A PRE-INVESTIGATION ON THE SAVING BEHAVIOUR OF THE EUROPEAN AREA: A ROBUST CLASSIFICATION ON THIS ISSUE

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Abstract

Saving behaviours of countries are shaped with the effects of the some elements as social policies, age structures, cultures, and so forth. Inherently these elements change country to country. Since the possible European countries saving behaviour variation can be seen as a striking issue, the paper aims to explore and classify the different structured countries. For the purpose the classification process is based on Modigliani's life-cycle model and performed with robust approach. .

Keywords: Life-cycle savings model, outlying European countries for saving structure comparison, robust outlier detection.

Jel Classification: E21, J11, N34, C19

Özet

Ülkelerin tasarruf davranışları sosyal politikalar, yaş yapısı, kültür ve bunun gibi bazı unsurların etkisiyle şekillenir. Doğal olarak bu farklılıklar ülkeden ülkeye değişmektedir. Zira Avrupa ülkelerinin olası tasarruf yapısı değişikliği dikkat çekici bir konu olarak görülebileceğinden, bu çalışma farklı yapıdaki ülkelerin incelenmesi ve sınıflandırılmasını amaçlar. Bu sebeple, sınıflama süreci dayanıklı yaklaşım çerçevesinde Modigliani'nin yaşam boyu hipotezine dayandırılmıştır.

Anahtar Kelimeler: Yaşam boyu tasarruf modeli, tasarruf yapısı karşılaştırmasına göre aykırı Avrupa ülkeleri, dayanıklı aykırı gözlem teşhisi.

Jel Sınıflaması: E21,J11,N34,C19

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1. INTRODUCTION

Mostly, national characteristics of countries are distinct from the each others and this natural result causes their savings behaviour variation. Actually the factors on these distinctions also can be counted in details; impact of culture, economic, demographic and institutional factors so forth. Instead analyzing in details and classifying according to these hardly measurable factors, the groups that the countries constituted are diagnosed here with an appropriate econometric technique.

Policy makers plan future steps of government and make decisions by considering some macroeconomic indicators and they submit their policies based on these macroeconomic variables. Hence sometimes immeasurable effects like behaviours appear as a key stress on the subject. The subject studied here can provide policy makers a point of view that helps their decision making on saving, for instance decision of a union, international trade or actuarial studies so forth.

In studying countries' savings, the model that we adopted is based on life cycle hypothesis. According to the conventional life-cycle savings hypothesis, a rational individual adopts a lifetime consumption plan that balances the utility gained from acquiring additional investment assets against expenditures on current consumption across all stages of the life-cycle (Ando & Modigliani, 1963). Economic agents in this model are assumed to save part of their disposable income during the period before retirement, and consume from the accumulated wealth during retirement. Besides the significant need of income variable, involving the population age structure is also a must for a saving model. Here by considering these both determinants, in 1980 a study was carried out by Belsey, Kuh and Welsch about to different countries from all over the world from 1960 to 1970. This paper puts the need to similar study for European countries with current data to examine saving behaviour cross-countries.

Through the prior knowledge of included European countries' possible dissimilar socioeconomic pattern, which might have meaning possible existence of outlier observations that are far from rest of them, we applied robust analysis as a supplement to the study of Belsey et al.

For that study, Belsey et al. used standard OLS analysis to diagnose outliers with classical diagnostics, but it is known that OLS analysis has 0-zero breakdown value (means that an arbitrarily small percentage of deviant observations can change the OLS estimations to any value at all from $-\infty$ to $+\infty$ (Asad et al, 2001)). This defect leads us to prefer to use robust regression analysis for avoiding some distortion effects in OLS estimates. Thus, in this presented study we adopted more effective estimation technique to diagnose outliers.

The data contain 27 different European countries' numbers from 1990 to 2006. Here we should remark that we took the median value of all variables for the period. So, the model that is of the interest;

$$GNSR_i = \alpha_0 + \alpha_1 RDPI_i + \alpha_2 \Delta RDPI_i + \alpha_3 AGE(-15)_i + \alpha_4 AGE(65+)_i + \varepsilon_i \tag{1}$$

where the response variable *GNSR* is gross national savings rate and the regressors are respectively real disposable income, changing real disposable income from year to year, average percentage of population under 15, and average percentage of population over

2. LIFE-CYCLE SAVINGS HYPOTHESIS

The life-cycle theory was developed by Modigliani, Ando and Brumberg. The life-cycle hypothesis views individuals, instead, as planning their consumption and saving behaviour over long periods with the intention of allocating their consumption in the best possible way over their entire lifetimes. So the life-cycle hypothesis views savings as resulting mainly from individuals' desires to provide for consumption in old age. Within this context, we can state the consumption function as;

$$C = aW_{NH} + bY_L \tag{2}$$

where W_{NH} is nonhuman wealth, *a* is mpc[*] (marginal propensity to consume) of wealth, Y_L is labor income, and *b* is the mpc of labor income. In other words, they determine two different incomes; employment and asset income. As it is seen both have different mpc

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[*] The marginal propensity to consume (mpc) is measured as the ratio of the change in consumption to the change in income.

and actually habits and interest rate determine it. Though there are difficulties associated with the measurement of them.

To simplify the hypothesis, the following assumptions are made; Income is constant during the working life. A temporary change in income doesn't change the consumption. So consumption is consistent along lifetime. People distribute their income among the consumption and investment to maximize their economic welfare or utility. People generally save while working and then use these savings to finance spending in their retirement years.

Life-cycle theory of saving predicts that people save a lot when their income is high relative to life time average income and dissave when their income is low relative to lifetime average (Dornbusch R. and Fisher S., 1994: 303). Below figure helps visual perception of this hypothesis.
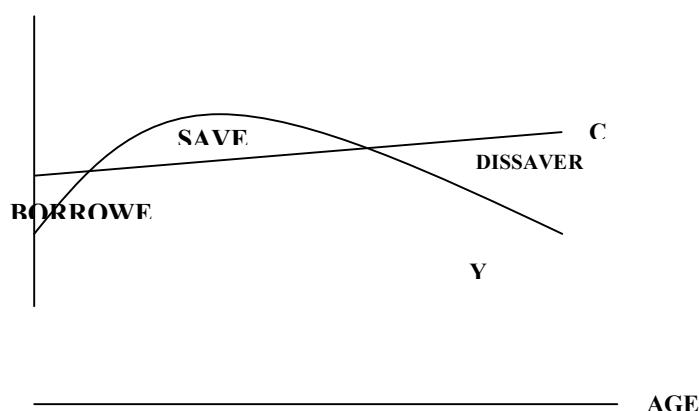
Figure 1. Representation of Life-Cycle Savings Hypothesis

If we think for macroeconomic level of these variables, aggregate consumption and saving depend in part on the age distribution of the population. Existing of more young people in population will raise the saving rate. Similarly population aging will reduce the level of private savings. Most of econometric studies have been done to indicate the effects of the changing age structure of the population. Concerning to life-cycle hypothesis against age structure changes, Figure 1 also refers to this situation of; as the saver area broadens (namely saving years increase), population aging will raise savings. In the related literature there have

placed some studies of Horioka (1997), Thornton (2001), Ekici and Yorulmaz (2008), in which the age structure and saving rate relation were investigated.

Beyond these settlements, one of the further studies of Modigliani (1986) provides a good review of the theory of the determinants of individual and national thrift. In this study he claims that saving rate is independent of its per-capita income.

Aggregate saving also depends on such characteristics of the economy as the average age of retirement and presence or absence of a social security program. Sun (2001) emphasized private pension and social security effects on savings. So it would be challenging to add model these two factors as variables that reflect the income and health care policies of countries. But the original version of the model is followed.

We used "gross national savings" variable instead of "personal savings" and justification for this preference can be stated like this; as Attanasio and Székely (2000) pointed out, especially micro data is affected by severe measurement problems. Due to measuring different items or elements, this kind of studies lead reader to conceptual confusion. For instance, the differences in the definition of consumption, income and differences in the population of reference all prevent a direct comparison between aggregate measures of saving rates and measures derived from micro sources.

We met the similar situation during the data collection. In the National Accounts of many developing countries national saving is not disaggregated into private and public, and, even available, private saving is not divided between households and corporate. On the other hand, in the few micro data sources available, data on asset ownership, entitlements to pensions and so on. Thus, matching aggregate private saving to micro data is not easy. Even if one thinks that households are the ultimate owners of corporations and assumes that they are able to "pierce the corporate veil," aggregate private saving and micro data may differ if foreign investors own some firms. (Attanasio, O. and Székely M., 2000).

3. METHOD

The Classification of European countries is based on outlier maps that are proposed in Rousseeuw and Van Zomeren's (1990) study. The drawings of these maps consist of the residuals obtained from regression and the distances of observations. At this point, the classical or robust method decision causes to emerge dissimilar classification results.

The standard OLS estimator is widely used in regression analysis due to its computational ease. Unfortunately, it is quite sensitive to outliers and other deviations from the standard linear regression model. One of the assumptions of OLS estimator is identically and independently distributed errors. However this assumption may not be ensured when the data contain outliers. An outlier is an observation that lies outside of the overall pattern of the other observations. The risk of outliers to the standard OLS estimation is that they can have a strong adverse effect on the estimations, and then estimations can be biased and inefficient. In low dimensional data it is possible to notice outliers but in high dimensional data, outliers might not be noticed visibly.

An observation can be an outlier in vertical (y direction), in horizontal (x direction) or both. Outliers in the x space are also referred as leverage points; they can affect the regression model. Outliers in the y direction have large residuals. Observations that lie far from the mass of the x have high leverage, they have a significant influence on the OLS regression coefficients. Observations that are close to the centre have a little leverage effect; they do not considerably affect the shape of the regression relationship.

As is known robust regression is an important technique for analyzing data that are contaminated with outliers and it provides resistant results and gives a possibility to detect outliers. In order to give resistant estimations, the technique limits the influence of outliers.

One of the simple robust regression methods is Least Absolute Deviations (LAD) but it is not protective against outliers in the x direction. Huber introduced M estimation (1973) for regression, but when the data contain outliers in the x direction, the method has no advantage over least squares.

Rousseeuw (1984) developed the first robust regression estimators, least median squares (LMS) and least trimmed squares (LTS). Both are high breakdown estimators which mean it still maintains its robustness in the case of contamination.

There are several other robust regression methods but we will not mention here. LTS technique has better statistical efficiency; it is not easily endangered by the contamination of data. Furthermore it can serve as a diagnostic tool to detect outliers. LTS regression is based on the subset of *h* cases (out of *n*) whose least squares fit possesses the smallest sum of squared residuals. $Min_{\alpha} \sum_{i=1}^{h} (e^2(\hat{\alpha}))_{i:n}$ The coverage *h* may be set between *n/2* and *n*.

As mentioned before, Rousseeuw and Van Zomeren (1990) proposed a figure to detect outliers (shows the classification of data into groups of regular observations, bad leverage points, good leverage points, and vertical outliers), they calculated robust distances with minimum volume ellipsoid. But since Minimum Covariance Determinant Estimator (MCD) and LTS are more advantageous in terms of efficiency the figure improved with them.

The good leverage points allow obtaining the regression estimation with high precision. The bad leverage points and vertical outliers may strongly affect the OLS estimation and even they can change the slope.

4. DATA AND FINDINGS

As mentioned above the study covers European countries listed here as Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Check Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom.

By use of these observations, the proposed map -mentioned in section 3- was drawn according to the classical and robust approaches. Equation (1) was decisive for these approaches. Firstly, least squares estimation method was used to obtain this relation and reached the following;

$$GNSR_i = 38.1794 - 0.00001 RDPI_i + 0.9207 \Delta RDPI_i - 0.2432 AGE(-15)_i - 0.7223 AGE(65+)_i \qquad (3)$$

Classical residuals and mahalonobis distances were derived from the estimated parameters of equation (3). And by means of both residuals and distances, LS Regression Outlier Map was formed. Afterwards, LTS estimation method used and the same steps were followed to obtain robust residuals and distances. The estimation of robust regression equation is as below;

$$GNSR_i = 38.4425 - 0.00001 RDPI_i + 0.1974 \Delta RDPI_i - 0.3808 AGE(-15)_i - 0.6135 AGE(65+)_i \qquad (4)$$

The coefficients of equations (3) and (4) give almost the similar results with Belsey et al. That means, the signs of the coefficients are as expected and the theory is verified. However, the classification is of the main interest of the paper, we give further details on mapping.

In the section that the method was declared, outlier(s) maps that will be used in categorization are based on regression residuals and observations' distances. These maps are drawn by using Matlab package LIBRA. In the vertical axes of these drawings, the bounds for residuals are determined with standard values (- 2,5) and (+ 2,5); and in the horizontal axes of it, the bound for Mahalanobis / robust distances is determined according to the related critical value of χ^2.

To show comparative advantage of robust analysis we preferred to start with reporting the classical outlier map.
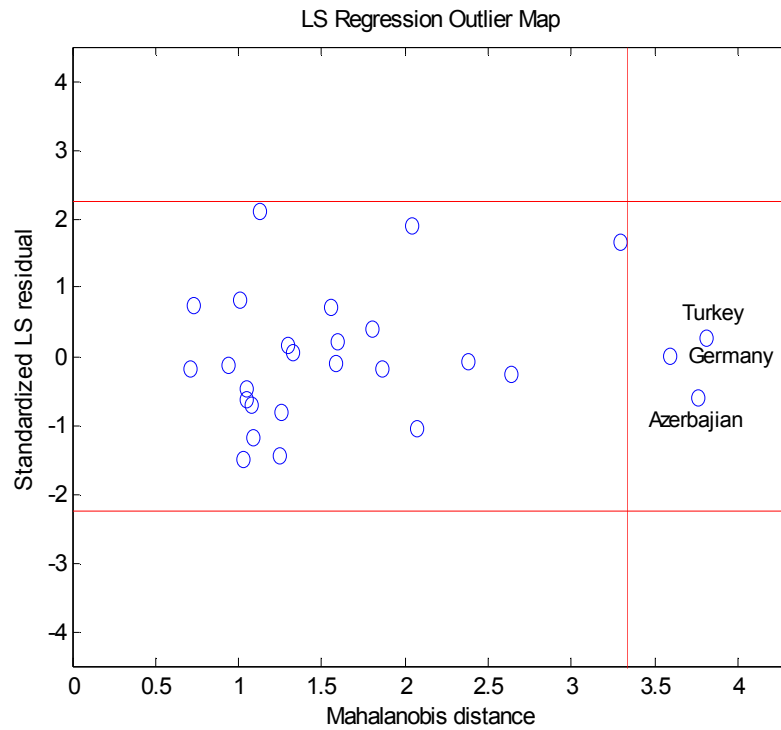
Figure 2. LS Regression Outlier Map

The map stated above was drawn according to Mahalanobis distance and standardized residuals (obtained from standard OLS). It shows that Germany, Turkey, Azerbaijan are good leverage points. Since the results are obtained from classical covariance matrix and standard OLS, researcher should be caution about it and needs to go through the further analysis. Intuitively we know that actual statuses of outlying countries are not just limited with these reported three countries.

However, with the robust version of outlier map based on LTS residuals and robust covariance matrix, number of identified outliers are increased. The evidences are seen Figure 3.;
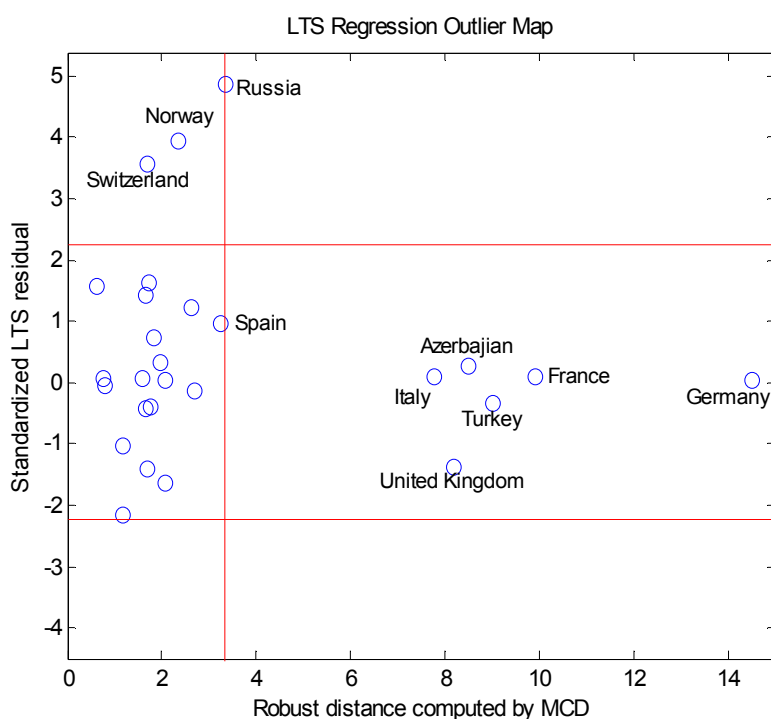
LTS Regression Outlier Map

Figure 3. LTS Regression Outlier Map

That is, on the contrary, the second map illustrates Norway and Switzerland as vertical outliers. Since regarding dependent variable -the savings rate- value, actually Norway and Switzerland are expected to be fall in the same area. Presumably we can classify these two outlying countries as self-specific saving rate observation group. What plays the role these countries (Norway and Switzerland) to be vertical outlier? For Norway, within the framework of a life-cycle model, a generation that is characterized as being particularly patient or prudent will save more while young and less while old, a result that goes against the intuition that the current old save much because they belong to a generation with preferences for high saving. (Halvorsen E., 2003) Beyond generational differences, mortality, preferences, expectations about pension benefits, and historical productivity growth so forth are mainly responsible for changes on saving rate level.

For Switzerland, a study made by Swiss-American Chamber of Commerce also remarks that Switzerland has one of the highest saving rates in the world. Furthermore Economic survey of Switzerland 2007 indicates that again Switzerland with a very high national saving rate – caused to some extent by the mandatory pension system.

Russia seems at the borderline, which disperses bad leverage points' area from vertical outliers' area. In Russia transition from socialism and so its uncertainties create considerable effects on income, consumption, even total economic system. The transition led initially to decline from the high rate of domestics savings maintained in the socialist era. This drop however was accompanied by a shift in the composition of savings. As the savings of the government and the enterprises fell, household savings rose, as a share of both total domestics savings and household disposable income (Foley and Pyle, 2005).

Both from a priori economic expectation and also from the results published at country yearly statistics, this rest of the countries at map named France, Germany, Italy, Spain and United Kingdom have high real disposable income levels, which implies being of x-direction outlier. According to our classification, it is reasonable to call this group as income-specific.

Here we should say that European Purchasing Power statistics appear as a figure that will verify our results. As is known Purchasing Power is defined as disposable income after deduction of taxes and compulsory social contributions. These five countries having great share of Purchasing Power (as Figure 4) are the countries having high level of disposable income. Besides Figure 4 contributes the comments that can be done for Figure 3 in our study as well. Even Figure 4 belongs to year 2006, and the shares of the countries remain the same for last decade.
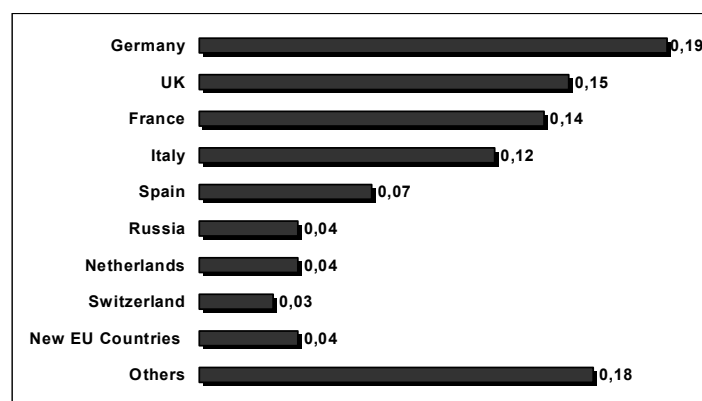

Figure 4. Purchasing Power 2006 in Europe

As to other two good leverage points namely Azerbaijan and Turkey are appeared in the same area since they are outlying on the x-direction, too. But here the different response

variables cause the countries to fall the area. It speaks of young age structure of Azerbaijan and Turkey explains this, and the group can be called as age-specific. Finally, the rest of 17 regular observations reflect EU region standard in terms of all variables included in the analysis. To sum up the interpretations, when the first map is benchmarked with the second one, the increment of the numbers of the good leverage points can be seen here obviously.

Definitely a serial of micro-studies might be done to explore the saving rate changes of the countries one by one, but it's out of the purpose of the paper.

5. CONCLUSION

This paper empirically focused on classification of 27 European countries' saving behaviour within the Modigliani's life cycle saving hypothesis. Robust method was employed to identify outlying countries that could bias standard OLS used in outlier map. Outliers using both robust and classical approaches were identified and discussed. The former approach that is resistant gave the parallel grouping with statistical factbooks. As a response to the title it's so clear that some European countries have similar saving tendencies and some have not. In this respect grouping became available. These findings appear crucial as a way to shed light on comparisons of saving rates between European countries, also make easy the policy makers to interpret this intricate issue and benefit in deciding policies. Besides they put more stress on the necessity of considering the countries with their different structures while executing their policies.

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