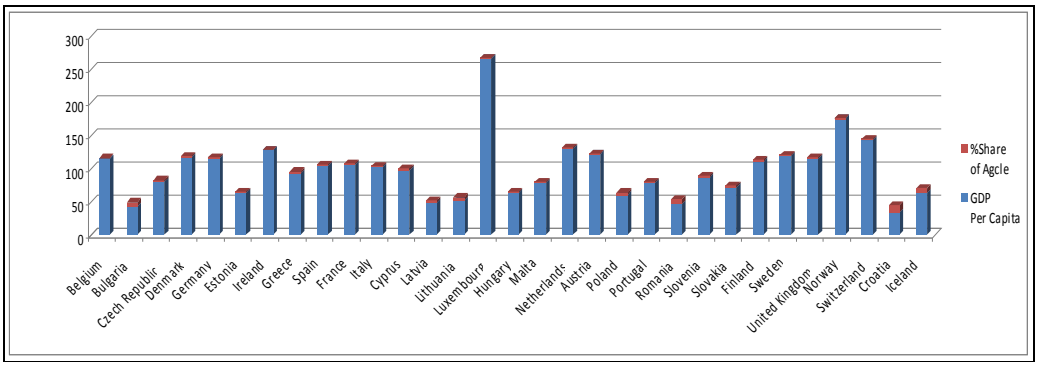

Figure 3. Gross value Added by Agriculture (% share of total value added)

The index of income from agricultural activity is also not very impressive. The correlation between agricultural index and income inequality is positive but insignificant (0.142). It is expected that a country with a larger share of agricultural income will have high income inequality. Of these two variables index of income from agricultural activity is used as a discriminating variable.

Another economic factor included in the study is annual growth rate of retail trade. Growth in retail trade is expected to reduce inequality. The correlation between these two is negative and significant at 0.01 levels (-0.543).

Demographic factors like population (65+), number of students and total life expectancy at birth are expected to bring about greater equality in income distribution. Similarly, social development indicators like number of persons with a second job and reduction in the number of crimes recorded by police are expected to reduce inequality. Infrastructural development is represented by inland freight by rail, energy prices and domestic expenditure on R & D by businesses. All these variables have negative correlation with income inequality. In the case of rail freight the coefficient is insignificant (-0.065), while those of the latter two, -0.463 and -0.462 respectively, are significant. Improvement in all these, are expected to reduce income inequality.

6. DATA ANALYSIS

Using beta distribution the 20 EU countries for which data are available are categorized into two groups. The first one comprises 12 countries with less income inequality (Slovenia, Czech Republic, Slovakia, Finland, Sweden, Belgium, Netherlands, Ireland, Luxembourg, France, Germany and Denmark) and the second group has 8 countries (Estonia, Poland, Bulgaria, Spain, Portugal, Lithuania, Romania and Latvia) with relatively high income inequality

Table 1. Case Summaries of 12 countries with relatively low Income Inequality

	GDP Per Capita	Ag Index	%Share Of Agcle	Age	Life Exp	Studnt	2nd Job	Crime	Gr Retail	Rail	Energy Prices	R&D Exp
N	12	12	12	12	12	12	12	12	12	12	12	12
Minimum	72	56,7	0,3	11,05	74,93	80,20	1,01	28,25	-10,48	2,7	7,83	0,2
Maximum	267	125,1	2,7	20,40	81,46	14065,40	9,31	6284,66	2,21	44,7	15,8114	2,78
First	87	83,4	2,4	16,44	79,14	387,90	3,47	88,20	-10,48	23,4	10,5315	1,07
Last	118	56,7	1,1	15,89	78,77	1151,60	9,31	445,27	-4,27	22,2	15,8114	1,91
% of Total N	100	100	100	100,00	100,00	100,00	100	100,00	100	100	100	100
Mean	121,08	90,50	1,61	15,66	79,50	3416,62	4,33	1241,10	-3,18	22,10	9,91	1,43
Range	195	68,4	2,4	9,35	6,52	13985,20	8,3	6256,41	12,69	42	7,9814	2,58
Std. Deviation	49,506	20,51	0,78	2,52	1,83	4654,50	2,58	1873,18	4,12	12,51	2,24	0,77
% of Total Sum	100	100	100	100	100	100	100	100	.	100	100	100

Case summaries of the 12 countries with less income inequality are presented in the table 1 and those of the other 8 countries with relatively high income inequality are presented in Table 2.

As depicted in the two tables, the 12 country group, on an average has relatively higher GDP per capita, life expectancy, student ratio, persons with a second job, crime, growth of retail trade, energy prices, railway freight and R&D expenditure than those of the 8 countries in the other group. The latter exceed the former in terms of agricultural index, share of agriculture and population above 65. However, share of agriculture, life expectancy, growth of retail trade and railway freight of the latter group exhibit greater variation, as reflected by higher standard deviation, than those of

the former. Table 3 presents a comparative statistics of means and standard deviations of both the groups.

Table 2. Case Summaries of 8 countries with relatively high Income Inequality

	GDP Per Capita	Ag Index	%Share Of Agcle	Age	Life Exp	Studnt	2nd Job	Crime	Gr Retail	Rail	Energy Prices	R&D Exp
N	8	8	8	8	8	8	8	8	8	8	8	8
Minimum	44	91,8	2,3	13,4946081	71,9631361	257,5	0,62	50,375	-27,96	0,6	6,1916	0,15
Maximum	104	136,9	7	17,6358795	81,1795085	8168,4	7,4	2309,859	2,9	41,9	8,9116	0,76
First	63	93,9	2,6	17,1168631	74,2763457	257,5	4,25	50,375	-18,27	0,6	8,0011	0,56
Last	49	98,6	3,1	17,2845282	72,471188	430,6	4,65	55,62	-27,96	41,9	7,1726	0,15
% of Total N	100	100	100	100	100	100	100	100	100	100	100	100
Mean	62,38	106,44	3,88	16,31	75,21	3045,46	4,21	556,65	-11,38	15,89	7,58	0,36
Range	60	45,1	4,7	4,14127139	9,2163724	7910,9	6,78	2259,484	30,86	41,3	2,72	0,61
Std. Deviation	20,071	16,152	1,66	1,45	3,36	3213,82	2,21	797,65	10,44	13,38	0,89	0,27
% of Total Sum	100	100	100	100	100	100	100	100	.	100	100	100

Table 3. Comparative Analysis

	Mean			**Difference in Group Mean**	**Std. Deviation**		
	Group of 12	**Group of 8**	**Total**		**Group of 12**	**Group of 8**	**Total**
GDP Per Capita	121,08	62,38	97,60	58,71	49,51	20,07	49,38
AG INDEX	90,5	106,44	96,88	-15,94	20,51	16,15	20,10
%Share of Agcle	1,61	3,88	2,52	-2,27	0,78	1,66	1,63
Age	15,66	16,31	15,92	-0,65	2,52	1,45	2,13
Life Exp	79,50	75,21	77,79	4,30	1,83	3,36	3,28
Studnt	3416,62	3045,46	3268,16	371,15	4654,50	3213,82	4047,54
2nd Job	4,33	4,21	4,28	0,12	2,58	2,21	2,38
Crime	1241,10	556,65	967,32	684,45	1873,18	797,65	1544,07
Gr Retail	-3,18	-11,38	-6,46	8,20	4,12	10,44	8,18
Rail	22,10	15,89	19,62	6,21	12,51	13,38	12,90
Energy Prices	9,91	7,58	8,98	2,33	2,24	0,89	2,14
R&D Exp	1,43	0,36	1,01	1,07	0,77	0,27	0,81

6.1. Discriminant Analysis Model

The discriminant analysis model involves linear equation of the underwritten form: D = b0+b1x1+b2x2+b3x3+……..+bixi
where: D = discriminant score; b's= discriminant coefficient or weight; x's= independent variables or predictors

Application of the discriminant function estimates the discriminant coefficient or weight (b's), so that the groups differ as much as possible on the values of the estimated discriminant function. This occurs only when the ratio of between-group sum of squares to within-group sum of squares for the discriminant scores is at a maximum. Different linear combination of the results will give smaller ratios.

6.2. Results and Interpretation

Present exercise has used the direct method of estimating the discriminant function in which all the predictors, the independent variables are used simultaneously, irrespective of their discriminating power. The other method, stepwise method is appropriate when the researcher needs to select a subset of the predictors for inclusion in the discriminant function.

The results are obtained by using SPSS. The first segment reporting the group means and the standard deviation give approximation of the results. It appears that the two groups are more widely separated by the record of crime than any other variable. There appears to be more of a separation on the basis of the number of students than GDP per capita. Extent of crime has the highest standard deviation in both the groups and this is followed by the number of students.

The study has considered two groups and as such, only one discriminant function has been estimated. The function estimates the eigen value to be 5.436, which accounts for 100 percent of the explained variance. The canonical correlation of the function is calculated to be 0.919. Square value of this correlation: $(0.919)^2 = 0.84$, reveals that 84 percent of the variance in the dependent variable, inequality of income distribution is explained or accounted for by this model.

Wilks's λ tests the significance of the discriminant function. Here the estimated value is 0.155. This gives the chi-square value of 23.27, with 11 degrees of freedom. It is statistically significant at 0.01 levels.

Relative importance of the variables is presented by the standardized discriminant function coefficients. Predictors with large standardized coefficient contribute more to the discriminating power of the function than those with small ones. On the basis of SPSS output we can suggest that crime recorded by police is the most important predictor in discriminating between the groups, followed by number of students. Comparison of the group means of these variables exhibit largest difference.

The structure matrix contains the simple correlation between the predictors and the discriminant function listed in order of magnitude.

The result provides unstandardised discriminant function coefficients. These represent the raw values of the variables in the process of classification. These coefficients could be used to formulate a multiple regression equation estimating income inequality as the dependent variable.

Next table gives the group centroids which contain the values of the discriminant function evaluated at the group means. Group 1, economies with less income inequality has a negative value (-1.806) while that of the group 2, encompassing economies with high income inequality is positive (2.709).

It may be observed that the signs of the coefficients associated with some of the variables are positive while some are negative. Out of the economic variables, GDP per capita, agricultural index have positive values. Improvement in these values will contribute to improve income inequality. Growth of retail trade, with a negative coefficient, exhibits opposite effect on income equality across the selected EU countries.

Demographic factors like population (65+) and number of students have positive coefficients; indicating improvement in these factors will contribute to improvement in equality.

Possibility of having a second job will improve equality while crime rate will reduce the same. This is revealed by the respective positive and negative coefficients.

Infrastructural factors, inland freight by rail, energy prices and gross domestic expenditure on R&D by the business sector as a percentage of GDP come up with negative coefficients. This speaks of improvement in these factors may not result in improvement in income equality.

Table 4. Standardized Canonical Discriminant Function Coefficients

	Function
	1
GDP Per Capita	.534
AG INDEX	.340
AGE	1.515
LIFE EXP	-.330
STUDNT	2.438
2ND JOB	.753
CRIME	-2.674
GR RETAIL	-.616
RAIL	-.552
ENERGY PRICES	-.667
R&D EXP	-.733

It could be noted that the variables identified in order of importance in the structure matrix does not match with those in the standardized discriminant coefficients. While R & D expenditure comes as the most important factor in the structure matrix, in the standardized discriminant function crime has the largest coefficient. The signs of some of the coefficients in both the tables also do not match. This anomaly is due to presence of multicollinearity.

The classification results show that the hit ratio, i.e., the percentage of cases correctly classified is 100 per cent. This implies that validity of the discriminant function is satisfactory.

7. CONCLUSION AND POLICY PRESCRIPTION

Present exercise attempted to assess the importance of some social, economic, demographic and infrastructural factors which account for the prevailing income inequality across 20 EU countries. Using discriminant analysis the study suggests that crime recorded by police is the most important predictor in discriminating between the groups, followed by number of students. Reduction in the level of crime and improvement in the student strength could help in reducing income inequality. Quite

intuitively, improvement in all the economic factors like GDP per capita and agricultural index will help to reduce income inequality. Identical is the case of the demographic factors. This calls for implementation of developmental policies towards improvement in these areas.

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