In this the book we present the Meta –Regression as a technique that is widely used technique in applied economics, than we prove and test 2 out of 6 international macroeconomics puzzles: Feldstein-Horioka puzzle, and Baxter-Stockman neutrality of exchange rate regime puzzle. Also we investigate the issue of inflation and unemployment trade off and the money and output.Also we write about population and growth theories and we empirically test the theories on a sample of Balkan countries.The authors are :Dushko Josheski and Darko Lazarov and we also thank our co-authors Nikola V. Dimitrov and Cane Koteski.

Dushko Josheski

Dushko Josheski was born on 29.08.1983. He received his Msc at Staffordshire University UK. His field of interest is applied economics with a focus on the New-Keynesian theories and models. He also won award for best young researcher in macroeconomics field from the National bank of Republic of Macedonia. He works at University "Goce Delcev"-Stip.

978-3-659-25941-8

Applied economics:theories and models

Josheski, Lazarov , V.Dimitrov

Dushko Josheski
Darko Lazarov
Nikola V.Dimitrov

Writings in Applied Economics - Part II

Theories and models

LAP LAMBERT Academic Publishing

Dushko Josheski
Darko Lazarov
Nikola V.Dimitrov

Writings in Applied Economics - Part II

Dushko Josheski
Darko Lazarov
Nikola V.Dimitrov

Writings in Applied Economics - Part II

Theories and models

LAP LAMBERT Academic Publishing

Impressum / Imprint
Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Coverbild / Cover image: www.ingimage.com

Verlag / Publisher:
LAP LAMBERT Academic Publishing
ist ein Imprint der / is a trademark of
AV Akademikerverlag GmbH & Co. KG
Heinrich-Böcking-Str. 6-8, 66121 Saarbrücken, Deutschland / Germany
Email: info@lap-publishing.com

Herstellung: siehe letzte Seite /
Printed at: see last page
ISBN: 978-3-659-25941-8

Introduction

In this book we are presenting ou research on a Applied Economics topics. This papers are published in journal some of them or as working papers which suppose to be published in journals. In this part of the book we present the Meta –Regression as a technique that is widely used technique in applied economics, than we prove and test 2 out of 6 international macoreconomics puzzles: Feldstein-Horioka puzzle, and Baxter-Stockman neutrality of exchange rate regime puzzle.

Also we investigate the issue of inflation and unemployment trade off and the money and output.Also we write about population and growth theories and we empirically test the theories on a sample of Balkan countries. On the next page are presented the authors Dushko Josheski and Darko Lazarov and we also thank our co-authors Nikola V. Dimitrov and Cane Koteski.

Acknowledgment

Dushko Josheski was born on 29.08.1983. He received his Msc at Staffordshire University UK. His field of interest is applied economics with a focus on the New-Keynesian theories and models. He also won award for best young researcher in macroeconomics field from the National bank of Republic of Macedonia. He works at University "Goce Delcev"-Stip Republic of Macedonia.

Darko Lazarov was born on 08.04.1984. He received his MA in SS.Cyril and Methodius University in Skopje. His field of interest is economic theory in general. He works at University "Goce Delcev"-Stip Republic of Macedonia.

Professor Nikola V. Dimitrov, Ph. D. geographer, demographer and spatial planner, University "Goce Delcev"-Stip Republic of Macedonia

Professor Cane Koteski was born on 01.07.1964. He is geographer.He works at University "Goce Delcev"-Stip Republic of Macedonia

Table of contents

Exchange rate volatility and trade: Meta-Regression Analysis

Dushko Josheski (Goce Delev University –Stip)
dushkojosheski@gmail.com
Darko Lazarov (Goce Delev University –Stip)
lazarovdarko@yahoo.com

Abstract

Many empirical studies have been done to investigate whether trade is influenced by exchange rate volatility. Conventional wisdom is that increased exchange rate volatility inhibits the growth of foreign trade.This MRA extends by 10 studies and 100 observations Pugh's and Coric (2008) meta regression.Now this MRA is updated with studies published to date (2012 year). Around 67 studies have investigated the effect of exchange rate variability and international trade resulting in 923 estimates. On average, exchange rate variability exerts negative effect on international trade. The conlcusion is that in the literature of exchange rate variability and trade there is presence of genuine empirical effect and not a presence fo publication bias. The publication bias that appeared in the clustered robust model is perhaps due to the ten papers that were added to Pugh's and Coric MRA.They were not from the Econlit data base. Results are summarized in the following two tables.

Key words: Meta regression analysis, exchange rate variability, international trade ,egger's bias regression

Introduction

There are many debates among economists about the exchange rate's volatitly and trade. The main subject of our paper is to identify and present the positive and negative side of exchange rate regime to foreign trade by empirical investigation. Some analyses show that flexible exchange rate increases the level of exchange rate uncertainly and thus reduce incentives to trade. Proponents of fixed exchange rate ragime have long argued that the risks associated with exghange rate variability discounrage economic agents from trading across borders, especially when we thing abount small open countries. Despite this widespread view, the substantial empirical literature examining the link between exchange rate uncertainty and trade has not found a sonsistent relationship. Moreover, the debate on the implications of the choice of the exchange rate regime basically lacks a sound analytical foundation.[1] On the other side, some research suggests an opposite direction of causality, where trade flows stabilize real exchange rate fluctuations, thus reducing real exchange rate volatility. These two differen point of view among economists imply the existence of a standard identification problem, whether exchange rate volatility influence international trade or vice verse?[2]

In that context, we will summarize the main findings based on empirical research that have been done to investigate the relationship between the exchange rate regime (stability) and trade.[3] First, exchange rate stability is not necessarily associated with trade. In a simple benchmark model with only monetary shocks, the level of trade is the same under a float as under a fixed exchange rate regime when preferences are separable in consumption and leisure. In general, trade can be higher under either exchange rate regime, depending on preferences and on the monetary policy rules followed under both regimes. Second, there are severel examples where trade is higher under one regime, while welfare is higher under the other. And finaly, we can conlude that the exchange rate regime is important for trade and welfare, but there are many other aspect that we have to take in to account.

[1] Baccheta, P. and E. vanWincoop (2000) "Does Exchange Rate Stability Increase Trade and Welfare?" American Economic Review, 90(5), pp.1093-1109.

[2] Broda, C., Romalis, J., 2003. Identifying the relationship between Exchange Rate Volatility and Trade. Mimeo, Federal Reserve Bank of New York, November 2003

[3] Ibid.

Literature survey

Many empirical studies have been done to investigate whether trade is influenced by exchange rate volatility. Conventional wisdom is that increased exchange rate volatility inhibits the growth of foreign trade. A detailed literature survey on the effects of exchange rate volatility on trade has been outlined in this section (see Table 1).This table is taken from Ilhan (2006). Several theoretical studies such as Ethier (1973); Clark (1973); Baron (1976); Cushman (1986); Peree and Steinherr (1989) have shown that an increase in exchange rate volatility will have adverse effects on the volume of international trade. Other theoretical studies have demonstrated that increased volatility can have ambiguous or positive effects on trade volume: for instance, Viaene and de Vries (1992), Franke (1991) and Sercu and Vanhulle (1992).

It is widely believed that increased exchange rate volatility inhibits the growth of foreign trade. Negative effects of exchange rate uncertainty on trade flows are reported by many authors. Studies by Hooper and Kohlhagen (1978), Gotur (1985), Bailey et al. (1986, 1987) McKenzie (1998), Aristotelous (2001), Bailey and Tavlas (1988), Bahmani et al. (1993), and Gagnon (1993), among others, do not find any significant relationship between exchange-rate volatility and trade.

On the other hand, McKenzie and Brooks (1997), Klein (1990), Franke (1991), Giovannini (1988), Brada and Mendez (1988), Asseery and Peel (1991), Kasman and Kasman (2005), Sercu and Vanhulle (1992), Doyle (2001) and Bredin et al. (2003) have found positive effects of exchange rate volatility on trade. Overall, a larger number of studies appear to favour the conventional assumption that exchange rate volatility depresses the level of trade.In the next Table are summarized studies about the exchange rate variability and trade from 1978 onwards.

Table 1 Exchange Rate Volatility and Trade: Literature Survey

Study	Sample Period	Nominal or real exchange rate used	Countries and Estimation technique used	Main Result
Alduar and Hilton (1984)	1974-S1Q	Nominal	OLS	Negative effect
Gotur (1985)	1974-82Q	Nominal	OLS	Little to no effect
Bailey. Taklas and Ulan (1986)	1973-84Q	Nominal	OLS	Not significant. mixed effects
Bailey. Tavlas and Ulan (1987)	1962-S5Q	Nomianal &Real	OLS	Little to no effect
Bailey and Tavlas (1988)	1975-86Q	Nominal	OLS	Not significant
Belenger et al. (1988)	1976-87Q		INT	Significant and negative in 2 sectors
Brada and Mendez (1988)	1973-77A	Real	Cross section	Positive effect
De Grauwe and Verfaille (1988)	1975-SSA	Real	Cross section	Level of trade significantly

				stronger within EMS than outside EMS
Koray and Lastpares (1989)	1961-85M	Real	VAR	Weak negative relationship
Mann (1989)	1977-87Q	Real	OLS	Few significant results
Peree and Steinherr (1989)	1960-85A	Nominal	OLS	Negative effect
Caballero and Corbo (1989)	--	Real	OLS and IVE	Significant and neg.ative effect
Lasaapes and Koray (1990)	1975-87Q	Real	VAR	Weak relationship
Medhora (1990)	1976-82A	Nominal	OLS	Not significant and positive effect
Asseery and Peel (1991)	1972-87Q	Real	OLS - ECM	Significant and positive except for UK
3mi — Smag.hi (1991)	1976-84Q	Nominal	OLS	Significant and neg.ative effect
Feenstra and Kendall (1991)	1975-88Q		G.A.RCH	Negative effect
Akhtar and Hilton (1991)	1974-S1Q	Nominal	OLS	Not significant. mixed effect
Kumar and	1974-	Nomin11	OLS	Not

Dhawan (1991)	850	& Real		significant and negative effect
Belenger et al. (1992)	1975-87Q	Nominal	IVE. GIVE	Significant and negative effect
Kumar (1992)	1962-87A	Real	Standard deviation	Mixed results
Sanides *(1992 i*	*1973-86.4*	*Real*	*Cross section*	Negative effect
Gagnon(1993)	0	Real	Simulation analysis	Not significant
Frankel and Wei (1993)	1980-90A	Nominal & Real	OLS and WE	Small and negative in 1980. positive in 1990
Kroner and Lastpares(1993)	1973-90M	Nominal	GARCH-M	Significant. varied signs and magnitudes
C howdhury(1993)	197$. 90Q	Real	VAR	Significant negative effect
Caporale and Dorodian (1994)	1974-92M	Real	Joint estimation	Significant negative effect
McKenzie and Brooks (1997)	1973-92M	Nominal	OLS	Positive effect
McKenzie (1998)	1969-95Q		ARCH	Generally positive effect
Daly (1998)	1978-910	Real	---	Mixed results

				(overall likely have a positive correlation)
Hook and Boon (2000)	1985-97Q	Both	VAR	Negative effect on export
Aristotelotts (2001)	1989-99A	Real	Gravitiy model	No effect on export
Doganlar (2002)	1980-96Q	Real	EG Cointegration	Negative effect on export
Vergil (2002)	1990-2000Q	Real	Standard deviation	Negative effect on export
Das (2003)	1980-2001Q	Both	ADF. ECM. Cointegration	Significant negative effect on export
Baal: (2004)	1980-2002A	Real	OLS	Significant negative effect on export
Tenreyro (2004)	1970-97A	Nominal	Gravity model	Insignificant and no effect on trade
Clark. Tamilisa. and Wei (2004)	1975-2000A	Both	Gravity model	Negative and significant effect
Kasman .S.: Kasman (2005)	1982-200IQ	Real	Cointegration. ECM	Significant positive effect on export
Arize et al. (2005)	19[7]3-	Real	Cointegration.	Sig..nificant

	2004Q	Real	ECM GARCH-M	negative effect on export Positive
Hwang and Lee (2005)	1990-2000M			effect on import and insignificant effect on export
Lee and Saucier (2005)	1936-200$Q	Nominal	ARCH-GARCH	Negative effect on tradd

Source : Ilhan ,(2006)

Overall from this table can be discussed that a large number fo studies appear to favor conventional wisdom that exchange rate volatility exerts negative effect on trade. In the next section we will outline the model specification and explain meta regression techniques as well present the empirical results.

Model Specification

Following, Jarrell and Stanley (1989), and considering Stanley (2001), and recommendations from Pugh and Coric (2008), about the degrees of freedom, the MRA model has the following functional form [4]:

$$tstat(erves)_j = \text{int} + \beta\sqrt{DF_j} + \sum \alpha_k merv_{jk} + u_j \qquad j = 1,2....L \quad k = 1,2....M$$

- $j = 1,.....346$ Indexes the regressions in the literature;
- $k = 1.....22$ indexes the moderator variables ;
- Int- intercept term
- DF_j – is the degrees of freedom of *j*-th regression
- β - is the coefficient to be estimated and measures the relationship between the square root of degrees of freedom and the effect size;
- $merv_{jk}$ – are moderator variables which reflect the main data and characteristics of j-th regression
- a_k – are *k* coefficients to be estimated , each of which measures the effect of a moderator variable on the effect size;
- u_j, e_i – are the usual residuals in the regression,
- L –represents the number of studies
- t_1 -is the usual t-statistics

Variable of interest

The variable of interest in this meta-regression is exchange rate variability. This ***exchange rate***

[4] In the following sections will be presented the final parsimonious model which will be tested by different econometric techniques

variability effect size (ERVES) is independent of the units in which variables in different studies are measured and, given the large sample, under the null of no genuine effect approximates the standard normal distribution (Stanley, 2005), which makes it suitable for the statistical analysis outlined in the following section.. Studies are compared, and results are combined. Meta-analysis usually is done if the author is not certain about the result from one particular study. And when these studies are heterogeneous, straightforward combination of the test results may be too simplistic, and more sophisticated techniques should be used (Kulinskaya, Morgenthaler, Staudte, 2008).

Effect Size and controlling for degrees of freedom

After compiling the set of relevant studies a summary statistic of the effect size has to be

- to combine and compare the effects size of the studies to find their mean value and test their significance
- and as the dependent variable of the MRA

chosen

Stanley and Jarrell (1989) recommended that, in economics, the *t-value* of regression is the natural effect size. The effect size approximates the standard normal distribution N~ (0, 1), under the null hypothesis of no effect. The t-statistics has no dimensionality, and it is standardized measure on the parameters of interest. Statistical theory predicts relationship between t-ratio and, the squared root of the degrees of freedom [5].The formula for the t-value on the estimated coefficient $\hat{\beta}_i$ is as follows where the denominator, in the square brackets is the standard error of $\hat{\beta}_i$:

$$t_{\hat{\beta}_i} = \frac{\hat{\beta}_i}{\frac{\left(\sqrt{\sum \hat{u}_i^2}\,\frac{1}{\sqrt{df}}\right)}{\sqrt{\sum (x-\bar{x})^2 (1-R_i^2)}}}$$

[5] According to Stanley (2005), to test for an authentic relationship the square root of degrees of freedom should be used instead degrees of freedom.

DF gives the difference between the number of observations and number of independent variables in the model. Positive or negative statistically significant association between the squared root of the degrees of freedom and the t-statistics is known as existence of the authentic empirical effect.

Earlier studies that employ different monetary indices, cannot be compared. Therefore the effect size is chosen to be a pure number to avoid that problem, for the variable of interest.

Moderator variables

MRA synthesizes the empirical literature by identifying important study characteristics or model specifications and reflecting those differences in $merv_{jk}$. The types of elements that make up the $merv_{jk}$ might include:

- Dummy variables which reflect whether potentially relevant independent variables have been omitted from or included in the primary study;
- Specification variables that account for differences in functional forms , types of regressions, and data definitions and sources;
- Sample size
- Selected characteristics of the authors of the primary literature;
- Measures of research or data quality;

Publication bias

Publication bias or, the "file drawer problem" is the consequence of choosing research papers for the statistical significance of their findings [6] (Stanley, 2007). Statistical significance is judged by whether, the t-ratio of the explanatory variable is higher, or exceeds 2 in absolute value (Card, Krueger, 2001). There is natural tendency of reviewers and editors to look more favourably on the studies with statistically significant results. Studies that find relatively small and "insignificant" results tend to remain, in the "file drawer" [7].

[6] Or, publication bias is a tendency to publish studies depending on the magnitude, direction and statistical significance of the results (McDaniel, Rothotein, Whetz, 2006).

[7] With meta-analyses, statistical methods can be employed to identify or accommodate these biases.

There are identified three sources of publication selection in economics:

- Researchers or editors maybe are, predisposed to accept papers consistent with the conventional view.
- Researchers may use the presence of conventionally expected results as a model selection test.
- And "statistically significant" results are treated more favourably.

Correcting for publication bias

Correcting this bias is impossible without making untestable assumptions [8].Bayesian methods for "correcting" publication bias introduced by Givens et al (1997), assumes prior distribution on the number of unpublished studies. As it is noted, direction, extent, and the impact of publication and related biases, are uncertain and may vary greatly depending on circumstances (Copas, Shi, 2000).The extreme view of the problem is that the journals are filled with, 5% of papers which show type I error, while the file drawers, are filled with the remaining 95% of the studies that show non-significant results (p>0.5) (Rosenthal, 1991). Sterling (1959) also argued that non-significant results are rarely published and therefore the published literature is full of type I errors (Hedges, Olkin, 1985).

Meta-regression analysis of the trade effect of exchange rate variability

Meta-analysis of the ERVES

Central consideration of meta-analysis is to test the null hypothesis, that the effect sizes are distributed standard normal, N~ (0,1), under the null hypothesis of no effect. The null hypothesis is that the mean effect is zero[9]. The hypothesised, exchage rate variability and trade relationship will be rejected , if the average effect size (average t-statistics), is not significantly different from zero. The data set of this MRA, consists of **923** estimated output elasticises, from the collected 67 empirical studies.This data set it is made of Pugh and Coric(2008) meta regression on exchange rate variability and trade, but we updated it with 10 more studies (100) observations. The mean value of the t-statistic, on the coefficients on the output elasticity -1.27, with standard deviation of 3.79149[10]. Provisionaly here we conclude that there exists negative relationship between exchange rate variability and trade. This

[8] And all of the methods for correcting the publication bias are based on some assumptions.
[9] Josheski, Dushko, Infrastructure Investment and GDP Growth: A Meta-Regression Analysis (September 1, 2008)
[10] See Appendix 1

conclusion is confirmed, by the simple vote-counting procedure[11] The observed erves ranges from -64.577 to 20.702 , which suggests considerable varioation around mean. However, if the differences among observed ERVES are random sampling effects, then under the null the standard deviation of the ERVES distribution should be one ($\sigma^2_{ERVES} = 1$); otherwise, in the presence of systematic variation from the mean, the standard deviation exceeds one ($\sigma^2_{ERVES} > 1$).

Table 2 Vote counting procedure

	Negative effect	No effect	Positive effect	Not conclusive
1. Hooper & Kohlhagen	0	1	0	0
2. Abrams (1980)	1	0	0	0
3. Cushman (1983)	1	0	0	0
4. Akhtar & Hilton (1984)	1	0	0	0
5. IMF (1984)	0	0	0	1
6. Gotur (1985)	0	0	0	1
7. Chan & Wong (1985)	0	1	0	0
8. Kenen & Rodrik (1986)	1	0	0	0
9. Bailey, Tavlas & Ulan (1986)	0	1	0	0
10. Cushman (1986)	1	0	0	0
11. Bailey, Tavlas & Ulan (1987)	0	0	0	1
12. De Grauwe & Bellfroid (1987)	1	0	0	0
13. Thursby & Thursby (1987)	1	0	0	0
14. Cushman (1988)	1	0	0	0
15. De Grauwe (1988)	1	0	0	0
16. Pradhan (1988)	0	0	0	1
17. Anderson & Garcia (1989)	1	0	0	0
18. Perée and Steinherr (1989)	1	0	0	0
19. Klein (1990)	0	0	1	0
20. Medhora (1990)	0	1	0	0
21. Bini-Smaghi (1991)	1	0	0	0
22. Smit (1991)	0	1	0	0
23. Assery & Peel (1991)	0	0	1	0
24. Pozo (1992)	1	0	0	0
25. Savvides (1992)	1	0	0	0
26. Grobar (1993)	1	0	0	0
27. Bahmani-Oskooee & Payesteh	1	0	0	0
28. Chowdbury (1993)	1	0	0	0
29. Kroner & Lastrapes (1993)	1	0	0	0
30. Qian & Varangis (1994)	0	0	0	1
31. Caporale & Doroodian (1994)	1	0	0	0

[11] Table 2 with studies and effects is given in the following page.

32. Arize (1995)	1	0	0	0
33. Holly (1995)	1	0	0	0
34. Stokman (1995)	1	0	0	0
35. Arize (1996a)	1	0	0	0
36. Arize (1996b)	1	0	0	0
37. Daly (1996)	0	0	0	0
38. Kiheung & WooRhee (1996)	0	0	1	0
39. McKenzie & Brooks (1997)	0	0	1	0
40. Arize (1997a)	1	0	0	0
41. Arize (1997b)	1	0	0	0
42.Arize(1998)	1	0	0	0
43.Arize&Shwiff(1998)	1	0	0	0
44. Hassan & Tufte (1998)	1	0	0	0
45.Mckenzie(1998)	0	0	0	1
46.Dell'ariccia(1999)	1	0	0	0
47.Lee(1999)	0	0	0	1
48. Arize, Osang & Slottje (2000)	1	0	0	0
49. Rose (2000)	1	0	0	0
50. Chou (2000)	1	0	0	0
51. Abbott, Darnell & Evans (2001)	0	1	0	0
52. Aristotelous (2001)	0	1	0	0
53. Doyle (2001)	0	0	0	0
54. Sauer & Bohara (2001)	0	0	0	1
55. Sekkat (2001)	0	1	0	0
56. Giorgioni & Thompson (2002)	1	0	0	0
57. Fountas & Aristotelous (2003)	0	0	1	0
58.ARIZE(1998)	1	0	0	0
59.Mahmood, Ehsanullah,Habib(2011)	0	0	0	1
60.Wesseh, Jr and Linlin Niu (2012)	1	0	0	0
61.Pickard(2003)	0	0	0	1
62.Vergil(1999)	1	0	0	0
63.Kandilov(2008)	1	0	0	0
64.Bakhromov(2011)	1	0	0	0
65.WangBarret(2007)	0	0	0	1
66.Tenreyro(2007)	0	0	0	1
67.Ngouana(2012)	0	0	1	0
Total	**39**	**8**	**6**	**12**

In the previous table we can see the summary of studies and the effects reported. Most of the studies find negative relationship between exchange rate variability and trade 39, 8 studies find no effect while 6 studies report positive effect between exchange rate variability and trade 12 studies are not cocnlusive about the relationship either positive or negative.

Independent varibales

We include in the MRA the squared root of the degrees of freedom to test for the existence of an authentic empirical effect (Stanley, 2005). To confirm the existence of an authentic empirical effect we need to confirm that a statistically significant relationship between the effect size (t-stat) and the squared root of the deegrees of freedom exists and that the relationship has the same sign as the estimated average effect size. In the presence of the squared root of the degrees of freedom, the intercept can be interpreted as a measure of the publication bias, and if it is significant it constitutes a rejection of the null of no publication bias. If we want to explain the varioations in the exchange rate variability effect size , we include moderator variables.Moderator variables are either 1 or 0 value. As the Pugh and Coric we include **bilater**(Billateral exchange rates) , and **sectalt**(sectoral trade flows), moderator variable for import demand (**import**) it is being constructed and export is a benchmark variable.Moderator variable (**realer)** it is being constructed (real exchange rate variability) and noiminal exchange rate is a benachmark. Also moderator variables for **dailyer**,**weeklyer**, **monther**,a**nnualer** for daily, weekly, monthly and annual frequency of exchange rate variability. Studies also differed over the ***choice of measure to proxy exchange rate uncertainty***. The most common measure, the standard deviation of either exchange rate changes or percentage changes, is used as the benchmark. However, we identified 13 alternative measures in the literature (MERV 1-13; see Appendix 2 for definitions).Moderator variables for **cross** –Cross section data , **pooled**-Panel data, **gravity**-Gravity model data, **lrcoint**-Cointegration, **errorcor**-error correction model data.This serve to know how the estimates are obtained. moderator variables were included for all studies that control for ***structural breaks*** (DOCKSTR - including dock strikes, oil shocks, changes in monetary regime and wars).

Descriptive statistics of the model

First of all most of the studies use data from floathing exchange rate period this variable **floper** (mean = **0.67382**), most of the studies are done for developed countries **dc** (mean=**0.68**). The variable for the effect size , exchange rate variability **erves** (mean=**-1.27306**) is our main variable of interest.Most studies use quarterly frequency of exchange rate variability **quarter** (mean=**0.442037**), also most of the studies use **realer real exchange rate variability** this variable mean=**0.543991**. Continuous variables are included for testing the authentic empirical effect in the MRA analysis following the recommendations of Pugh and Coric (2008), and Stanley (2008): the square root of the degrees of freedom (**sqrtdf**,

mean=**16.24771**; sd=**26.44371**).Most estimates are obtained with panel methods,**pooled** variable (mean=**0.204936**)[12].

Results

The robustness of the results it is being taken into account by estimating the model with 4 estimation techniques namely: Robust OLS, Clustered Robust OLS, Weighted least squares (WLS), and clustered robust weighted least squares. Type I publication bias is directional and Type II publication bias that favors statistical significance regardless of the direction. Acrossthree estimates , except for the clustered robust OLS ,intercept is insiginificant which rejects the null hypothesis of publication bias[13].The coefficient on the squared root of the degrees of freedom is negative and significant and this supports the presence of genuine empirical effect.

Table 3 Model specification

dependent variable is effect size erves		robust OLS		clustered robust OLS		weighted least squares		WLS cluster robust	
		Coef.	t	Coef.	t	Coef.	t	Coef.	t
sqrtdf	Squared root of the degrees of freedom	-0.0475	-4.02	-0.0475	-2.77	-0.03204	-2.75	-0.03204	-1.47
fixper	Fixed ER period	-1.58868	-1.12	-1.58868	-0.97	-4.9558	-5.77	-4.9558	-1.56
floper	Floathing ER period	0.677103	1.6	0.677103	1.02	1.307307	3.16	1.307307	2.02
ldc	Least developed countres	-1.20466	-2.98	-1.20466	-2.37	-0.89725	-1.93	-0.89725	-1.95
us	USA	0.887143	2.89	0.887143	1.51	0.589007	1.4	0.589007	1.28
import	Import	-1.13771	-1.49	-1.13771	-1.35	-1.39234	-3.24	-1.39234	-1.79
sectalt	Sector level	-0.51355	-0.84	-0.51355	-0.64	0.102027	0.19	0.102027	0.11
dailyer	Daily ER variability	-2.44723	-1.03	-2.44723	-1.17	-4.78492	-2.3	-4.78492	-1.23
weaklyer	Weakly ER variability	-1.40415	-0.67	-1.40415	-0.91	-1.32967	-0.75	-1.32967	-0.46
monther	Monthly ER variability	-1.90671	-0.93	-1.90671	-1.23	-3.02091	-1.81	-3.02091	-0.95
quarter	Quarterly ER variability	-2.67886	-1.25	-2.67886	-1.65	-3.98164	-2.33	-3.98164	-1.12
annualer	Annualy ER variability	-4.22572	-2.21	-4.22572	-2.9	-3.7513	-2.07	-3.7513	-1.22

[12] See Appendix 3 Descriptive statistics of the model

[13] In the Pugh and Coric meta regression there was no evidence of type I publication bias ,here with augmented sample for 10 studies in clustered robust OLS model there is evidence of Type I publication bias at 1% level fo significance.This maybe result from the sample of 10 studies which we add and are not part of Econlit

realer	Real ER variability	0.29986	1.01	0.29986	0.85	-0.1223	-0.3	-0.1223	-0.24
cross	Cross-section data	-0.1015	-0.19	-0.1015	-0.13	-0.21942	-0.28	-0.21942	-0.21
pooled	Panel data	-0.80391	-0.57	-0.80391	-0.46	-2.29203	-3.48	-2.29203	-0.97
sesonadj	Seasonaly adjusted data	-0.69999	-1.46	-0.69999	-0.99	0.630447	1.07	0.630447	1.1
errorcor	Error correction model	-0.5354	-1.04	-0.5354	-0.62	0.092995	0.2	0.092995	0.21
lrcoint	Cointegration analysis	-1.4216	-2.05	-1.4216	-1.6	-0.67766	-1.05	-0.67766	-0.59
dockstr	Structural effects	-0.02461	-0.04	-0.02461	-0.04	1.001405	2	1.001405	0.88
MERV 1= 1 if absolute values of ER percentage change		1.376068	2.59	1.376068	2.31	0.988401	1.23	0.988401	1.28
MERV2= 1 if average absolute values of ER percentage changes		-1.94153	-0.79	-1.94153	-0.8	-3.72734	-3.89	-3.72734	-0.97
MERV 3= 1 if absolute differences between previous forward and current spot rat		-2.70365	-2.81	-2.70365	-1.22	-2.62199	-2.45	-2.62199	-3.06
MERV 4= 1 if the moving standard deviation of ER changes or percentage changes		-0.09833	-0.31	-0.09833	-0.19	-0.11085	-0.22	-0.11085	-0.23
MERV 5= 1 if the standard deviation of ERs from an ER trend equation		1.827757	1.68	1.827757	1.42	4.573659	4.97	4.573659	2.04
MERV 6= 1 if the standard deviation of ERs from a first-order autoregressive equation		-0.13978	-0.18	-0.13978	-0.18	0.779148	0.69	0.779148	0.83
MERV 7= 1 if long-run uncertainty; Perée and Steinherr's (1989) V and U measures		0.760523	0.95	0.760523	0.69	0.674792	0.66	0.674792	0.79
MERV 8= 1 if squared residuals from an ARIMA model		-0.8977	-0.67	-0.8977	-0.39	-1.50554	-1.81	-1.50554	-1.4
MERV 9= 1 if conditional variance calculated by an ARCH or GARCH model		1.164038	3.16	1.164038	2.24	0.351167	0.64	0.351167	0.59
MERV 10= 1 if variance calculated by a LM (linear moment) model		1.351917	0.89	1.351917	0.64	1.280663	1.1	1.280663	0.82
MERV 11= 1 if the variance of the ER around its trend prediction (ln et = φ0 + φ1t + φ0 t2 +εt)		-1.8922	-2.07	-1.8922	-1.83	-1.5627	-1.11	-1.5627	-1.07
MERV 12= 1 if unanticipated changes in ERs (used by Savvides, 1992)		-0.24288	-0.19	-0.24288	-0.21	-1.24283	-0.84	-1.24283	-0.85
MERV 13= 1 if information contained in forward exchange rate concerning exchange rate expectations (used by Cushman, 1988)		0.948364	0.51	0.948364	0.38	3.151435	2.22	3.151435	1.11
_cons	Intercept	2.125416	1.07	2.125416	1.61	2.262174	1.36	2.262174	0.78
F-stat(32, 890)=		17.09		None		8.3		8.56	
R-squared		0.2407		0.2407		0.2298		0.2298	
Num.of observations		923							

In this MRA the studies that control for least developed countries (**ldc)**, fixed exchange rate period(**fixper)**, import (**import**), quarterly exchange rate variability (**quarter**), real variability diverges from nominal in longer periods this is supported by the significant and negative estimates on the annua exchange rate variability (**annualer**), and all of the modeling strategies cros-ssection data (**cross)**,panel data (**pooled),**error correction model **(errocor),**and cointegraion model **(lrcoint),** exert negative results. Dummy variable for structural breaks in time series (dockstr), in this MRA appear not to be significant. 7 measures of the exchange rate

uncertainty used in the literature do not robustly influence the exchange rate variability effect size. Also as in Pugh and Coric MRA the negative coefficient on **annualer**,**ldc**,and **realer**, confirms that the exchange rate variability has an adverse effect on trade. Next are presented results on Type II publication bias.

Table 4 Type II publication bias

ABServes	Absolute value of the effect size	Coef.	t
sqrtdf	Squared root of the degrees of freedom	0.022802	2.09
fixper	Fixed ER period	0.843288	0.63
floper	Floathing ER period	-1.00232	-2.6
ldc	Least developed countres	0.474035	1.31
us	USA	-0.53026	-2.29
import	Import	0.339242	0.48
sectalt	Sector level	-0.80442	-1.46
dailyer	Daily ER variability	2.539618	1.21
weaklyer	Weakly ER variability	0.839861	0.46
monther	Monthly ER variability	1.243429	0.69
quarter	Quarterly ER variability	1.166528	0.6
annualer	Annualy ER variability	0.868214	0.52
realer	Real ER variability	-0.0309	-0.13
cross	Cross-section data	-0.18598	-0.43
pooled	Panel data	1.435453	1.09
sesonadj	Seasonaly adjusted data	0.171385	0.43
errorcor	Error correction model	-0.18751	-0.42
lrcoint	Cointegration analysis	0.670748	1.07
dockstr	Structural effects	-0.51433	-0.81
merv1	1 if absolute values of ER percentage change	-0.7666	-1.68
merv2	1 if average absolute values of ER percentage changes	3.591151	1.53
merv3	1 if absolute differences between previous forward and current spot rat	1.172268	1.35
merv4	1 if the moving standard deviation of ER changes or percentage changes	0.169814	0.7
merv5	1 if the standard deviation of ERs from an ER trend equation	0.485537	0.53
merv6	1 if the standard deviation of ERs from a first-order autoregressive equation	0.793093	1.05
merv7	1 if long-run uncertainty; Perée and Steinherr's (1989) V and U measures	-0.11331	-0.17
merv8	1 if squared residuals from an ARIMA model	3.25965	3.52
merv9	1 if conditional variance calculated by an ARCH or GARCH model	0.049136	0.17
merv10	1 if variance calculated by a LM (linear moment) model	-1.87414	-1.26
merv11	1 if the variance of the ER around its trend prediction (ln et = φ0 + φ1t + φ0 t2 +εt)	0.41302	0.52
merv12	1 if unanticipated changes in ERs (used by Savvides, 1992)	1.565604	1.44
merv13	1 if information contained in forward exchange rate concerning exchange rate expectations (used by Cushman, 1988)	-2.77359	-1.5
_cons	Intercept	1.085821	0.61

Non significant coefficient on the intercept and of a small size means that we can reject the null of indicates non presence of publication bias. The other three models are not reported but are available and exert same result. The simplest and most commonly used method to detect publication bias is an informal examination of a funnel plot.

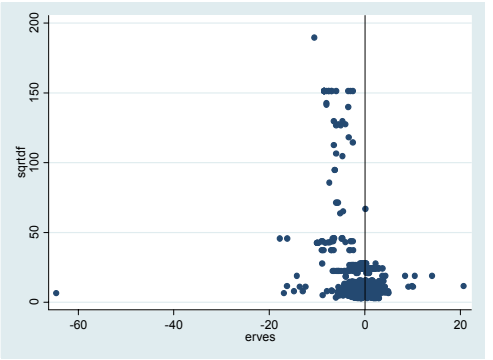


Figure Funnel Plot, t-stat(erves) on squared root of the degrees of freedom

In the absence of publication selection and regardless of the magnitude of the true effect, estimates will be symmetrically around the true effect. Because small sample studies with large standard errors and less precision are at the bottom of the graph , the plot will be more spread out at the bottom than it is at the top (Stanley,2005).

Egger's regression method

The Egger et al. regression asymmetry test and the regression asymmetry plot tend to suggest the presence of publication bias more frequently than the Begg approach. The Egger test detects funnel plot asymmetry by determining whether the intercept deviates significantly from zero in a regression of the standardized effect estimates against their precision (STATA 11 manual).

- The intercept value (A) = estimate of asymmetry of funnel plot
- Positive values (A > 0) indicate higher levels of effect size in studies with smaller sample sizes.
- Regression equation: SND = A + B x SE(d)-1. SND=standard normal deviate (effect, d divided by its standard error SE(d)); A =intercept and B=slope.

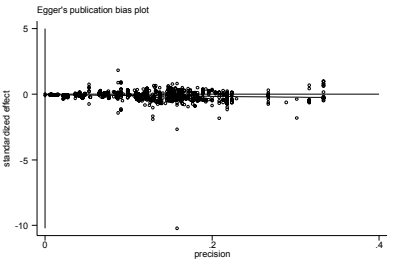
Asymmetry on the right of the graph (where studies with high standard error are plotted) may give evidence of publication bias.On the next Table 5 are presented egger's test results.

Table 5 Eggert's test

Egger's test			
Std_Eff	**Coef.**	**t**	**p-value**
slope	-0.635791	-2.88	0.004
bias	-0.030748	-0.97	0.333

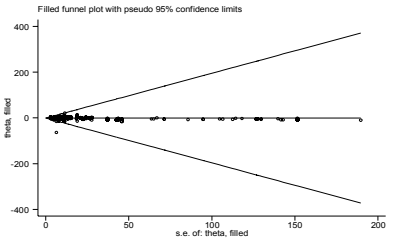
The intercept is negative and significant at all conventional levels of significance, which indicates assymetry to the left.the coefficient on the bias is insiginificant which rejects the existence of bias. Next it is presented eggert's publication bias plot which indicates that standardized effect is scattered on positive and negative side and the regression line is not very far from the intercept.

Graph Egger's publication bias plot



Egger's publication bias plot shows slight assymetry on the negative side.

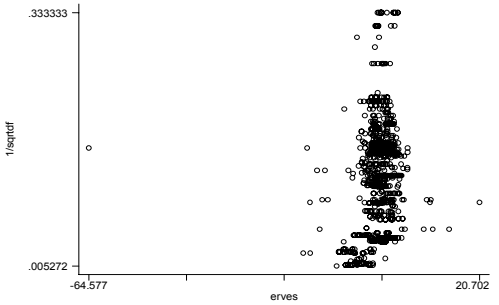
Next we present Funnel plot



Funnel plot did not show much heteroigeneity between studies.

On the next funnel effect size is plotted against the invesrse of the squared root of the of the degrees of freedom

Funnel plot effect size and invesrse of the squared root of the degrees of freedom



The funnel shows that effect size has a left assymetry when plotted against the squared root of the degrees of freedom.

Conclusion

Across three estimates, the intercept term (_cons) is not significantly different from zero at conventional levels, which rejects the null of publication bias.But in the clustered robust model the intercept is significant at 10% level fo significance Coefficient on the squared root of the degrees of freedom is negative and statistically significant at all levels of statistical significance except in the Cluster robust WLS model. The conlcusion is that in the literature of exchange rate variability and trade there is presence of genuine empirical effect and not a presence fo publoication bias. The publication bias that appeared in the clustered robust model is perhaps due to the ten papers that were added to Pugh's and Coric MRA.They were not from the Econlit data base. Results are summarized in the following two tables.

Findings on Type I publication bias: Dependent variable (effect size): t-statistics on the variable of interest in each study

Type I publication bias (t-stat as dependent variable)	sign on the coefficient on sqrtdf (squared root of the degrees of freedom) and significance			
	t-stat regressed on sqrtdf (model 1)			
squared root of the degrees of freedom (sqrtdf) +control variables	OLS	Cluster robust OLS	WLS	Cluster robust WLS
Sign on the squared root of the degrees of freedom (sqrtdf) and significance	-***	-***	-***	-
Sign on the constant and significance	+	+*	+	+

"- "- negative sign on the variable *- significant at 10 percent level of significance

"+"-positive sign on the variable **-significant at 5 percent level of significance

n.a.- not available ***- significant at 1 percent level of significance (all levels of significance)

Findings on Type I publication bias: Dependent variable (effect size): t-statistics on the variable of interest in each study

Testing type I publication bias	OLS		Cluster robust OLS		WLS		Cluster robust WLS	
Model 2 (t-stat regressed on the squared root of the degrees of freedom)	type I publication bias	authentic empirical effect	type I publication bias	authentic empirical effect	type I publication bias	No authentic empirical effect	type I publication bias	authentic empirical effect
	×	√	√	√	×	√	×	×

Findings on Type II publication bias: Dependent variable (effect size): absolute t-statistics on the variable of interest in each study

Testing type II publication bias	OLS	
Model 3 (absolute t-statistics regressed on the squared root fo the degrees fo freedom)	type II publication bias	authentic empirical effect
	×	√

√- There is evidence of Type II publication bias or authentic empirical effect

×- There is no evidence of Type I publication bias or authentic empirical effect

From the available regression on the Type II publication bias and the conclusions in the previous Table we can conlcude thata there iss absence of Type II publication bias but presence of authentic empirical effect in the literature between exchange rate variability and trade in this case negative. Next, **388** of **923** regressions report t-statistics **>+2** or **<-2**. Of which, **79** regressions report t-statistics **>+2,** and **309** regressions report t-statistic **<-2**.This shows that in this literature,Type II publication bias is not likely to be present.

The mean effect size is **(-1.273063)** [14], this suggests negative relationship between *exchange rate variability and international trade*.

Furthermore, this MRA suggests that exchange rate variability effects on trade are more intensive in least developed countries (***ldc)*** than in US economy [15].,where studies that control for US variable find more positive association between exchange rate variability and trade.

[14] See Appendix 1

[15] Coefficient on us-studies (***us***) variable is positive and statistically significant except in the WLS and cluster robust WLS,coefficient on the (***ldc***) is negative and significant.

Appendix 1

Meta-Analysis

H_0:AERVES=0 H_1:AERVES≠0	Appendix B: Testing • H_0: $\sigma^2_{ERVES}=1$ • H_1 : $\sigma^2_{ERVES}>1$
AERVES: Average exchange rate variability effect size	
$\text{t - stat} = \frac{\text{Average Erves}}{\sigma_{ERVES}^{\ 2}}$ Where $\sigma^2_{ERVES} = \frac{\hat{\sigma}_{ERVES}^{\ 2}}{\sqrt{DF}}$ AERVES= -1.273063 σ^2_{ERVES}=3.79149; and DF=899 $t = \frac{-1.273063}{\frac{3.79149}{\sqrt{899}}} = -10.0674$ Non –zero t-statistic	Chi-sq test statistic $\left(\chi^2\right) = (n-2)\frac{\hat{\sigma}_{ACOOEL}}{\sigma_{ACOOEL}}$ Where n=932; $\sigma^2_{ERVES} = 3.79149$; σ_{ERVES}=1; Hence, χ^2 =3532.28 Excess Variation The two-tailed P value is less than 0.0001 By conventional criteria, this difference is considered to be extremely statistically significant. For practical purposes, there is zero probability of making a type one error by rejecting H_O.

Appendix 2

MERV1 = 1 if absolute values of ER percentage changes

MERV2 = 1 if average absolute values of ER percentage changes

MERV3 = 1 if absolute differences between previous forward and current spot rates

MERV4 = 1 if the moving standard deviation of ER changes or percentage changes

MERV5 = 1 if the standard deviation of ERs from an ER trend equation

MERV6 = 1 if the standard deviation of ERs from a first-order autoregressive equation

MERV7 = 1 if long-run uncertainty; Perée and Steinherr's (1989) V and U measures

MERV8 = 1 if squared residuals from an ARIMA model

MERV9 = 1 if conditional variance calculated by an ARCH or GARCH model

MERV10 = 1 if variance calculated by a LM (linear moment) model

MERV11 = 1 if the variance of the ER around its trend prediction ($\ln et = \varphi 0 + \varphi 1 t + \varphi 0\ t2 + \varepsilon t$)

MERV12 = 1 if unanticipated changes in ERs (used by Savvides, 1992)

MERV13 = 1 if information contained in forward exchange rate concerning exchange rate expectations (used by Cushman, 1988)

Appendix 3

Descriptive statistics

Variable		Obs	Mean	Std. Dev.	Min	Max
result		932	466.5	269.1895	1	932
author	authors	932	37.95815	20.22631	1	68
weight	Weights	932	0.083691	0.318745	0.01852	9.25
df	Degrees of freedom	932	962.5075	3873.021	9	35984
fixper	Fixed ER regime	932	0.077253	0.267136	0	1
floper	Floathing ER regime	932	0.67382	0.469066	0	1
fixflo	Fixed float	932	0.277897	0.448203	0	1
ldc	Least developed countries	932	0.236052	0.424882	0	1
dc	Developed countries	932	0.688841	0.463216	0	1
us	US	932	0.219957	0.41444	0	1
import	Imports	932	0.182403	0.386384	0	1
export	Exports	932	0.805794	0.395801	0	1
dailyer	Daily ER variability	932	0.032189	0.176596	0	1
weaklyer	Weakly ER variability	932	0.064378	0.245556	0	1
monther	Monthly ER variability	932	0.299356	0.458222	0	1
quarter	Quarterly ER variability	923	0.442037	0.496898	0	1
annualer	Annualy ER variability	932	0.137339	0.34439	0	1
bilater	Billateral exchange rates	932	0.474249	0.499605	0	1
realer	Real exchaneg rate variability	932	0.543991	0.498328	0	1

nomer	Nominal exchange rate variability	932	0.419528	0.493747	0	1
cross	Crosssection data	932	0.096567	0.295525	0	1
pooled	Panel	932	0.204936	0.403871	0	1
gravity	Gravity model	932	0.122318	0.327828	0	1
lrcoint	Cointegration	932	0.06867	0.253027	0	1
errorcor	Error-correction model	932	0.081545	0.273817	0	1
lagtest	Lag test performed	932	0.560086	0.496643	0	1
dockstr	Structural effects	932	0.141631	0.348858	0	1
merv1	1 if absolute values of ER percentage changes ER percentage changes	932	0.079399	0.270506	0	1
merv2	1 if average absolute values of ER percentage changes	932	0.043991	0.205186	0	1
merv3	1 if absolute differences between previous forward and current spot rates	932	0.025751	0.158477	0	1
merv4	1 if the moving standard deviation of ER changes or percentage changes	932	0.29721	0.457275	0	1
merv5	1 if the standard deviation of ERs from an ER trend equation	932	0.06867	0.253027	0	1
merv6	1 if the standard deviation of ERs from a first-order autoregressive equation	932	0.032189	0.176596	0	1
merv7	1 if long-run uncertainty; Perée and Steinherr's (1989) V and U measures	932	0.052575	0.223304	0	1
merv8	1 if squared residuals from an ARIMA model	932	0.01824	0.133891	0	1
merv9	1 if conditional variance calculated by an ARCH or GARCH model	932	0.138412	0.345517	0	1
merv10	= 1 if variance calculated by a LM (linear moment) model	932	0.022532	0.148486	0	1
merv11	= 1 if the variance of the ER around its trend prediction (ln et = $\varphi 0 + \varphi 1t + \varphi 0\ t2 + \varepsilon t$)	932	0.01824	0.133891	0	1
merv12	= 1 if unanticipated changes in ERs (used by Savvides, 1992)	932	0.008584	0.092299	0	1
merv13	1 if information contained in forward exchange rate concerning exchange rate expectations (used by Cushman, 1988)	932	0.022532	0.148486	0	1
erves	Effects size(t-stats on exchange rate vaiability coefficient)	932	-1.27306	3.79149	-64.577	20.702
sqrtdf	Squared root of the degrees of freedom	932	16.24771	26.44371	31	89.6945

Refferences

1. Abbott, A., Darnell, A., Evans, L., 2001. T**he Influence of Exchange Rate Variability on UK Exports**. Applied Economic Letters 8, 47--49.
2. Abrams, R., 1980. **International Trade Flows Under Flexible Exchange Rates. Federal**
3. Akhtar, M., A., Hilton, R., S., 1984. **Exchange Rate Uncertainty and International Trade: Some Conceptual Issue and New Estimates for Germany and the United States**. Federal Reserve Bank of New York, Research Papers 8403.
4. Anderson, M., Garcia, P., 1989. **Exchange Rate Uncertainty and the Demand for US**
5. Ardeni, P., Lubian, D., 1991. **Is there trend reversion in Purchasing Power Parity? European Economic Review** 35, 1035--1055.
6. Arize, A., C., 1995. **The Effect of Exchange Rate Volatility on US Exports**. Southern
7. Arize, A., C., 1996a., **Real Exchange Rate Volatility and Trade Flows: The Experience of Eight European Economies**. International Review of Economics and Finance 5, 187--205.
8. Arize, A., C., 1996b. **The Impact of Exchange Rate Uncertainty on Export Growth: Evidence from Korean Data**. International Economic Journal 10, 49--60.
9. Arize, A., C., 1997a. **Conditional Exchange Rate Volatility and Trade Flows: The Experience of Eight European Economies**. Southern Economic Journal 64, 235--253.
10. Arize, A., C., 1997b. **Foreign Trade and Exchange rate Risk in G-7 Countries**. Review of Financial Economics 6, 95--112.
11. Arize, A., C., Osang, T., Slottje, D., J., 2000. E**xchange rate Volatility and Foreign Trade: Evidence from Thirteen LDC's**. Journal of Business and Economic Statistics 18, 10--17.

12. Assery, A., Peel, D., A., 1991. **The Effect of Exchange Rate Volatility on Exports: Some new Estimates**. Economic Letters 37, 173--177.
13. Card, David, Krieger, B, Alan,(2001), ***Time Series Minimum-Wage Studies :A Meta Analysis***, American Economic Association

14. Copas J,Henmi Masayuki ,(2007), ***Confidence Intervals and P-values for Meta Analysis with Publication Bias***, Biometrics, 63 Economic Journal 62, 34--43.

15. Iqbal Mahmood, Major Ehsanullah, and Habib Ahmed**,(2011) Exchange Rate Volatility Macroeconomic Variables in Pakistan ,** Business Management Dynamics Vol.1, No.2, August 2011, pp.11-22
16. A. C. ARIZE,(1998), **THE EFFECTS OF EXCHANGE RATE VOLATILITY ON U.S. IMPORTS: AN EMPIRICAL INVESTIGATION, INTERNATIONAL ECONOMIC JOURNAL** 31 Volume 12, Number
17. Joseph C. Pickard(2003), **EXCHANGE RATE VOLATILITY AND BILATERAL TRADE FLOWS: AN ANALYSIS OF U.S. DEMAND FOR CERTAIN STEEL PRODUCTS FROM CANADA AND MEXICO,** Falls Church, Virginia
18. Hasan Vergil,(1999), **Exchange Rate Volatility in Turkey and Its Effect on Trade Flows,** Journal of Economic and Social Research 4 (1), 83-99
19. OZTURK, Ilhan,(2006), **EXCHANGE RATE VOLATILITY AND TRADE: A LITERATURE SURVEY** *International Journal of Applied Econometrics and Quantitative Studies* Vol.3-1 (2006)
20. Ivan T. Kandilov, **The Effects of Exchange Rate Volatility on Agricultural Trade**
21. Sabri, Nidal Rachid; Peeters, Marga and Abulaben, Diama K.(2012), **The impact of exchange rate volatility on trade integration among North and South Mediterranean countries,** working paper
22. Nodir Bakhromov(2011), **The Exchange Rate Volatility and the Trade Balance: Case of Uzbekistan,** Journal of Applied Economics and Business Research JAEBR, 1(3): 149- 161 (2011)
23. Silvana Tenreyro(2007), **On the trade impact of nominal exchange rate volatility**, Journal of Development Economics 82 (2007) 485–508
24. Stanley, T.D., Jarrell, B. Stephen, (1989), ***Meta-Regresssion analysis: A Quantitative Method of Literature Surveys***, Blackwell Publishing
25. Card, David, Krieger, B, Alan,(2001), ***Time Series Minimum-Wage Studies :A Meta Analysis***, American Economic Association
26. Josheski, Dushko, ***Infrastructure Investment and GDP Growth: A Meta-Regression Analysis*** (September 1, 2008)
27. Presley K. Wesseh, Jr. and Linlin Niu(2012), **The Impact of Exchange Rate Volatility on Trade Flows: New Evidence from South Africa,** *International Review of Business Research Papers Vol. 8. No. 1. January 2012. Pp. 140 – 165*

28. Pugh, Geoff, Coric , Bruno, (2008), ***The effects of exchange rate variability on international trade : A meta-regression analysis***, Applied Economics ,1-14
29. Rose, K. Andrew, Stanley, T.D.,(2005), ***A Meta-Analysis of the Effect of Common Currencies on International Trade***, Journal of Economic Surveys, Vol.19 No.3
30. Rose, K. Andrew, Stanley, T.D.,(2005), ***A Meta-Analysis of the Effect of Common Currencies on International Trade***, Journal of Economic Surveys, Vol.19 No.3
31. Stanley, T.D. (2005), ***Beyond Publication Bias***, Journal of Economic Surveys , Vol.19, No.3
32. Stanley, T.D. , (2008) , ***Meta-Regression Methods for Detecting and Estimating Empirical Effects in the Presence of Publication Selection***, Oxford Bulletin of Economics and Statistics , 70,1
33. Stanley, T.D., Jarrell, B. Stephen, (1989), ***Meta-Regresssion analysis: A Quantitative Method of Literature Surveys***, Blackwell Publishing
34. Stata corp. (2011), ***STATA base reference manual***, Q-Z, Release 10,A Stata press publication, StataCorp LP,College Station, Texas
35. Wooldridge, Jeffrey , (2002), **Introductory Econometrics A Modern Approach**, Thomson

International trade and Economic growth: cross-country evidence

Dushko Josheski (Goce Delcev University –Shtip)
dushkojosheski@gmail.com
Darko Lazarov (Goce Delcev University –Shtip)
darko.lazarov@ugd.com

Abstract

Many empirical studies have been done to investigate whethere growth is influenced by international trade. But despite the great effort that has been devoted to studying the issue, there is little persuasive evidence concerning the effect of trade on growth. The main subject of our paper is to summarize the main findings based on empirical research that have been done to investigate the relationship between the trade and economic growth by using data for 208 regions and countries in OLS regression analysis.

Our results from empirical investigation show: 1) the ratio of trade volume (sum of exports and imports at current prices-*current openness* or sum of exports plus sum of imports) to GDP as a proxy of trade openness has positive effect on economic growth, 2) black market premium as a proxy for imbalance in macroeconomic policies has negative effect, 3) in the presence of macroeconomic policies, trade has statistically and economic significant positive influence on growth, and 4) in an institutional environment trade lacks influencing growth, the coefficient on institutions is positive and statistically significant.

Keywords: International trade, economic growth, institutions, macroeconomic imbalances

Introduction

Starting from Adam Smith's discussion on specialization and the extant of the market by international trade, to the debates about import substitution versus exported growth (growth based on exporting more goods and services), to recent work on increasing returns and endogenous growth models, there are increasing debates among economists about the international trade and economic growth.

The advances in growth theory avoid (enable) economists to focus on some issues that have long been central to international economics. In addition, we will present some of those issues; 1) to what extent and in what ways, international trade might be "engine of growth"?, 2) Do international exchanges of goods and services naturally enhance the growth performance of individual trading countries? And what economic policies are especially conductive to high levels of income in a growing, open economy?

Some theoretical backgrounds of the global economy seem especially important for understanding growth performance in context of endogenous growth models (when growth is based on firms' incentives to invest in creation of knowledge).[16] First, comparative advantage may determine to what extent particular counties are led to specialize in the creation of knowledge and in the production of goods that make incentives use of human capital and new technologies. Second, the large scale of the world economy provides great opportunities for the exploitation of research successes and enhancing the incentives that firms have to invest in the generation of new technologies. Third, in a world of rapid and cheap communication, ideas and information spread very quickly across international borders. Countries stand to benefit from the spillovers generated by investments in knowledge in trade partner counties. Finally, participation in international capital markets provides an expanded set of opportunities for financing investments in all forms of capital, including knowledge capital.

The aspects of international trade environment that we have mentioned above we only use as a theoretical background of our empirical research, the research of transmission effects of trade to economic growth is not our primary goal in this paper.

[16] Frankel, Jeffrey A. and David Romer (1999). "Does Trade Cause Growth?" *The American Economic Review*, (June) 379-399.

Empirical literature overview

Over the past decades relationship between trade and growth had been of interest among the economists. In the next Table we present the selected studies and their main findings.

Study	Technique	Main findings
Kwan and Cotsomitis (1991)	Granger causality test to study Chinese growth and foreign trade	output was an exogenous variable and there was a one-way causal relationship between the two.
Ghartey (1993)	United States, Japan and Taiwan cross-section data	American GDP promoted its export, but Taiwan is quite the opposite and there was a two-way causal relationship between the two in Japan
Jordan Shan and Fiona Sun (1998)	VAR	There is no relationship between the two variables
Jung and Marshall (1985)	Causalitty test	No relationship between growth and trade openness
Chengxiang Shen (1999)	Granger causality test	Two way relationship between trade and growth but no long term relationship.

Source: Chen(2009)

Data and models

In this sample we use data for 208 regions and countries (**See Appendix 1 Descriptive statistics**) actually variables are collected from the data set uste in one study[17].We employ neo-classical framework in out models:

$$\log y_i(t) - \log y_i(0) = \gamma_0 + \gamma_1 \log y_1(0) + \gamma_2 \log(n_i + g + \delta) + \gamma_3 \log K + \gamma_4 \log H + \gamma_5 TrOpen + \varepsilon_i \quad \textbf{(1)}$$

This model is suggested by Mankiw et all(1992),the left had side expression is the first difference logarithm of real GDP per worker between 1960 to 2000, other right hand side y_1 represents initial output, while $\mathbf{n_i + g + \delta}$ are population growth, technological growth and depreciation in each country or region respectively, *K* and *H* represents both the physical and human capital accumulation. The term *TrOpen* denotes country i's degree of trade openness. Following MRW, we assume that the sum of rates of depreciation and technological progress is constant and equal to 0.05 across countries.We use real investment to GDP as proxy for

[17] Bülent Ulaşan, 2012, "Openness to International Trade and Economic Growth: A Cross-Country Empirical Investigation [Dataset]", http://hdl.handle.net/1902.1/18245 UNF:5:2bZyPUz4MN/u7sAKORnl5A== Economics: The Open-Access, Open-Assessment E-Journal [Distributor] V3 [Version]

physical capital and secondary school enrolment rate as proxy for human capital as recommended by MRW (1992). We employ OLS technique to estimate this cross-country regression results are presented in Table 1

Table 1 Economic Growth and Trade Volumes: OLS Estimation results

We start our estimations with the ratio of trade volume to GDP. We obtain two measures for this variable: one is from the World Bank and the other is from Penn World Tables (Version 6.1). One advantage of the World Bank measure is that the data are published in terms of exports and imports. Thus, this allows us to investigate the export-growth connection and import- growth connection separately. On the other hand the trade ratio of the Penn World Tables is published only as a sum of exports and imports at current prices. This is known as *current opennes* . Columns 1 and 2 show the regression results using the ratio of exports and the ratio of imports, respectively. Column 3 includes the trade ratio as a sum of the ratio of exports and the ratio of imports. In each regression the coefficient of the openness variable using world bank data is positive but not statistically significant, but Penn world table data current and real openness coefficient is positive and statistically significant suggesting that 10% increase in the trade ration will increase the growth by 2.7% over the period 1960-2000.

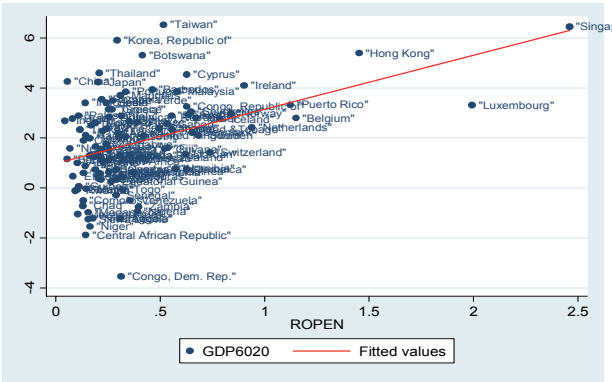
Variables	Variables definition	**Dependent variable is GDPGR6020 log difference of real GDP per worker between 1960 and 2000.**									
		1	**t-stat**	**2**	**t-stat**	**3**	**t-stat**	**4**	**t-stat**	**5**	**t-stat**
LY1960	**log GDP per worker 1960**	-0.43	-7.63	-0.46	-7.43	-0.46	-7.59	-0.46	-7.53	-0.43	-7.03
LNGD	**log(n_i + g +δ)**	-1.10	-2.73	-1.06	-2.61	-1.08	-2.66	-1.02	-3.01	-1.10	-3.02
LINV	**log of Investment rate**	0.36	3.04	0.40	2.99	0.40	3.01	0.34	3.08	0.36	3.44
LSCH	**log of School enrolment**	0.43	4.98	0.45	5.16	0.45	5.1	0.44	6.12	0.43	6.02
XGDP_WB	**Exports ratio of WB**	0.27	1.24	–	–	–	–	–	–	–	–
MGDP_WB	**Imports ratio of WB**	–	–	0.32	1.10	–	–	–	–	–	–
XMGDP_WB	**Trade ratio of WB**	–	–	–	–	0.18	1.19	–	–	–	–
ROPEN	**Real Openness**	–	–	–	–	–	–	0.40	3.57	–	–
COPEN	**Current Openness**	–	–	–	–	–	–	–	–	0.27	2.46
_cons	**constant**	2.24	2.34	2.73	2.32	2.72	2.33	2.73	2.84	2.24	2.25
Number of observations		93				93		105		105	
R-squared		0.6257		0.6231		0.6248		n.a		0.6486	

In summary, the regression results in Table 1 show a positive association between economic growth and international trade and confirm the fiindings of previous work[18]. Physical and human capital are positively associated across all five models. Convergence and initial levels

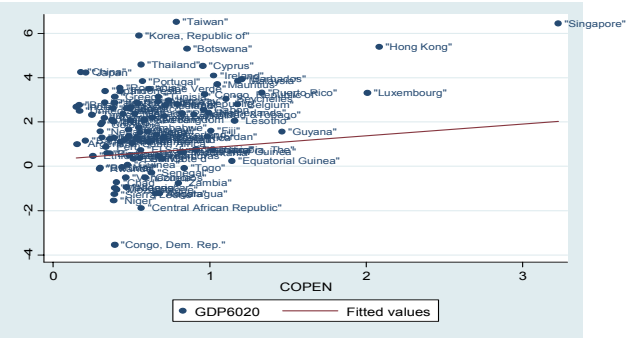
[18] Vamwakidis (2002), Dollar and Kraay (2003), Yanikkaya (2003), Alcala and Ciccone (2004) are a few examples.

of capital are negatively associated with growth which is consistent with neo-classical growth theory[19] In the next scatter we identify outliers in the scatter real openness vs growth.

(a) Real Openness: Exports plus Imports as a ratio of GDP in PPP



(b) Current Openness: Exports plus Imports as a ratio of GDP in current prices



On the previous scatter we identify Singapore, Hong Kong, and Luxembourg as outliers. Their outstanding characteristics are that they have the highest trade ratios with an average value of 244 percent according to the current openness and experience very high growth performances over the sample period.

[19] One of the main implications of Solow-type neoclassical growth models (Solow **1956)** is a notion of "convergence" according to which developing countries grow faster than developed countries given the growth rates of technology and population. In particular, if countries are similar with respect to structural parameters, neoclassical growth models predict that a country's per capita growth rate tends to be negatively related to its starting level of income per person. (Fukuda, Toya,1995).

Direct Trade Policy Measures and economic growth

In the second step we investigate the openness-growth connection by employing direct trade policy measures namely tariff rates, non-tariff barriers on imports[20]

Table 2 Economic Growth and Direct Trade Measures: OLS Estimates

.

Variables	Variables definition	Dependent variable is GDPGR6020 log difference of real GDP per worker between 1960 and 2000.							
		1	t-stat	2	t-stat	3	t-stat	4	t-stat
LY1960	**log GDP per worker 1960**	-0.49	-6.76	-0.48	-7.05	0.083	-5.38	-0.48	-6.13
LNGD	**log(ni + g +δ)**	-1.29	-3.07	-1.27	-3.12	0.443	-2.5	-1.06	-2.8
LINV	**log of Investment rate**	0.43	3.18	0.43	3.19	0.153	2.89	0.4	3.35
LSCH	**log of School enrolment**	0.42	4.52	0.43	4.93	0.091	4.89	0.448	5.44
OWTI	**Own-import weighted tariff rates, 1983-1985 period**	-0.33	-1.08	—	—	—	—	—	—
OWQI	**Own-import weighted non-tariff barriers, 1983-1985 period**	—	—	-0.12	-0.6	—	—	—	—
M_DUTY	**Collected import duties [21]**	—	—	—	—	0.997	0.38	—	—
UWATR	**Unweighted average tariff rate, 1990-99 period.**	—	—	—	—	—	—	-0.48	-0.85
_cons	**constant**	2.56	2	2.50	2.04	1.542	1.72	3.109	2.35
Number of observations		87		85		93		101.00	
R-squared		0.62		n.a		0.58		0.63	

In columns 1 and 2 of Table 2, we only include tariff rate and non-tariff barriers, respectively. Both measures enter the regressions with negative but insignificant coefficient estimates.The coefficient on import duties is positive but statistically insignificant. It is well known fact that the ratio of collective import duties in a country's overall imports is a problematic measure in order to reflect a country's tariff structure due to the fact that a country with very high tariff rates may appear open by this measure

Black Market Premium: A Proxy for Trade Policy or Macroeconomic Imbalances?

Most of the countries in Africa and Latin America experience higher levels of black market premium.

[20] It is obvious that the first two measures directly affect a country's trade volume and reducing or removing them clearly indicates a more open trade regime.

[21] Collected import duties as ratio of imports over 1970-1998 period

Table 3 Black Market premium and economic growth OSL estimates

Dependent variable is GDPGR6020 log difference of real GDP per worker between 1960 and 2000.	Variables definition	Coef.	t	Coef.	t	Coef.	t	Coef.	t
LY1960	**log GDP per worker 1960**	-0.53	-6.5	-0.51	-7.48	-0.48	-7.36	-0.50	-7.37
LNGD	**log(ni + g +δ)**	-1.09	-2.88	-1.25	-3.65	-1.05	-3.12	-1.11	-3.19
LINV	**log of Investment rate**	0.28	3.29	0.24	3.27	0.23	3.28	0.26	3.5
LSCH	**log of School enrolment**	0.57	6.13	0.52	6.41	0.52	6.55	0.54	6.62
LogBMP60	log (1+BMP) in 1960s	-0.16	-1.39	–	–	–	–	–	–
LogBMP70	log (1+BMP) in 1970s	–	–	-0.29	-2.2	–	–	–	–
LogBMP80	log (1+BMP) in 1980s	–	–	–	–	-0.20	-3.21	–	–
LogBMP90	log (1+BMP) in 1990s	–	–	–	–	–	–	-0.23	-1.9
_cons	constant	3.22	2.97	2.57	2.57	2.86	2.91	2.93	2.83
Number of observations		93		107		107		107	
R-squared		0.6061		0.6323		0.6505		0.628	

it is more likely that negative and significant connection between black market premium and economic growth over the period 1960-2000 reflects the adverse relation between macroeconomic imbalances and growth. Black market premium in 1960's,70's,80's,90's is negatively and statistically significantly associated with GDP growth[22].

Macroeconomic policy variables

First, we include two variables related to macroeconomic policy, namely inflation rate and government consumption expenditures. Inclusion of these variables is particularly important since an important criticism on the openness-growth literature is that openness measures are proxy for other macroeconomic policies rather than trade policy.

[22] This mainly depends on the high level and high variation in the black market premium during the 1980s in which many developing countries launched the liberalisation programs after the debt crises in the late 1970s and the early 1980s.

Table 4 Economic growth and macroeconomic policy variables including trade ratio as macroeconomic policy.

Panel Between Effects models			
Dependent variable is GDPGR6020 log difference of real GDP per worker between 1960 and 2000.	Variables definition	Coef.	t
LY1960	**log GDP per worker 1960**	-0.36	-3.35
LNGD	**log($n_i + g + \delta$)**	-1.23	-2.02
LINV	**log of Investment rate**	0.58	3.72
LSCH	**log of School enrolment**	0.35	2.4
XMGDP_WB	Trade ratio by World Bank	0.37	2.21
INFLATION	inflation rate	0.12	1.36
GOVCONS	government consumption/GDP	0.48	0.33
_cons	constant	1.45	0.81
Number of observations		46	
R-squared(0verall)		0.65	

Trade ratio as proxy for openness in such environment is positive and statistically significant unlike macroeconomic variables that are insignificant.

Institutions effect on economic growth

We measure institutional quality by using a composite index based on the data set of *International Country Risk Guide* (ICRG)[23].

Table 5 Institutions as factor on economics growth vs trade openness

Panel Between Effects models			
Dependent variable is GDPGR6020 log difference of real GDP per worker between 1960 and 2000.	Variables definition	Coef.	t
LY1960	**log GDP per worker 1960**	-0.30	-2.44
LNGD	**log(ni + g +δ)**	-1.52	-2.32
LINV	**log of Investment rate**	0.61	3.78
LSCH	**log of School enrolment**	0.28	1.65
XMGDP_WB	Trade ratio by World Bank	0.26	1.2
INFLATION	inflation rate	0.16	1.73
GOVCONS	government consumption/GDP	-1.10	-0.68
ICGR	Institutional Quality Index based on the ICRG data	0.15	2.12
_cons	constant	-0.26	-0.12
Number of observations		41	
R-squared(0verall)		0.67	

Coefficient on the institutions proxy variable is positive and statistically significant, while coefficient on trade in the presence of institutions variable has diminished significance and it is insignificant.

[23] Published by a private international consulting company *Political Risk Services,* this index consists of equally weighting an average of four ICRG components for the years 1984-2000: i) investment profile as a average of three subcomponents namely, contract viability, profits repatriation and payment delays; ii) law and order; iii) corruption; and iv) bureaucratic quality.

Conclusion (resume)

Overall trade openness has positive effect on economic growth, black market premium as a proxy for imbalance in macroeconomic policies has negative effect, in the presence of macroeconomic policies (government consumption and inflation) trade has statistically and economic significant positive influence on growth, and in an institutional environment trade lacks influencing growth, the coefficient on institutions is positive and statistically significant.

Appendix 1 Descriptive statistics of the variables

Variable	Variables definitions	Obs	Mean	Std. Dev.	Min
GDPGR6020	Log difference real GDP per worker btw 1960 and 2000	118	0.67284	0.663944	-1.35254
LY1960	Log of Real GDP per worker in 1960	118	8.315269	0.838991	6.573731
LNGD	Log of sum of rates of population growth, TP and depreciation over 1960-2000 period.	191	-2.67835	0.166289	-3.06888
LINV	Log of Average investment share in GDP at constant prices over the 1960-2000 period.	116	-2.00554	0.605964	-3.87963
LSCH	Log of Average secondary school enrolment rate over the 1960-2000 period.	125	-1.01186	0.848931	-3.11522
MGDP_WB	Imports share by the World Bank (MGDP WB)	107	0.337736	0.188695	0.072298
XGDP_WB	Exports share by the World Bank	107	0.295786	0.18485	0.065576
XMGDP_WB	Trade ratio by World Bank	107	0.633522	0.358251	0.145264
COPEN	Current Openness of Penn World	114	0.643167	0.416541	0.147656
ROPEN	Real Openness of Penn World	114	0.373446	0.352563	0.043561
OWTI	Own-import weighted tariff rates, 1983-1985 period	104	0.168817	0.162973	0
OWQI	Own-import weighted non-tariff barriers, 1983-1985 period	102	0.185794	0.237151	0
M_DUTY	Collected import duties	117	0.12293	0.088828	0
logBMP6020	log (1+BMP), 1960-2000 period.	121	0.377613	0.671639	-0.00443
logBMP60	log (1+BMP) in 1960s.	103	0.213121	0.409949	-0.0009
logBMP70	log (1+BMP) in 1970s.	121	0.232322	0.346003	-0.07214
logBMP80	log (1+BMP) in 1980s.	121	0.398824	0.634852	-0.0142
logBMP90	log (1+BMP) in 1990s.	121	0.274288	0.7994	-0.00351
UWATR	Unweighted average tariff rate, 1990-99 period	121	0.149564	0.093249	0.0032
ICGR	Institutional Quality Index based on the ICRG data	124	3.77601	1.144813	1.11152
INFLATION	Average Inflation Rate over the 1960-2000 period	118	0.399947	1.257691	0.02486
GOVCONS	Government Consumption	121	0.155383	0.05326	0.059789

References

[1]. Andy C. C & KwanJohn A. (1991). Cotsomitis. ***Economic Growth and the Expanding Export Sector: China 1952-1985***,*International Economic Journal*, 5(1): 105 – 116.

[2]. Bülent Ulaşan, (2012), "***Openness to International Trade and Economic Growth: A Cross-Country Empirical Investigation*** ", Economics: The Open-Access, Open-Assessment E-Journal [Distributor]

[3]. Chen,Huan (2009), ***A Literature Review on the Relationship between Foreign Trade and Economic Growth***,International journal of economics and finance

[4]. Dollar, David and Kraay, Aart***, Growth is Good for the Poor*** (April 2001). World Bank Policy Research Working Paper No. 2587.

[5]. Ghartey. E. E. (1993). ***Casual Relationship between Exports and Economic Growth: Some Empirical Evidence innTaiwan, Japan and the US***, *Applied-Economics.* (9): 1145-1152

[6]. Jung, S**.** W**.**, Marshall. Exports (1985). ***Growth and Causality in Developing Countries***. *Journal of Development Economics,* (18):1-12.

[7]. Mankiw,Romer,Weil(1992), ***Acontribution to the empirics of the economic growth, The quarterly journal fo economics***, Vol107,Issue,2 pp.407-437

[8]. Frankel, Jeffrey A. and David Romer (1999). "Does Trade Cause Growth?" *The American Economic Review*, (June) 379-399.

[9]. Robert, M. Solow (1956) ***"A Contribution to the Theory of Economic Growth"*** Quarterly Journal of Economics**.** Vol. 70 (1) pp. 65-94.

[10]. Shan & Fiona Sun. (1998). On ***The Export-led Growth Hypothesis: The Econometric Evidence From China***. *Applied Economics,* (30).

[11]. Shan, J. & F. Sun. (1998b). ***On the Export-led Growth Hypothesis: The econometricEvidence from China.*** *Applied Economics,* 30: 1055-1065.

[12]. Fukuda,S., Hideki,T.,(1995), Conditional Convergence in East Asian Countries: The Role of Exports in Economic Growth, University of Chicago Press, ISBN: 0-226-38670-

Feldstein-Horioka puzzle for a panel of 14 CEE countries: Empirical evidence

Dushko Josheski (dusko.josevski@ugd.edu.mk)

Teaching assistant for the field **applied economics** at University Goce Delcev-Stip

Darko Lazarov (darko.lazarov@ugd.edu.mk)

Teaching assistant for the field **economic theory** University Goce Delcev-Stip

Abstract

In this paper we investigate Feldstein Horioka puzzle for 14 CEE countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, Latvia, Lithuania, Macedonia, Estonia,Poland,Romania,Serbia). In our paper when we investigate the whole sample of 14 CEE countries we find less positive association between investment and savings meaning that capital is highly mobile. While when we regress the subsample of those countries from the sample which are EU members we find the lowest coeffcient of association between investment and saving therefore capital is highly mobile in those countries.While in the Non-EU members from this CEE countires the coeficient is highest 0.13 ,meaning there is lowest capital mobility. Unit root tests proved that in this sample of countries savings are I(1) or I(2) process, and investments are stationary.

Keywords:Investment savings correlation, stationarity, capital mobility,macroeconomic puzzles

Introduction

A well known stylized fact in international macroeconomics is the high correlation between domestic savings and investment in major industrial countries.[24] Feldstein and Horioka's (1980) seminal work, they interpret this high savings-investment correlation as an indicator of capital immobility. This interpretation, however, poses an uncomfortable puzzle[25], the so-called Feldstein-Horioka (hereafter FH) puzzle, as the conventional wisdom in the field of international macroeconomics is that the rich countries have a high degree of capital mobility.The literature on Fedlstein Horioka puzzle is extenzive the original FH article has been cited 142 times[26] between 1988 and 1995. From the CA identity:

$$CA_t = S_t - I_t = -FinancialAccount_t \Rightarrow I_t = FA_t + S_t$$

FH argued that if there is perfect K mobility, we should observe low correlation between domestic I and S. Investors in one country do not need the funds from domestic savers and can borrow from international markets at world rates. By the same token, savers can lend to foreign investor the entirety of the domestic savings. This concept related to long-term real capital flows. Frankel (1995) came up with the distinction between this measure of capital mobility and the financial capital flows measured by real interest party, covered and uncovered interest parities.

F-H estimated:

$$\frac{I_t}{Y_t} = \alpha + \beta \frac{S_t}{Y_t} + u_t \text{ for each country}$$

With perfect capital mobility, the null hypothesis is that the slope coefficient would be zero for small open economies. For large economies the slope coefficient would be larger than zero. For the small economy result to hold, we would also need Corr(r*,S)=0, interest parity

[24] See, for example, Feldstein and Horioka (1980), Feldstein (1983), Penati and Dooley (1984), Dooley et al (1987), Obstfeld (1986), Frankel et al (1986), Tesar (1991), Feldstein and Bachetta (1991).

[25] Since the conventional wisdom in most exchange rate and open-economy macroeconomic models was that capital mobility was high.

[26] Coakley,Farida Kulasi, and Ron Smith(1998), The Feldstein–Horioka Puzzle and Capital Mobility: A Review, International Journal of Finance and Economics *Int. J. Fin. Econ.* **3**: 169–188 (1998)

must hold (r=r*) and corr(S,u)=0. In the next section will review empirical literature on this topic.

Empirical literature review

Existing empirical studies on the savings-investment relationship can be split into two broad groups according to their estimation methodologies. The first group takes a non-time-series approach. The second group uses time series techniques. In the next table we present some of the most important studies.

Study	Technique	Main findings
Feldstein Horioka(1980)	cross-section regressions	the two ratios(savings and investment) are highly correlated
Krol (1996)	pooled data of 21 OECD countries	an estimated coefficient of 0.2, which is significantly smaller than the cross-section estimates reported in earlier studies
Miller (1988)	Time series techniques	He finds that the two series are cointegrated under the fixed exchange rate regime but not under the flexible exchange rate regime
Jansen (1996) and Coakley and Kulasi (1997)	Time series techniques	also show a positive long-run equilibrium relationship between saving and investment in OECD countries.
Coiteux and Olivierar (2000)	a panel cointegration technique	long-run saving-investment correlation of 0.6 in 21 OECD countries
Caporale et al. (2005)	a variety of asymptotically efficient cointegration estimators to test the hypothesis of a unit retention coefficient	they find sample evidence of the FH puzzle
Sarno and Taylor (1998)	Blanchard and Quah decomposition	They show that the short-run correlation is significantly higher than the long-run correlation.

Source**:** Grier, Lin, Ye (2008)[27]**Data and methodology used in this paper**

[27] Kevin Grier, Shu Lin.Haichun Ye,(2008), Savings and Investment in the USA: Solving the Feldstein Horioka Puzzle , University of Colorado Denver

The data are collected from the World Bank data site[28]. Data are for 14 countries. We investigate Feldstein Horioka puzzle for 14 CEE countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, Latvia, Lithuania, Macedonia, Estonia, Poland, Romania, Serbia).Variables of interest here are: Domestic investment to GDP, Domestic savings to GDP, Current account balance, and income per capita. Definitions are given in Appendix 1. Descriptive statistics is presented in Table 1.From the six plots in Appendix 0 we can see that savings and investment are I (1) variables and heteroscedasticity and normality is not a problem.

Table 1 Descriptive statistics of the model[29]

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Current account balance	283	-6.8354	5.08295	-27.16	9.33
Domestic investment to GDP	283	21.3767	5.0348	5.2	35.99
Domestic savings to GDP	283	10.7553	14.3818	-71.82	48.11
credit spread(real interest rates difference)	283	106.177	56.8535	1	204
income per capita	283	127.859	71.9734	1	251

From the table we can see that domestic savings constitutes on average 10.75% of GDP, while domestic investment is 21.37% of GDP. Current account Balance on average is negative -6.8354 of GDP. In the tables is given also the descriptive statistics for the credit spread and income per capita. In the following Table 2 we present the results from the Feldstein Horioka equation. F-H model is presented with the following regression:

Feldstein-Horioka regression: $(I/GDP = \alpha + \beta(NS/GDP) + v$

Feldstein (1980) argued that if capital were perfectly mobile, he would find β = 0. Instead, β was much closer to 1.The coefficient ("saving retention") fell a bit subsequently, but still high. Three "puzzles", if the saving –investment coefficient is to be measured as a measure of barriers to international financial integration:

1. The coefficient is statistically far above zero (the original Feldstein- Horioka finding),
2. it is even higher for industrialized than for developing countries, and

[28] http://search.worldbank.org/data?qterm=&language=EN&format=
[29] See Also Appendix 0 six plots for variables of interest Domestic savings and Domestic investment

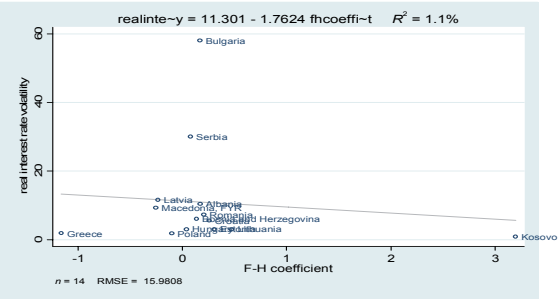
3. There is little observed tendency for it to decline over time.

Table 2 Feldstein -Horioka coefficients and real interest rate volatility

Number	country	F-H coefficient	p-value	real interest rate volatility[30]
1	Albania	**0.1710691**	0.003	**10.4115**
2	Bosnia and Herzegovina	**0.1348117**	0.043	**6.10058**
3	Bulgaria	**0.1655095**	0.495	**58.029**
4	Croatia	**0.2558244**	0.414	**5.62731**
5	Estonia	**0.3041591**	0.308	**3.0999**
6	Greece	**-1.163623**	0.096	**1.90076**
7	Kosovo	**3.197321**	0.452	**0.90936**
8	Macedonia, FYR	**-0.256733**	0.306	**9.35132**
9	Romania	**0.2028929**	0.341	**7.33394**
10	Latvia	**-0.235994**	0.053	**11.6626**
11	Lithuania	**0.4730747**	0.136	**3.10633**
12	Poland	**-0.104444**	0.858	**1.85471**
13	Serbia	**0.0752897**	0.746	**30.0429**
14	Hungary	**0.0368432**	0.890	**3.04876**

Here it should be noted that even though we expect F-H coefficient[31] to be between 0 and 1, there are some deviations from this range, which implies that this model describes very simplified behaviour of savings and investment. P-value is probability of significance of this coefficient. Real interest rate volatility is the standard deviation of the interest rate spread. Regression we use here or the second model is: $SDIR = \alpha + \beta FH + v$

Result is represented in the following ***aaplot***



In our model higher F-H coefficient is associated with lower real interest rate volatility or vice versa. This implies that higher level of financial integration is not associated with higher volatility of interest rate spread. This is opposite for the Results presented in (Giang Lee,

[30] Standard deviations of interest rate

[31] Feldstein Horioka coefficient measures capital mobility.The higher this coefficient is means that capital is less mobile in that country or countries, the lower this coefficient is it is interpreted as capital mobility.

2000) for instance for his paper on financial integration in Asian economies. From the table 2 we can see that standard deviations of interest rates are high. So in this period interest rates in CEE countries are highly volatile. They are more volatile than in the sample of Asian countries in (Giang Lee, 2000), but for the period 1976-1996. The small countries like CEE countries take anchor LIBOR or EURIBOR[32], so it is likely that the source of fluctuations is in the outside economy than in the home country itself. On the next plot is presented the cross section OLS regression for the CEE countries. In the table 3 below graph is presented the result from the Panel regression. From the aaplot (scatter) we can see positive linear trend between domestic savings and investment[33].

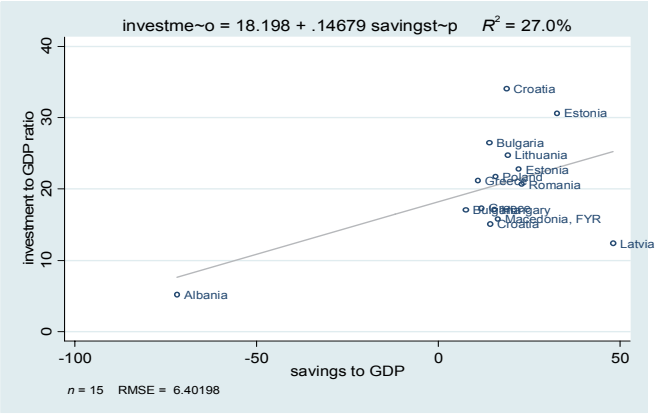


Table 3 Panel regression results on the Feldstein Horioka model [34]

Dependent variable	Domestic investment to GDP	Coef.	p-value
Independent variables	Domestic savings to GDP	0.090869	0.000
	Constant	20.2719	0.000
Number of observations		283	
R^2(between panels)		0.4281	

[32] Euribor and LIBOR are comparable base rates. Euribor is the average interbank interest rate at which European banks are prepared to lend to one another. LIBOR is the average interbank interest rate at which a selection of banks on the London money market are prepared to lend to one another. Just like Euribor, LIBOR comes in 15 different maturities. The main difference is that LIBOR rates come in 10 different currencies. We would like to refer to current LIBOR interest rates and background information on LIBOR, in case you are interested in additional information on LIBOR.

[33] See Appendix 3 Feldstein Horioka regression for every CEE country.
[34] See Appendix 2 Feldstein Horioka Panel regression

In Appendix 3 are presented the results for each CEE countries for the Feldstein Horioka model. The F-H coefficient is of small size and very positive and statistically significant meaning that CEE countries are highly financially integrated.

Unit root tests for the domestic savings and investment in CEE countries

In the next table we summarize the results from the ADF test on the whole sample of countries for the domestic savings and investment variables.

Table 6 Augmented Dickey-Fuller tests for the whole sample of countries

Augmented Dickey-Fuller test	**Domestic savings**	**domestic investment**
	test statistic versus critical value at 95%	test statistic versus critical value at 95%
Albania	(-9.804>-3.000) stationary	(-3.380 >-3.000) stationary
Bosnia and Herzegovina	(-4.905 > -3.750) I(2)	(-3.960>3.750) stationary
Bulgaria	(-6.853 > -3.000) I(2)	(-4.494 > -3.000) stationary
Croatia	(-13.608 > -3.000) I(2)	(-8.029 >-3.000) stationary
Estonia	(-5.033 >-3.000) I(1)	(-4.679 >-3.000) stationary
Greece	(-4.217>-3.000) I(1)	(-4.745 >-3.000) stationary
Kosovo	(-2.763<-3.000) non-stationary	(-5.530 >-3.000) stationary
Macedonia, FYR	(-3.690>-3.000) stationary	(-4.633 >-3.000) stationary
Romania	(-3.404>-3.000) I(1)	(-4.668 >-3.000) stationary
Latvia	(-8.231>-3.000) stationary	(-4.668 >-3.000) stationary
Lithuania	(-3.649>-3.000) stationary	(-4.351 >-3.000) stationary
Poland	(-3.404>-3.000) I(1)	(-4.668 >-3.000) stationary
Serbia	(-3.563>-3.000) I(1)	(-7.212 >-3.000) stationary
Hungary	(-3.680>-3.000) I(1)	(-5.902>-3.000) stationary
overall conclusion	**I(1) or I(2) process**	**Stationary**

Current account balances and economic integration (Blanchard, Giavazzi, 2002)

As Olivier Blanchard wrote in his working paper with Giavazzi[35], a country borrower must take into account when it wants to borrow, interest rate and the price cuts it will have to make in order to generate revenues to repay the debt in the future. In the case of increased integration Blanchard argues borrower countries will borrow more, and lender countries will lend more. If we define *ca* as current account balance to national income than ca is defined as:

$$ca_t = \frac{1}{2}\left(1 - \left[\frac{Y_{t+1}}{Y_t}\frac{1}{R(1+x)}\frac{P_{t+1}}{P_t}\right]\right)$$

So, from the equation above the determinants of the current account balance are: Income the higher is output in the nest period relative to this period the higher will be current account deficit. Second the larger the interest rate the lower will be current account deficit (it will be more costly to borrow). Third, The larger the fall in the price of the domestic good required next period to sell domestic goods and repay the debt, the more expensive it is to borrow, the lower the current account deficit.

$$(Ca/Y)_{it} = \alpha_t + b_t\left(\frac{Y/N_{it}}{Y/N_t}\right) + X_{it}\beta + \varepsilon_{it}$$

Table 7 Panel between effects linear model (whole sample)[36]

Dependent variable	Current account balance	Coef.	p-value
Independent variables	Income per capita	0.069965	0.012
	Constant	-15.7449	0.000
Number of observations		283	
Number of groups (panels)		14	
R^2(between panels)		0.4043	

$$Ca / GDP = -15.75 + 0.069Y / N$$

[35] Blanchard, Giavazzi, (2002), **Current Account Deficits in the Euro Area. The End of the Feldstein Horioka Puzzle?,**Working paper

[36] See Appendix 4 Between effects panel estimation current account balance on income per capita

P-value=0.000 P-value=0.012

As expected the coefficient on the income per capita is positive and statistically significant. In the next Table we introduce the same regression but for the EU members between CEE countries 8 countries[37].

Table 8 Panel between effects linear model -EU members [38]

Dependent variable	Current account balance	Coef.	p-value
Independent variables	Income per capita	0.029145	0.043
	Constant	-9.72245	0.000
Number of observations		152	
Number of groups (panels)		8	
R^2(between panels)		0.3573	

Second subsample: $Ca/GDP = -9.72 + 0.029 Y/N$

P-value=0.000 P-value=0.043

Here we can see that he difference from the whole sample model is that the coefficients are smaller in size, while the signs are the same. In the next table we present the same model for Non-EU members from CEE countries.

Table 9 Panel between effects linear model NON-EU members[39]

Dependent variable	Current account balance	Coef.	p-value
Independent variables	Income per capita	0.13546	0.000
	Constant	-25.3208	0.000
Number of observations		131	
Number of groups (panels)		6	
R^2(between panels)		0.9313	

Third subsample: $Ca/GDP = -25.32 + 0.136 Y/N$

P-value= 0.000 P-value= 0.000

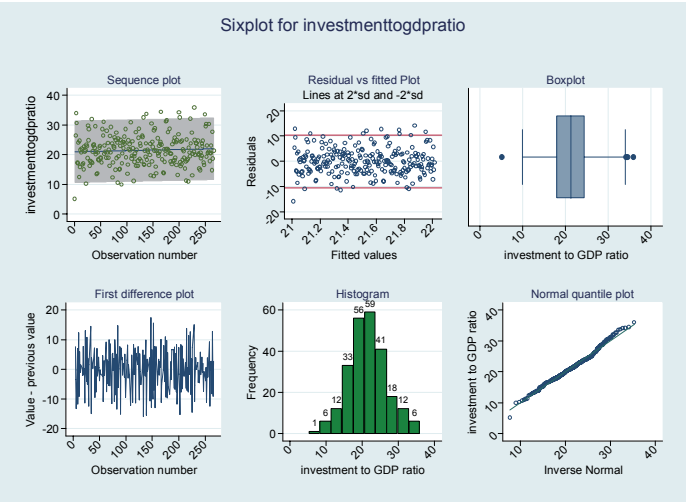
[37] Bulgaria, Greece, Hungary, Latvia, Lithuania, Estonia, Poland, Romania
[38] See Appendix 5 Panel between effects linear model -EU members
[39] See Appendix 6

So on average in the three subsamples we find positive relationship between current account balance and income per capita but this relationship is of bigger size in non-EU members of CEE countries[40].The difference is not very significant because these countries have similar current account balances and income per capita when clustered together.

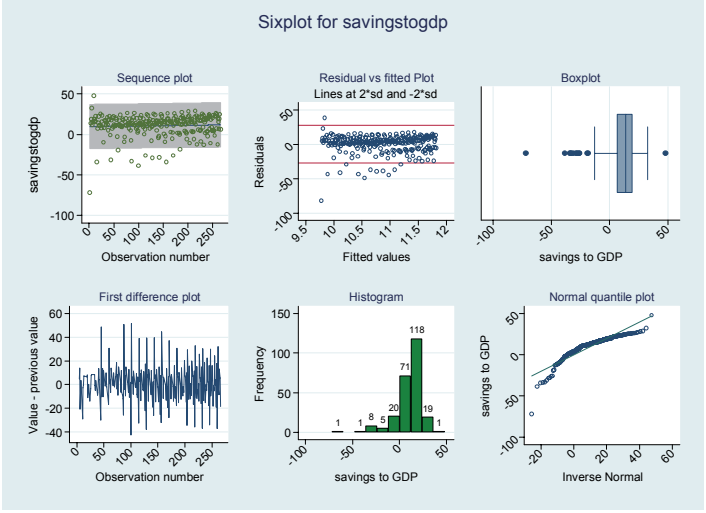
Conclusion (Resume)

In our paper when we investigate the whole sample fo 14 CEE countries we find less positive association between investment and savings meaning that capital is highly mobile. While when we regress the subsample of those countries from the sample which are EU members we find the lowest coeffcient of association between investment and saving therefore capital is highly mobile in those countries.While in the Non-EU members from this CEE countires the coeficient is highest 0.13 ,meaning there is lowest capital mobility. Unit root tests proved that in this sample of countries savings are I(1) or I(2) process, and investments are stationary.

Appendix 0 Six plots for domestic investment and savings



[40] Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Serbia


Sixplot for savingstogdp
Sequence plot
savingstogdp
Observation number
Residual vs fitted Plot
Lines at 2*sd and -2*sd
Residuals
Fitted values
Boxplot
savings to GDP
First difference plot
Value - previous value
Observation number
Histogram
Frequency
savings to GDP
Normal quantile plot
savings to GDP
Inverse Normal

Appendix 1 Definitions of the variables

Interest rate spread	is the interest rate charged by banks on loans to prime customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits.
Current account balance	Current account balance is the sum of net exports of goods, services, net income, and net current transfers
domestic savings	Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption).
domestic investment	Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.

Appendix 2 Feldstein Horioka Panel regression

Random-effects GLS regression Number of obs = 283

Group variable: ctry Number of groups = 14

R-sq: within = 0.0199 Obs per group: min = 19

between = 0.4281 avg = 20.2

overall = 0.1054 max = 36

Random effects u_i ~ Gaussian Wald chi2(1) = 12.57

corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0004

---

investment~o | Coef. Std. Err. z P>|z| [95% Conf. Interval]

---

savingstogdp | .0908694 .0256274 3.55 0.000 .0406406 .1410981

_cons | 20.2719 .6324887 32.05 0.000 19.03225 21.51156

---

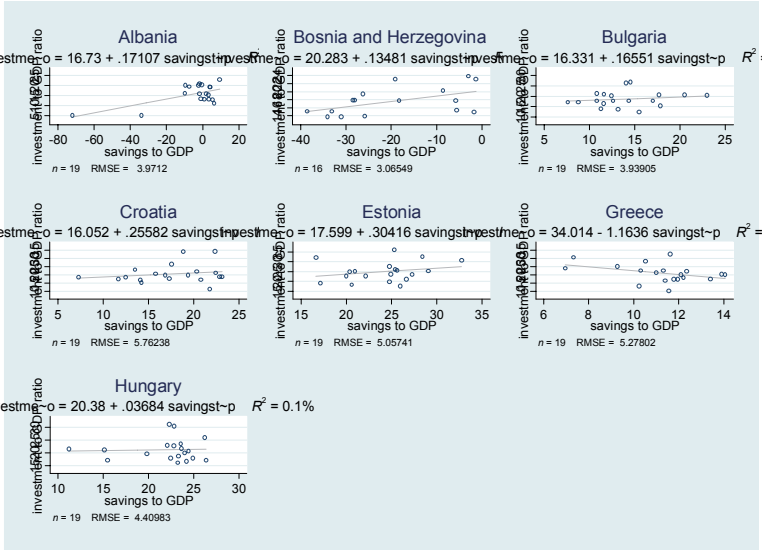
sigma_u | 1.8688231

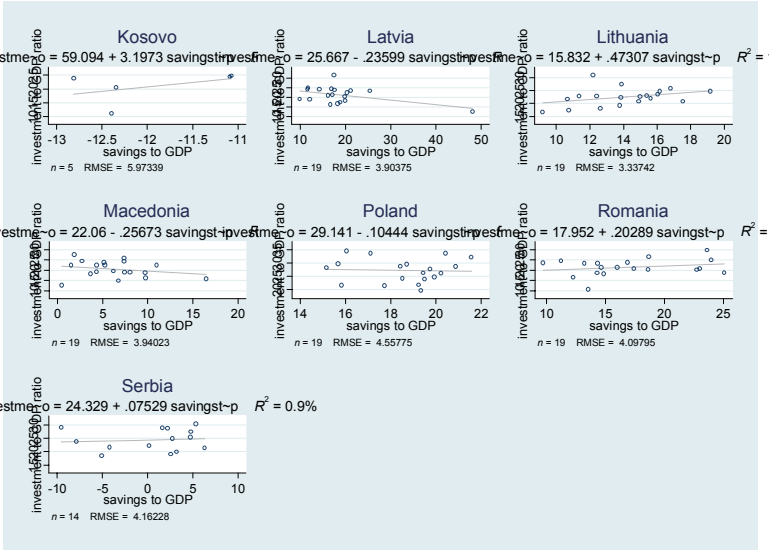
sigma_e | 4.4017456

rho | .15272523 (fraction of variance due to u_i)

Appendix 3

Feldstein-Horioka regression for CEE countries




Kosovo
investmen~o = 59.094 + 3.1973 savingst~p
investment ratio to GDP
savings to GDP
n = 5 RMSE = 5.97339
Latvia
investmen~o = 25.667 - .23599 savingst~p
investment ratio to GDP
savings to GDP
n = 19 RMSE = 3.90375
Lithuania
investmen~o = 15.832 + .47307 savingst~p R² = 12.6%
investment ratio to GDP
savings to GDP
n = 19 RMSE = 3.33742
Macedonia
investmen~o = 22.06 - .25673 savingst~p
investment ratio to GDP
savings to GDP
n = 19 RMSE = 3.94023
Poland
investmen~o = 29.141 - .10444 savingst~p
investment ratio to GDP
savings to GDP
n = 19 RMSE = 4.55775
Romania
investmen~o = 17.952 + .20289 savingst~p R² = 5.4%
investment ratio to GDP
savings to GDP
n = 19 RMSE = 4.09795
Serbia
investmen~o = 24.329 + .07529 savingst~p R² = 0.9%
investment ratio to GDP
savings to GDP
n = 14 RMSE = 4.16228

Appendix 4 between effects panel estimation current account balance on income per capita

(running xtreg on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..... 50

Between regression (regression on group means) Number of obs = 283

Group variable: ctry Number of groups = 14

R-sq: within = 0.0473 Obs per group: min = 19

between = 0.4043 avg = 20.2

overall = 0.0185 max = 36

Wald chi(1) = 6.25

sd(u_i + avg(e_i.))= 1.660289 Prob > chi2 = 0.0124

(Replications based on 14 clusters in ctry)

| Observed Bstrap *

currentacc~e | Coef. Std. Err. z P>|z| [95% Conf. Interval]

incomeperc~a | .0699652 .0279821 2.50 0.012 .0151212 .1248091

_cons | -15.74487 3.829871 -4.11 0.000 -23.25128 -8.238465

Appendix 5 between effects panel estimation-EU members

(running xtreg on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..... 50

Between regression (regression on group means) Number of obs = 152

Group variable: ctry Number of groups = 8

R-sq: within = 0.0673 Obs per group: min = 19

between = 0.3573 avg = 19.0

overall = 0.0489 max = 19

Wald chi(1) = 4.09

sd(u_i + avg(e_i.))= .8245042 Prob > chi2 = 0.0431

(Replications based on 8 clusters in ctry)

| Observed Bstrap *

currentacc~e | Coef. Std. Err. z P>|z| [95% Conf. Interval]

incomeperc~a | .0291447 .0144116 2.02 0.043 .0008986 .0573909

_cons | -9.722447 1.603641 -6.06 0.000 -12.86553 -6.579367

Appendix 6 between effects panel estimation-NON EU members

(running xtreg on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..... 50

Between regression (regression on group means) Number of obs = 131

Group variable: ctry Number of groups = 6

R-sq: within = 0.0302 Obs per group: min = 19

between = 0.9313 avg = 21.8

overall = 0.0005 max = 36

Wald chi(1) = 17.16

sd(u_i + avg(e_i.))= .8019493 Prob > chi2 = 0.0000

(Replications based on 6 clusters in ctry)

| Observed Bstrap *

currentacc~e | Coef. Std. Err. z P>|z| [95% Conf. Interval]

incomeperc~a | .1354603 .032697 4.14 0.000 .0713755 .1995452

_cons | -25.32076 4.435219 -5.71 0.000 -34.01363 -16.62789

Refferences

[1]. Blanchard, Giavazzi, (2002), **Current Account Deficits in the Euro Area. The End of the Feldstein Horioka Puzzle?,**Working paper

[2]. Chen, H.(2007), **Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure**, University of Chicago GSB

[3]. Coakley,Farida Kulasi, and Ron Smith(1998), **The Feldstein–Horioka Puzzle and Capital Mobility: A Review**, International Journal of Finance and Economics *Int. J. Fin. Econ.* **3**: 169–188 (1998)

[4]. Feldstein, Martin; Horioka, Charles (1980), "**Domestic Saving and International Capital Flows**", *Economic Journal* (The Economic Journal, Vol. 90, No. 358) **90** (358): 314–329,

[5]. Frankel, J.A., '**Measuring International Capital Mobility— A Review'**, *American Economic Review*, **82** (1992),197–202.
Horioka puzzle for Australia, *Department of Business Economics, Auckland University of Technology, New Zealand, Department of Economics, University of the West of England, Bristol, UK*

[6]. Kevin Grier, Shu Lin.Haichun Ye,(2008), **Savings and Investment in the USA: Solving the Feldstein Horioka Puzzle** , University of Colorado Denver

[7]. Krol, H., 'International Capital Mobility: Evidence from Panel Data' *Journal of International Money and Finance*, **15** (1996), 467–74.

[8]. Kumar , S. Fargher,S., Webber,D.(2010), **Testing the validity of the Feldstein-**

[9]. Obstfeld, M. and Rogoff, K., '**The Intertemporal Approach to the Current Account**', in G.M. Grossman and K. Rogoff (Eds.), *op.cit*., 1995, 1731–99.

[10]. Özmen,E, (2004), **Financial Development, Exchange Rate Regimes and the Feldstein-Horioka Puzzle: Evidence from the MENA Region**, **ERC Working Papers in Economics 04/18**

Nominal effective exchange rate neutrality: the case of Macedonia

Dushko Josheski, Msc

Teaching assistant

dusko.josevski@ugd.edu.mk

Darko Lazarov, Msc

Teaching assistant

darko.lazarov@ugd.edu.mk

Abstract

This paper uses quarterly data on Macedonian nominal effective exchange rate for the time period 1992 to 2009 along with six other variables to investigate the nominal effective exchange rate neutrality. SVAR and Impulse response functions had been used to prove the hypothesis. Empirical evidence in this paper supports the nominal exchange rate neutrality in the case of Macedonia.

Keywords: NEER, SVAR, Impulse response functions

1. Introduction

Currently, the exchange rate regime in the Republic of Macedonia is what is refered to as a "managed float." The exchange rate of the denar is established on the basis of supply and demand of foreign exchange markets. The denar exchange rate against the euro serves as a fundamental of the Republic of Macedonia monetary policy. Money supply and interest rates are dictated by the exchange rate target. This paper uses Structural Vector Autoregression method to find empirical evidence for the nominal exchange rate neutrality concept for the case of macedonia. In particular, it examines whether Macedonian real GDP is neutral to changes in the nominal exchange rate as predicted by the macroeconomic theory.

Baxter and Stockman (1988),found little evidence of systematic differences in the behavior of other macroeconomic aggregates or international trade flows under alternative exchange rate systems. This is contradictory to the claims that existed before this paper was published[41]. This is known as **Baxter-Stockman** neutrality of exchange rate regime puzzle. In this paper we will test the neutrality of the nominal effective exchange rate. Germany is our biggest trade partner so in the SVAR model we test influence of German Real GDP relative to Macedonian Real GDP.

This paper is divided as follows, Part 2 Theoretical and empirical literature on neutrality, here we set the theoretical foundations and empirical findings in this literature, in Part 3 we give data definitions and their sources, in Part 4 we set the SVAR model, in Part 5 we are interpreting the results from our models and in Part 6 we make conclusions.

[41] Large class of theoretical models before implied that the nominal exchange rate system has important effects on a number of macroeconomic quantities, but Baxter and Stockman proved opposite.

2. Theoretical and empirical literature on neutrality

Neutrality is a condition in which one variable does not change as a result of changes in another variable(Geweke,1986). Geweke comments on structural and stochastic neutrality. First neutrality is when one variable has no effect on other variables in the model, while the second neutrality is when the change in the mean of the exogenous variable does not have impact of the value of a mean of an endogenous variable.Fisher and Seater (1993), define long run super neutrality .Let say nominal effective exchange rate is long run super neutral if

$$LRD_{y,\Delta neer} = \mu$$

Where LRD is long run derivative y is some real variable(let say Real GDP), Δ is some change in nominal effective exchange rate μ should be equal to one if y is the nominal exchange rate and $\mu=0$ when y is real variable. Fisher and Seater (1993),claim that super neutrality applies to those variables that $LRD_{y,\Delta neer} = 0$, so long run neutrality is necessary but not sufficient condition for super neutrality. Since the paper by Lucas(1972), money neutrality became one of the central issues in macroeconomics (Lucas tried to resolve Gurley paradox) [42].Nowadays, economists use VAR (Vector Auto Regressions) and SVAR(Structural Vector Autoregressions) techniques generally found some evidence of neutrality (Cogley 1993). In this study, the neutrality is refered to a situation, in which real GDP in Macedonia is neutral with regards to changes in the nominal exchange rate.Caporrale and Pittis (1995), they used the exchange rate neutrality to refer to the effect of the nominal exchange rate determination regime. As Papel (1992), points out the literature on nominal exchange rate neutrality is dominated by examinations of the neutrality of the exchange rate determination regime.

[42] John Gurley wrote the following parody of Friedman's monetary views: "Money is a veil, but when the veil flutters real output sputters." He meant, in theory, the money supply should only determine the number of zeros on price tags; it should not have real economic effects. In practice, however, wild swings in the money supply can produce wild swings in real output.

3. **Data source and definitions**

In this paper we use quarterly data derived from Econstats™ [43], and from the OECD data base[44], and State statistical office of Macedonia [45] in the Table 1 these variables are summarized

Table 1 Summary statistics

Variable	description	Obs	Mean	Std.Deviation	Min	Max
realgdpmacedonia	Macedonian real GDP(quarterly data)[46]	24	12.5	7.071068	1	24
neermacedonia	Nominal effective exchange rate of Macedonia(quarterly data)	71	33.19718	20.33197	1	68
inflation	PPI index (quarterly data)	55	87.34418	15.43846	30.69	104.4
ir	Lending interest rate (quarterly data)	63	27.05957	48.68202	9.6	380.7
M1macedonia	Monetary aggregate M1(quarterly data)	27	14	7.937254	1	27
M2macedonia	Monetary aggregate M2(quarterly data)	27	14	7.937254	1	27
germanyGDP	German Real GDP(quarterly data)	71	95.25592	7.039186	83.46	108.2

[43] http://www.econstats.com/ifs/NorGSc_Mac2_M.htm

[44] Data on the German real GDP are gathered from OECD data base

[45] Data on Macedonian Real GDP are collected from this source

[46] All these are quarterly data i.e. realgdpmacedonia (2004q1,2009q4), neermacedonia(1992q1,2009q3),inflation(1993q1,2006q3),ir(1994q1,2009q3),M1macedonia(2003q1,2009q3), M2macedonia(2003q1,2009q3),germanyGDP(1992q1,2009q3)

All series will be transformed into logs for analysis except for interest rates and inflation.

This study uses quarterly data over the period from 1992 to 2009 encompassing 72 observations utmost (on some variables observations are missing).The use of 18 year horizon is short to international studies. Now, we will briefly explain the variables. The price of one currency in terms of another is called exchange rate. Here we use as a proxy for the exchange rate nominal effective exchange rate (NEER) variable, which adjusts all the individual bilateral rates for their share of total trade. This variable covers period from 1992quarter 1 to 2009quarter3. The relationship between nominal effective exchange rate and Real GDP is in the focus of our research. Gross Domestic Product data are calculated according to the new National Classification of Economic Activities NACE Rev.2.Money supply is included to capture the impact on other variables in the model, M1 the includes physical money such as coins and currency, it also includes demand deposits which are checking accounts, and all cash and assets that can quickly be converted in to currency. M2 is a category within the money supply that includes M1 in addition to all time-related deposits, savings deposits, and non-institutional money-market funds.These tvo variables cover period from 2003quarter 1 to 2009quarter3.Inflation as Producers price index is in the data set. Interest rate is another important variable in the macroeconometrics models, in our data it is the lending rate it covers period from 1994quarter 1 to 2009quarter 3.

4. Structural Vector Auto Regression (SVAR)

Since Sims(1980) VAR approach is very popular in the macroeconomic literature. In VAR modes all of the variables are considered endogenous and can impact other variables in the model. VAR representations are given in their structural or reduced form (Stock and Watson 2001)

$$Y_t = C(L)Y_t + \varepsilon_t$$

Where C represents the lagged values of the variable and other variables in the model, Y_t is the vector of the variables in the model. SVAR model imposes restrictions on the VAR model. These restrictions that have the effects of assuming no causal relationship either contemporanesly or through lags are used as assistance in the identification of the model (Stock and Watson 2001).German Real GDP it is used in the model since Germany is our biggest

trade partner .German GDP it is assumed it is not affected by Macedonian events; That is due to the fact that Macedonian economy is small size relative to the German economy.

Macedonian Interest rates are assumed to be influenced by the world economy, similar as Macedonian inflation. Macedonian money supply is related to the inflation, interest rates. Macedonian Real GDP is influenced by the all of the variables.

Table 2 Contemporaneous Relationships among Variables

	INDEPENDENT VARIABLES					
DEPENDENT VARIABLES	germanyGDP	inflation	ir	M1 or M2 macedonia	neermacedonia	realgdpmacedonia
germanyGDP						
inflation	*					
ir	*	*				
M1 or M2 macedonia	*	*	*			
neermacedonia	*	*	*	*		
realgdpmacedonia	*	*	*	*	*	

5. Interpretation of the results

When conducting VAR analysis standard procedure is to perform unit root test, to verify the stability of the system. There a number of different types of test each of them with different null hypothesis. For example Dickey-Fuller test and Philips Perron test (Phillips and Perron 1988),starts with the null hypothesis of unit root while KPSS test (Kwiatkowski at. el. 1992) tests stationarity rather than its absence. In this paper all three tests are conducted and are reported in the Table 3.

As it is common in this literature the tests gives mixed results regarding stationarity. Hence, some judgment about the nature of the series and transformation required to make it stationary is required in the estimation. The summary for the conclusions and the method of transformation are given in the Table 4.

Table 3 Summary of Unit Root test results

Variable	Augmented D-F test(test statistic vs crtitical value at 95% confidence level)	Philips-Perron test(test statistic vs crtitical value at 95% confidence level)	KPSS	Conclusion
realgdpmacedonia	trend stationary (-6.461> -3.600)	trend stationary (-27.642 >-17.900	Trend stationary	trend stationary
neermacedonia	trend stationary (-6.257>-3.480)	trend stationary (-43.174>-20.160)	I(1)	trend stationary
inflation	trend stationary (-8.265>-3.496)	I(1) (-25.584>-19.854	I(1)	I(1)
ir	trend stationary (32.048>-3.488)	trend stationary (-46.743 > -20.016)	I(1) or I(2)	trend stationary
M1macedonia	I(1) (-7.213 > -3.600)	I(1) (-34.196 > -17.900)	I(1) or I(2)	I(1)
M2macedonia	I(1) (-5.266>-3.600)	I(1) (-27.891 > -17.900)	Stationary	I(1)
germanyGDP	I(1) (-5.971>-3.481)	I(1) (-47.673 >-20.142)	I(1,2)	I(1)

Monetary aggregates are trend stationary Macedonian Real GDP is also trend stationary, same as nominal effective exchange rate other variables are I(1) variables.

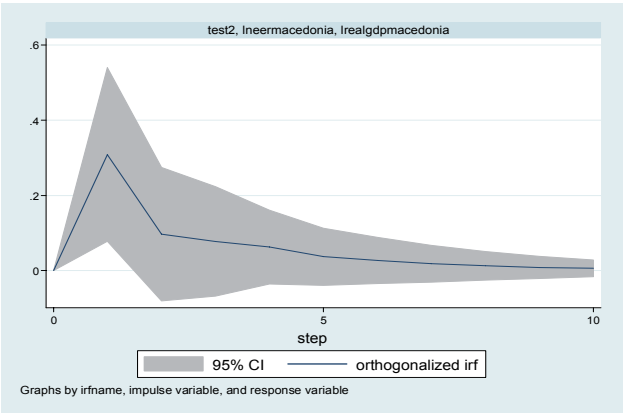
Table 4 Summary of conclusions regarding stationarity and transformation

Variable	Test statistic	Transformation required
realgdpmacedonia	trend stationary	detrending
neermacedonia	trend stationary	detrending
inflation	I(1)	First difference
ir	trend stationary	detrending
M1macedonia	I(1)	First difference
M2macedonia	I(1)	First difference
germanyGDP	I(1)	First difference

Impulse Response functions

For the sake of brevity, we report only the responses of Macedonian real GDP to a shock in the nominal exchange rate.

Figure 1: Impulse Response Functions-Impact on Real GDP to a shock to the effective exchange rate



Findings from our models clearly support nominal exchange rate neutrality fo Macedonia. As expected, some responses are found in the short-run, but they dissipate quite quickly and revert back to the base line level implying no impact on the long run equilibrium real GDP.From the Figure 1 one can tell that Real GDP responds to a shock in nominal effective exchange rate but only in the first five quarters and the effects afterwards dissipate slowly. Son the impact on Real GDP on a shock of the nominal effective exchange rate lasts 1 year in three months(5 quarters).

SVAR reuslts are presented in the following tables .As it can be seen from the table 1, 1% change in the nominal effective exchange rate for Macedonia affects Macedonian Real GDP by 6.4% but on a long run the effect is zero. A -matrix shows negative impact of -0.12 (12%) but on a long run the effect is zero.

Table 5 SVAR of Nominal effective exchange rate as impuse function and Real GDP as reposnse

	lrealgdpmacedonia	**lneermacedonia**
lrealgdpmacedonia	-0.0465	0
lneermacedonia	0.0640474	0.2288

$$A = \begin{pmatrix} 1 & 0 \\ -0.12691 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 0.504 & 0 \\ 0 & 0.228 \end{pmatrix}$$

Macedonian and German GDP

On a short run 1% growth in German GDP influences the growth of Macedonian GDP by 0.2% .A-matrix shows that this impact is negative on short run but on a long run the effect is zero.

$$A = \begin{pmatrix} 1 & 0 \\ -0.00482 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 0.449 & 0 \\ 0 & 0.005 \end{pmatrix}$$

	lrealgdpmacedonia	lgermangdp
lrealgdpmacedonia	0.4492	0
lgermangdp	0.0021	0.005

6. Conclusion

Nominal exchange rate neutrality is the situation where variations in the nominal exchange rate have no impact upon real GDP. It is generally defined for the long-run allowing some short-run variations during the period of adjustment. Empirical results presented in this paper support the nominal exchange rate neutrality for the case of Macedonia.

Refferences

1. Phillips, P.C.B. and Perron, P. 1988, 'Testing for a Unit Root in Time Series Regression', *Biometrika*, vol 75, no 2, pp335-346
2. Sims, C.A. 1980, 'Macroeconomics and Reality', *Econometrics*, vol 48, no 1, 1-48
3. Stock, J.H. and Watson, M.W. 2001, 'Vector Autoregression', *Journal of Economic Perspectives*, vol 15, no 4, pp101-115
4. Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. 1992, 'Testing the null hypothesis of stationarity against the alternative of a unit root', *Journal of Econometrics*, vol 54, no1-3,pp159-178
5. Stock, J.H. and Watson, M.W. 2001, 'Vector Autoregression', *Journal of Economic Perspectives*, vol 15, no 4, pp101-115
6. Caporale, GM. and Pittis, N. (1995), Nominal exchange rate regimes and the stochastic behavior of real variables, Journal of International Money and Finance 14 (3) : 395- 415
7. Papell, D.H. (1992), 'Can equilibrium models explain nominal exchange rate non-neutrality?
8. HarbingerC, Albert Wijeweera, Nominal Exchange Rate Neutrality: The Case of Australia, University of New England, Armidale, NSW 2351
9. Baxter, M. & Stockman, A.C., (1989)"Business Cycles and the Exchange-Rate Regime" Journal of Monetary Economics, Vol. 23, No. 3, pp. 377-400, (May 1989).

10. Fisher, M.E. and J.J. Seater (1993), “Long Run Neutrality and Superneutrality in an ARIMA Framework,” *American Economic Review* 83: 402-415.

11. Lucas, Robert (1972). "Expectations and the Neutrality of Money". Journal of Economic Theory 4 (2): 103–124.

12. Geweke, John F, 1986. "The Superneutrality of Money in the United States: An Interpretation of the Evidence," Econometrica, Econometric Society, vol. 54(1), pages 1-21, January

13. Cogley, T. 1993, ‘Empirical Evidence on nominal wage and price flexibility’, *Quarterly Journal of Economics*, vol CVIII, Issue 1, pp475-491

NEW KEYNESIAN MACROECONOMICS: EMPIRICALLY TESTED IN THE CASE OF REPUBLIC OF MACEDONIA

Dushko Josheski [47]

Darko Lazarov[48]

Abstract

In this paper we test New Keynesian propositions about inflation and unemployment trade off with the New Keynesian Phillips curve and the proposition of non-neutrality of money. The main conclusion is that there is limited evidence in line with the New-Keynesian theory. Money and growth are cointegrated series and that money growth influences the economics growth with one quarter lag. Cointegration means also that if the two series are cointegrated they have long run equilibrium. St.Louis model in the paper showed overall that increase in money growth leads to decrease in the economy growth. But the effect in the equation at three quarters lag is positive. The NAIRU rate in the unemployment inflation trade off model is almost similar as high to the actual unemployment. In the New Keynesian Phillips curve not surprisingly, there appears to be no statistically significant relationship between inflation and Unemployment –even in the classical Philips curve and in adaptive expectations Philips curve by Modigliani- Papademos (1975). Or the Friedman-Phelps- Lucas expectations-augmented one between the difference of actual and expected inflation rate and the gap between actual and the natural rate of unemployment presented in the next equation.

Keywords: New-Keynesian Macroeconomics, NAIRU, Money and output trade off

[47] (Goce Delcev University –Shtip)
Email: dushkojosheski@gmail.com
[48] Goce Delcev University –Shtip)
Email:darko.lazarov@ugd..edu.com

"If you were going to turn to only one economist to understand the problems facing the economy, there is little doubt that the economist would be **John Maynard Keynes**. Although Keynes died more than a half-century ago, his diagnosis of recessions and depressions remains the foundation of modern macroeconomics. His insights go a long way toward explaining the challenges we now confront."- **N. Gregory Mankiw** (2008) a professor of economics at Harvard. He was an adviser to President Bush and advised Mitt Romney in his campaign,2012 for the Republican presidential nomination.

Introduction

In this paper we will investigate the issue of inflation and unemployment trade off and the money and output. In the part where we use data we will investigate this relation with data for Macedonian macroeconomic aggregates[49]. Since, 1991 Macedonia has gone from command to a market economy (process called transition). This resulted in high level of poverty and unemployment. Unemployment was a problem even before 1990, in 1970 in Macedonia were registered 20% unemployed, and in 1991 already there were 24% unemployed but the situation with the unemployment later further deteriorated. Some factors that contributed to the high levels of unemployment are: low export intensive economy, low level of FDIs, decline of economic activity, large informal economy, inefficient labor market policies weak law enforcement and rigid labor legislation. In one study for transition vs OECD countries(Cazes,2002), was tested whether policies that promote social dialogue, extending it to pay higher attention to employment promotion and unemployment reduction and to ensure more labor market stability, are to be on political agenda rather than just a pure deregulation. And the results were that social dialogue is more efficient than just pure deregulation. Later in the section Money and Output we are testing the monetary policy efficiency in a small economy like Macedonia.The research here includes money supply as a conventional channel of monetary policy and how does money supply affects growth of GDP. We employ VAR technique and OLS technique for estimations.

New-Keynesian Macroeconomics: Inflation-Unemployment trade offs

Alben Phillips (1958) in his paper concluded that there exist stable relationship between rate of change of money and unemployment for almost 100 years. That means that wages are

[49] Data used in this paper cover the period from 2004.1 to 2009.4 quarterly data .Data on inflation (CPI) unempolyment, M2(monetary aggregate), and GDP(Gross Domestic Poduct).

stationary $\left(\frac{dw}{w}=0\right)$ at certain level of unemployment[50].There is countercyclical "loop" meaning that $\frac{dw}{w}\uparrow$ when $\frac{du}{t}\downarrow$ and opposite case when $\frac{dw}{w}\downarrow$ when $\frac{du}{t}\uparrow$ .Lipsey (1960) introduced new theoretical relationship between $w=\frac{dw}{dN}=k\times\left[\frac{N^d-N^s}{N^s}\right]$

Where N^d is demand for labor and N^s is a labor supply. , this relationship tells that the change in money wage rate is proportional to excess demand for labor. Now the key transformation form Phillips –Lipsey to Samuelson Sollow (1960) curve is done through *mark-up* pricing

$P_t=(1+a)\frac{W_tN_t}{Q_t}$ .On the next equation nominal GDP is equal to 1+a times nominal wage.

Now $laboproductivity=\frac{Q_t}{N_t}$ .By substituting we get $P_t=(1-a)\frac{W_tP_tQ_t=(1+a)W_tN_t}{laborproductivity}$

In logarithms we get $\log P_t=\log(1+a)+\log W_t-\log laborprodu\,ctivity_t$

$\frac{\Delta P_t}{P_t}=\frac{\Delta W_t}{W_t}-\frac{\Delta laborproductivity_t}{laborprroductivity_t}$ So the inflations is negatively associated with productivity and is positively associated with wage growth. Next morel general Phillips curve is being introduced

$$w=\pi^e+bu^{-1}+\beta laborproductivity,\ b>0,\ 0\le\beta\le 1$$

Here π^e is assumed to be stable and to be zero. Next it is being assumed modern Phillips curve $\pi=\pi^e+bu^{-1}-(1-\beta)laborproductivity$.

Friedman-Phelps Phillips curve was about the short run trade -off between unemployment and inflation and that on the short run, expectations shift the short run Phillips curve which is depicted in the following expression: $\pi=f(u)+\pi^e$

Now, from Friedman's accelerationist hypothesis $(1-\theta)\pi_{t-1}=(1-\theta)\pi^e_{t-1}-b(1-\theta)(u_{t-1}-u^*)$

If we subtract from the original equation: $\pi_t=\pi_{t-1}+b(1-\theta)(u_{t-1}-u^*)-b(u_{t-1}-u^*)$

[50] It was 5 ½ % for the United Kingdom for the period 1861-1957

$\pi_t = \pi_t^e, \pi_t = \pi_{t-1}, and\ u_t = u_{t-1}.$

So when inflation is fully anticipated:

By substituting: $\pi_t - \pi_{t-1} = -b\theta(u_t - u^*) - b(1-\theta)(u_t - u_{t-1})$

$But\ \pi_t = \pi_{t-1} \Rightarrow \pi_t - \pi_{t-1} = 0 \quad and\ u_t = u_{t-1} \Rightarrow u_t - u_{t-1} = 0.$

So $0 = -b\theta(u_t - u^*)$ and $u_t = u^*$.

This expression implies that unemployment reverts to the natural rate at the long run Phillips curve once inflation is fully anticipated. In 1975, Modigliani and Papademos (1975) introduced the anagram NIRU, meaning "Non-Inflationary Rate of Unemployment", into the debate over the monetary policy and its consequences to inflation and unemployment.

…..(NIRU) It is defined as a rate such that, as long as unemployment is above it, inflation can be expected to decline - except perhaps from an initially low rate. The existence of NIRU is implied by both the "vertical" and the "nonvertical" schools of the Phillips curve" [Modigliani and Papademos, 1975: 141-142].later other authors used the term NAIRU (nonaccelerating - inflation rate of unemployment) like Tobin, and Baily (1977)[51].

The Role of Monetary Policy and Inflation and Unemployment

The term "natural rate of unemployment" was used by Milton Friedman in order to express the idea that high levels of unemployment in a society could not be pegged by monetary policy, and that it is a result of real economic forces only[52].

> "The „natural rate of unemployment", in other words, is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is embedded in them the actual structural characteristics of the labour and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering informationabout job vacancies and labour availabilities, the costs of mobility and so on" [**Friedman, 1968:8**].

So, we can say that for Friedman the natural rate of unemployment is the outcome of imperfections, frictions and rigidities either in the labour market that prevents a Walrasian general equilibrium market-clearing position in the economy.

[51] Other authors such as Okun (1978) do not make an explicit distinction between NAIRU and the natural rate of unemployment

[52] In his presidential lecture to the American economic association in Washington D.C., Friedman discussed monetary policy limitations.

Positively sloped Phillips curve

> "Just as the natural-rate hypothesis explains a negatively sloped Phillips curve over short periods as a temporary phenomenon that will disappear as economic agents adjust their expectations to reality, so a positively sloped Phillips curve over somewhat longer periods may occur as a transitional phenomenon that will disappear as economic agents adjust not only their expectations but their institutional and political arrangements to a new reality."
>
> (**Friedman 1976, Nobel prize lecture**)

Friedman in 1976 Nobel Prize lectures offered the possibility of positively sloped Phillips curve. According to Friedman increasing volatility and increasing government intervention within the pricing system are the major factors to increase the unemployment, not high volatility or high intervention. So this requires contracts to be renegotiated to shorter lengths. This is why monetary policy influences the real variables: Imperfect information on the labour market, second monetary policy deals with nominal variables while the rate of unemployment is real phenomenon.

Money and output

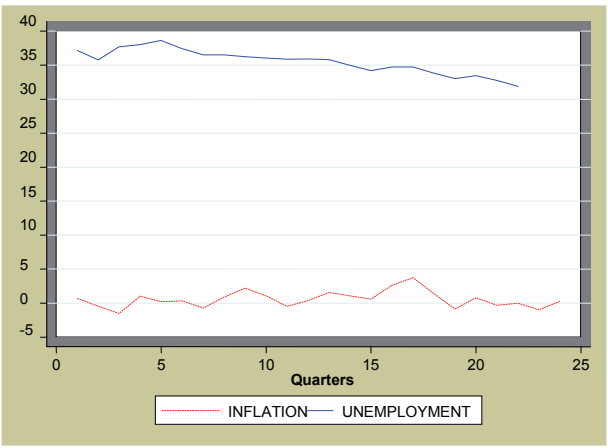
In the next table we summarize the three alternative views of monetary policy Real business cycle model, New classical model, and New Keynesian model.

<table>
<tr><th colspan="4">Summary of Monetary Policy and Output: Three Alternatives</th></tr>
<tr><th colspan="4">Is current Output Affected by an…</th></tr>
<tr><th>Alternative</th><th>Unexpected change in money supply?</th><th>Expected change in money supply?</th><th>Is Activist policy desirable?</th></tr>
<tr><td rowspan="2">Real Business cycle model</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td colspan="3">Prices are perfectly flexible, so monetary policy cannot affect real money balances or output in the short run</td></tr>
<tr><td rowspan="2">New classical model</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="2">Only expected changes in the money supply affect output.</td><td>Monetary policy affects output and the real interest rate only by "fooling" households and firms.</td></tr>
<tr><td rowspan="2">New Keynesian model</td><td>Yes</td><td>Yes</td><td>Rarely</td></tr>
<tr><td colspan="2">Both unexpected and expected changes in the money supply affect output, although effects of unexpected changes are greater.</td><td>Frequent changes in monetary policy can reduce the credibility of the monetary authority.</td></tr>
</table>

About the credibility of central banks, both models New Classical and New Keynesian School argued that is the important problem in the early 1990's.Credibility in some research (Geraats, 2002)[53],is measured as low past inflation outcomes. Macroeconomic performance based on the variability of inflation and output reveals that credibility and to a lesser degree transparency improves macroeconomic performance. Recent evidence supports the New Keynesian view.

Empirical investigation of unemployment and inflation trade off

On the next graph we present the movement of inflation and unemployment. Here we use quarterly data from 2004 quarter 1 to 2009 quarter 4 [54] . Data are collected from Econstats™.



Source: IMF IFS and EconStats™

On the graph we can see persistent unemployment and moderate low inflation. The low infation is associated with the primary goal of National bank of Republic of Macedonia which is price stability. The persistent unemployment is because there are no posts (involuntary unemployment) or due to lack of qualifications necessary to be employed (structural unemployment). The mismatch between the skill requirements of newly created jobs and effective skills owned by the workers has become a substantial problem (Svejnar, 2002). Consequently, the labor markets in early transition became less dynamic with a

[53] Geraats, M.Petra, (2002), ***Central bank transparency***, The Economic Journal, (112), Royal Economic Society
[54] http://www.econstats.com/ifs/NorGSc_Mac2_M.htm

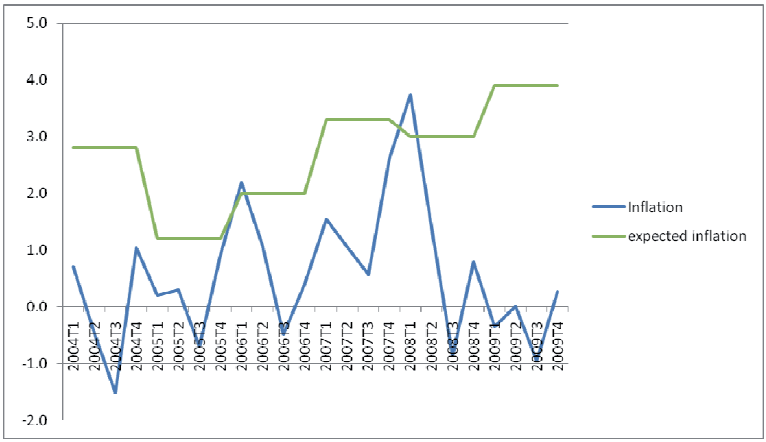
relatively stagnant unemployment pool leading to increases in unemployment and especially longterm unemployment (Cazes and Nesporova, 2003).Now in this paper we try to test the applicability fo NAIRU (Non-Accelerating-Inflation Rate of Unemployment), which refers to the level of unemployment below which inflation rises. Fridman and Phelps at the end of 1960's established that the Philips curve is vertical in the long run as a feature of the Walrasian. In the next Table are presented the Inflation and Unemployment in percentages quarterly data.[55]

Quarters	Inflation	Unemployment	Expected inflation
2004T1	0.7	37.1	2.8
2004T2	-0.5	35.8	2.8
2004T3	-1.5	37.7	2.8
2004T4	1.0	38.0	2.8
2005T1	0.2	38.6	1.2
2005T2	0.3	37.4	1.2
2005T3	-0.7	36.5	1.2
2005T4	0.9	36.5	1.2
2006T1	2.2	36.2	2
2006T2	1.1	36.1	2
2006T3	-0.5	35.9	2
2006T4	0.4	35.9	2
2007T1	1.5	35.8	3.3
2007T2	1.0	35.0	3.3
2007T3	0.6	34.2	3.3
2007T4	2.6	34.7	3.3
2008T1	3.7	34.8	3
2008T2	1.4	33.8	3
2008T3	-0.9	33.0	3
2008T4	0.8	33.5	3
2009T1	-0.3	32.7	3.9
2009T2	0.0	31.9	3.9
2009T3	-1.0	n.a	3.9
2009T4	0.3	n.a	3.9

Source: IMF IFS and EconStats™ and NBRM (for the expected inflation data)

On the next graph are presented the movements in the period 2004.1 to 2009.4 of actual inflation and expected (projected) inflation by the National bank of Republic of Macedonia.

[55] Data on inflation are derived from CPI indexes and converted into percentages



Source: Econstats™, and NBRM (reports of projected inflation)

The classic Philips curve:

$(\pi_t) = f(U_t)$

$$\pi_t = 4.39 - 0.1225U_t$$

Standard errors (8.816) (0.247)

We can compute the underlying natural rate of unemployment as:

$$U^n = \frac{\hat{\beta}_1}{-\hat{\beta}_2} = \frac{4.39}{0.1225} = 35.84 \quad R^2=0.0298$$

From the results above we can observe that estimated coefficients have the expected signs, but they are both highly statistically insignificant. Moreover, the coefficient of determination is close to zero, which indicates a low explanatory power of the applied linear regression model. Therefore, we argue that NAIRU concept is far from being applicable in the case of Macedonian labour market. The NAIRU concept applies for mature market economies, not for a young labour market like that in Macedonia set up just at the beginnings of 1990's. And most of the transition countries including Macedonia in the beginning of establishing the labour market had experienced high inflation rates which cannot be explained by the unemployment.

Most of the NAIRU literature emphasises its importance as a long-run concept (Hahn, 1995; Ball, 1999; Ball and Mankiw, 2002). In the short-run, unemployment can deviate from the NAIRU, but in the long run is assumed to return to a unique NAIRU.

The simple adaptive expectations Phillips Curve(Modigliani-Papademos,1975**)**:
$(\pi_t) = f(\pi_{t-1}, U - U^*)$

$$\pi_t = -0.015 - 0.96\pi_{t-1} - 0.40(U - U^*)$$

Std.errors (0.256) (0.339) (0.205) R^2=0.54

Not surprisingly, there appears to be no statistically significant relationship between inflation and

Unemployment –even in the classical Philips curve and in adaptive expectations Philips curve by Modigliani- Papademos (1975). Or the Friedman-Phelps- Lucas expectations-augmented one between the difference of actual and expected inflation rate and the gap between actual and the natural rate of unemployment presented in the next equation.

The simple expectations augmented Phillips Curve(Friedman, 1968-Phelps, 1967 **)**[56]:
$(\pi_t) = f(\pi_t^e, U_t - U^*)$

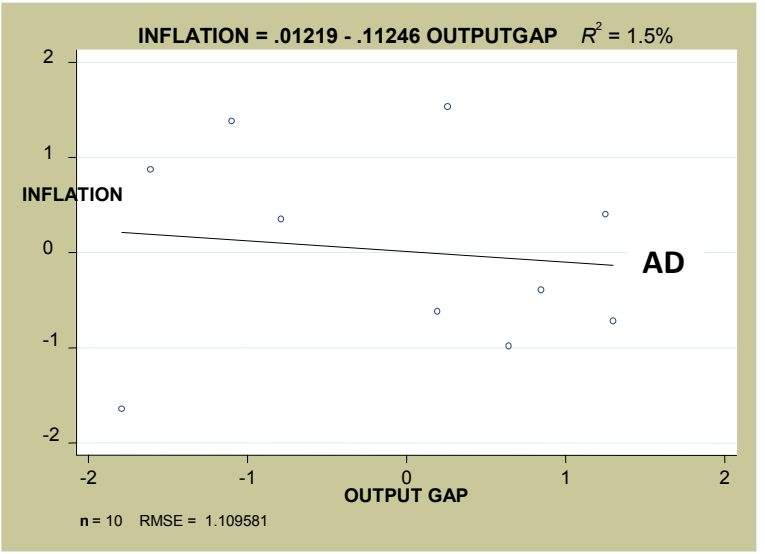
$$\pi_t = 0.932 - 0.294\pi_t^e - 0.34(U - U^*)$$

Std.errors (0.97) (0.285) (0.327) R^2=0.157

INFLATION AND OUTPUT GAP TRADE-OFF IN MACEDONIA

According to New-Keynesian theories, fluctuations in output and employment rise because of fluctuations in nominal aggregate demand (Ball, Mankiw, Romer, 1988).

[56] Graphical depictions of these relationships can be seen in Appendix 1



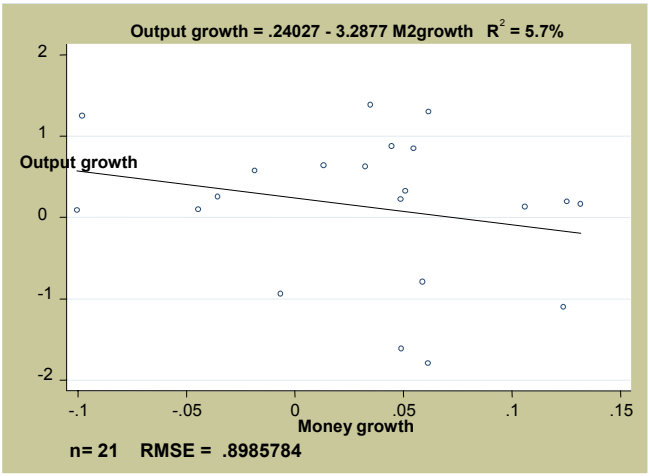
Output is demand determined, according to a Keynesian view prices below Walrasian levels, raise output, same as when decreases in demand decrease output.

MONEY AND OUTPUT

Next we consider whether money is neutral in the short run. The most obvious thing to do is to run a regression of current output on the current money supply (all in log differences or growth rates).

$$\Delta \log(y_t) = b\Delta \log(m_t) + \varepsilon_t$$

This is often called St.Louis equation because it was used by the St. Louis FED economists in 1960's. Graphical representation is depicted in the next scatter with fitted values line.



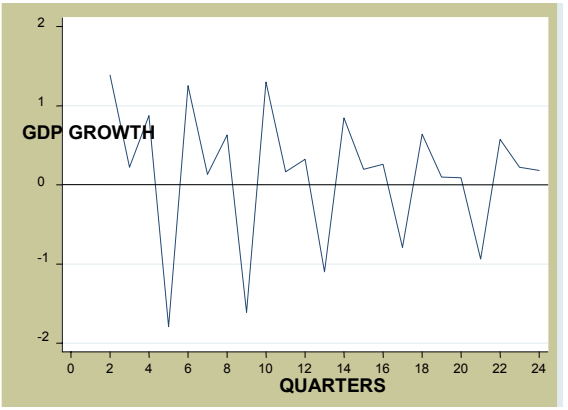
STATIONARITY OF THE VARIABLES

In this section we do a unit root testing for the variable economic growth. The result of the ADF (Augmented Dickey-Fuller tests) test[57] is presented in the next table.

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-8.439	-3.750	-3.000	-2.630
MacKinnon approximate p-value for Z(t) = 0.0000				

The null hypothesis is that the variable contains a unit root, and the alternative is that the variable was generated by a stationary process. From the table we clearly can reject the null of unit root for the economic variable and accept the alternative of stationary process. On the next graph, stationarity of the economic growth variable is being depicted.

[57] From the above table we can clearly note that the Mac Kinnon p-value is 0.000 if we reject the null hypothesis that the tested series is generated by non-stationary process.

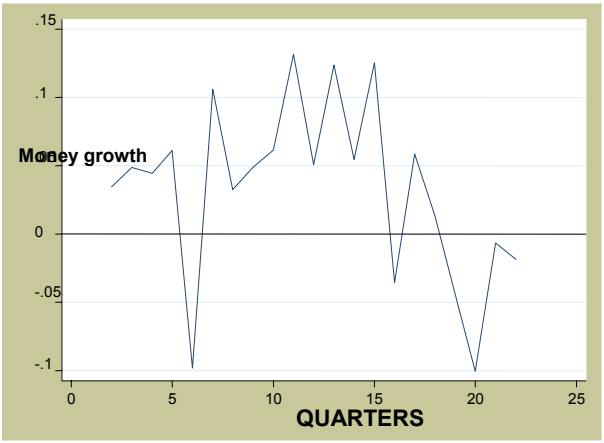


In this section we do a unit root testing for the variable Money growth. The result of the ADF (Augmented Dickey-Fuller tests) test[58] is presented in the next table.

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.767	-3.750	-3.000	-2.630
MacKinnon approximate p=0.0033				

On the next graph, stationarity of the Money growth variable is being depicted.

[58] From the above table we can clearly note that the Mac Kinnon p-value is 0.0033 if we reject the null hypothesis that the tested series is generated by non-stationary process.



we assume $\{\varepsilon t\}$ is a sequence of uncorrelated random variables having zero mean and variance σ^2, unless stated otherwise.A (weakly) stationary time series has a constant mean, a constant variance and the covariance is independent of time. Stationarity is essential for standard econometric theory. Without it we cannot obtain consistent estimators. A quick way of telling if a process is stationary is to plot the series against time. If the graph crosses the mean of the sample many times, chances are that the variable is stationary; otherwise that is an indication of persistent trends away from the mean of the series.

VAR MODEL

Vector autoregression (VAR model) is possible to deal with dynamic relationships between macroeconomic variables, where causality may be mutual According to Sims, if there is true simultaneity among a set of variables, there should not be any a priori distinction between endogenous and exogenous variables. It is in this spirit that Sims developed his **VAR** model.[59] Now we will estimate two equations:

$$GDPgrowth = \alpha + \sum_{j=1}^{k} \beta_j GDPgrowth_{t-j} + \sum_{j=1}^{k} \gamma_j Moneygrowth_{t-j} + u_{1t}$$

$$Moneygrowth = \alpha + \sum_{j=1}^{k} \theta_j GDPgrowth_{t-j} + \sum_{j=1}^{k} \gamma_j Moneygrowth_{t-j} + u_{1t}$$

Here u's are impulses or innovations or shocks in the VAR language.

[59] **Gujarati**, **D**. **Basic Econometrics**, (McGraw Hill, **2003**) 4th edition (GJ).

VECTOR AUTOREGRESSION ESTIMATION BASED ON 2 LAGS

In the next Table it is presented VAR estimation of the above equations [60]

DEPENDENT VARIABLE Growth of GDP				
Variable	**coefficient**	**Standard errors**	**Z-value**	**Probability of type I error**
Growth of GDP (-1)	-0.60	0.20	-2.99	0.00
Growth of GDP (-2)	-0.34	0.21	-1.62	0.11
M2growth (-1)	4.76	2.47	1.93	0.05
M2growth (-2)	-3.63	2.42	-1.50	0.13
Constant	0.11	0.18	0.61	0.54
DEPENDENT VARIABLE Money growth(M2growth)				
Variable	**coefficient**	**Standard errors**	**Z-value**	**Probability of type I error**
Growth of GDP (-1)	0.02	0.02	1.26	0.21
Growth of GDP (-2)	-0.03	0.02	-1.72	0.09
M2growth(-1)	0.33	0.20	1.61	0.11
M2growth(-2)	0.20	0.20	0.98	0.33
Constant	0.02	0.01	1.14	0.25

Below are given the general statistics for the two equations.

Sample: 2004.1 – 2009.4	**No. of obs = 19**	
Log likelihood =11.6603	**(Akaike info criteria) AIC=-0.17477**	
FPE =0.002952	**(Hanann-Quin info criteria) HQIC=-0.09064**	
Det(Sigma_ml) =0.001005	**(Schwarz-Bayes criteria) SBIC=0.322304**	
Equation	**RMSE(Root mean squared error**	**R(squared) of the regression**
GDPgrowth	**0.723774**	**0.4974**
Money growth	**0.059705**	**0.4169**

[60] We can estimate the two equations by SURE method also.

From the above results we can see that Money growth influences positive on economic growth on 1 lag, but negatively on 2 lags while GDP growth influences negatively and statistically significant at two lags. While in the autoregressions growth of GDP on 1 lag negatively influences current GDP growth, and monetary growth influences its current value negatively at minus 2 lags.

Granger causality test

Next procedure is to test the causality to see whether GDP growth influences money growth or is it opposite that money growth influences GDP growth or the two variables influence each other.

According to Gujaraty(2003) R.W.Hafer used the Granger test to find out the causality between GDP and money supply(M2). He used the growth rates of the variables, and we also use the growth rates of the two variables.

"Granger causality" tests - or more correctly perhaps, Granger non-causality tests - are statistical tests of "causality" in the sense of determining whether lagged observations of another variable have incremental forecasting power when added to a univariate autoregressive representation of a variable. The test itself is just an F-test (or, as above, a chi-squared test) of the joint significance of the other variable(s) in a regression that includes lags of the dependent variable.In the next table we present Granger causality Wald test results.

First estimated equation excludes Money growth, null hypothesis here is that only lagged values of GDP growth influence the GDP growth, and M2 growth does not influence the GDP growth.

Granger causality Wald test

Null hypothesis is that excluded variable does not Granger cause the variable in the equation.

Equation	**Excluded**	χ^2	**Degrees of freedom**	**Pvalue of χ^2 test**
GDPgrowth	**Money growth**	4.8766	2	0.087
Money growth	**GDPgrowth**	7.6854	2	0.021

From the above results we reject the null hypothesis that money growth does not influence the GDP growth at 10% level of significance, while we can't reject at 1% and 5% conventional levels of significance. While in the second equation where the null hypothesis is that Money growth is supposedly influenced only by its own lagged values and not by the GDP growth variable, we reject the null at 5% and 10% levels of conventional significance and not on 1%.

So in a way the causality runs in both directions from GDPgrowth ⟶ M2 growth and from M2growth ⟶ GDPgrowth. But this test has some drawbacks for which the literature must be consulted.

ST. LOUIS EQUATION

St.Louis equation show that all of the GDP response to change in money occurs in about a year[61]

GDPgrowth	**Coefficient**	**Robust standard errors**	**t**	**p-value**
M2growth(-1)	2.30	4.66	0.49	0.63
M2growth(-2)	-13.03	9.43	-1.38	0.19
M2growth(-3)	14.28	8.67	1.65	0.13
M2growth(-4)	-6.08	2.76	-2.21	0.05
t	0.00	0.06	-0.03	0.97
_cons	-0.10	0.95	-0.10	0.92

In our equation contrary to traditional St.Louis equation only the sign is different (-) instead of (+) and it is expectedly that the changes in money growth influence the GDP growth in one year.

[61] "The relationship between the growth of the economy and the growth of the money supply is just no longer there"-Lyle E.Gramley former governor of the Federal Reserve board , Kansas City (1980-85)

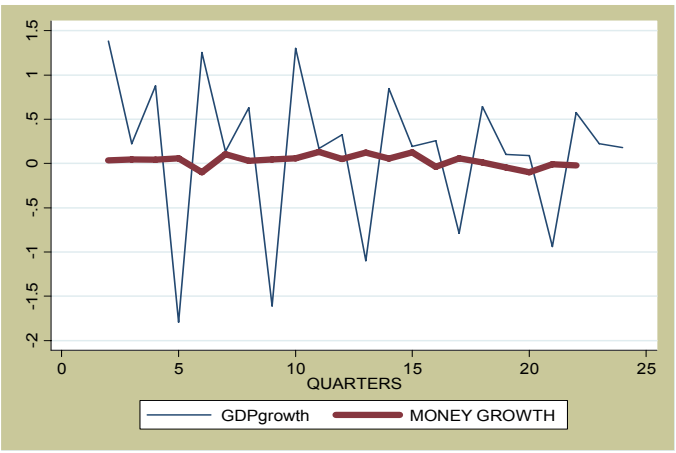
If we add the coefficients on the lagged M2 values we get 2.30-13.03+14.28-6.08= -2.53.Meaning that if the monetary aggregate M2 increases about 1%, GDP will lower on average about 2.53 %.

According to Romer (2006) the relationship between money and output is negative and it will lower the output , because the positive monetary shock will increase the demand for money but it will increased the money stock and interest rates, which will lead to output reduction. We test the stationarity of the saint Louis equation. We save the residuals from the equation and then we perform Unit root test on them.

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.874	-3.750	-3.000	-2.630
MacKinnon approximate p=0.000				

The two series do not contain unit root and are **cointegrated**[62].

Cointegration refers to the fact that two or more series share an stochastic trend (Stock & Watson). Engle and Granger (1987) suggested a two step process to test for cointegration (an OLS regression and a unit root test), the EG-ADF test.



[62] P-value is 0.000

CONCLUSION

From the empirical part we can see that the NAIRU concept is far from being applicable in the case of Macedonian labour market. The causality runs in both directions from GDP growth to M2 growth and from M2 growth to GDP growth, but this test has some drawbacks for which the literature must be consulted. And the money growth and GDP growth are cointegrated times series they share a stochastic trend.

There are many explanations why NAIRU concept is not applicable in the economy such as Macedonian. If we go back and see some important empirical investigations in this field we can conclude that the well-known trade-off between unemployment and inflation works only under some specific conditions. One of explanation is that relationship between unemployment and inflation is applicable only in large economy that is based on well-established market economy underpinnings, especially in labor and capital market, in the long time series. Macedonian as a post-transition economy is not a part of that group of countries. In that context, the Macedonian central bank is not able to moderate the level of inflation compere to unemployment as that can does Fed.

Some empirical investigations of St.Louis equation show positive and statistically significant correlation between money supply and economic growth. The result that we obtain in our regression is quite different. Namely, when the money supply increases that leads to decrease in the economy growth, the exception from this is the effect of money supply growth to output at three quarters lag, which is positive. In this direction, we can conclude that the monetary policy in Macedonian is not effective, and consequently the Macedonian central bank is not able to implement monetary policy in order to influence on the economic growth.

APPENDIX 1 : A VISUAL APPROACH – SCATTER PLOTS

Three scatter plots, showing quarterly data from the late 2004.1-2009.4 are included in the appendix below to show the types of functional relationships that were empirically investigated here.

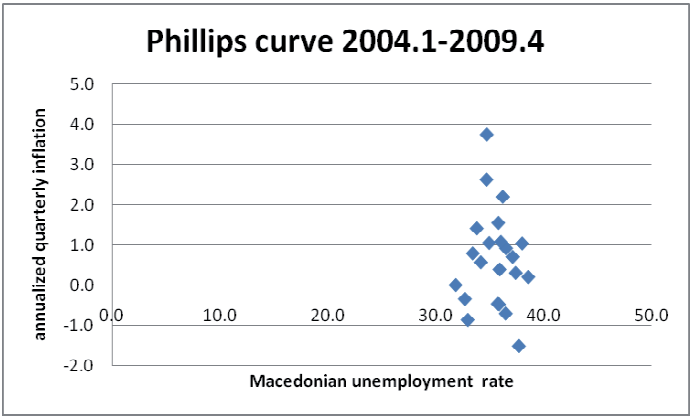


Figure 1 A graphical depiction of $(\pi_t) = f(U_t)$

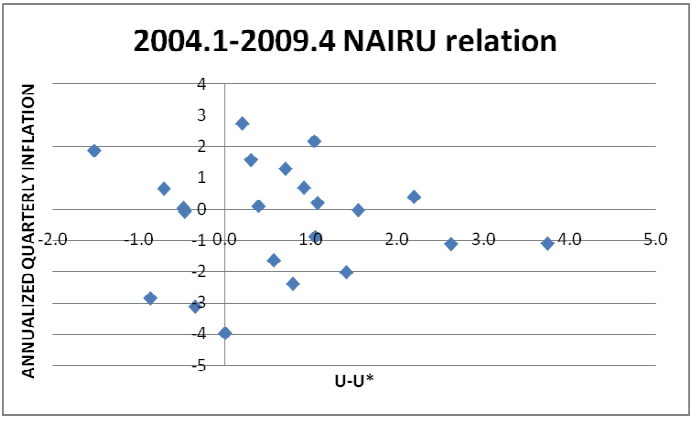


Figure 2 A graphical depiction of $(\pi_t) = f(\pi_{t-1}, U - U^*)$

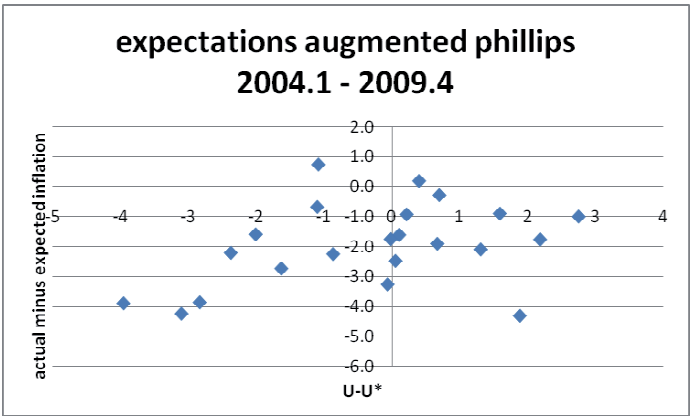


Figure 3 A graphical depiction of $(\pi_t) = f(\pi_t^e, U_t - U^*)$

References

[1] Ball, Laurence, N. Gregory Mankiw, and David Romer. (1988.) "**The New Keynesian Economics and the Output-Inflation Tradeoff**," *BPEA,* 1988:1, 1-82.

[2] Ball, Laurence, N. Gregory Mankiw,(2002), "**The NAIRU in Theory and Practice",**Discussion Paper, Harvard Institute of Economic Research

[3] Cazes, Sandrine(2002), **Do labour market institutions matter in transition economies? An analysis of labour market flexibility in the late nineties,** INTERNATIONAL INSTITUTE FOR LABOUR STUDIES

[4] Dwyer, Jr. Gerald P., and Hafer R. W.(1988)," **Is Money Irrelevant**?" Federal Reserve Bank of St. Louis

[5] Friedman M.(1968), **The Role of Monetary Policy**, The American Economic Review, Volume LVIII

[6] Friedman M.(1976), **Inflation and Unemployment**, Nobel Memorial Lecture, December 13, 1976,The University of Chicago Illinois

[7] Geraats, M.Petra, (2002), ***Central bank transparency***, The Economic Journal, (112), Royal Economic Society

[8] Gujarati**,** D. **Basic Econometrics**, (McGraw Hill, **2003**) 4th edition (GJ).

[9] Modigliani, Franco, and Lucas Papademos, (1975) "**Targets for Monetary Policy in the Coming Year**" Brookings Papers on Economic Activity, 141 – 165. The Brookings Institution.

[10] Phelps, Edmund S. (1967), ***Expectations of Inflation and Optimal Unemployment over Time***, Economica, New Series, Vol. 34, No. 135, (Aug., 1967), pp. 254-281

[11] Phillips, A. W. (1958). "**The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861-1957**". *Economica* **25** (100): 283–299.

[12] Samuelson, P.A., and R.M. Solow, (1960) "**Analytical Aspects of Anti-Inflation Policy**" *American Economic Review Papers and Proceedings* 50(2), pp. 177-94.

Population and economic growth theme: Longitudinal data for a sample of Balkan countries

Dushko Josheski (dushkojosheski@gmail.com)

Nikola V.Dimitrov (nikola.dimitrov@ugd.edu.mk)

Cane Koteski (cane.koteski@ugd.edu.mk)

University Goce Delcev-Stip

Abstract

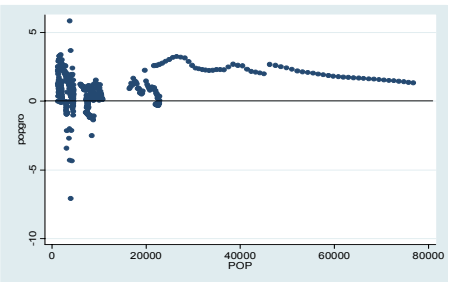
In this paper we use pooled cross-sectional (longitudinal data) in a sample of 10 Balkan countries. The period we cover is from 1950-2009 data are for population and economic growth. In the theoretical part we present optimal intergenerational model of population growth .The optimal population growth depends on capital in the future period and future consumption. Consumption should be greater than zero, and less than total capital of the current generation. In the econometric part OLS regression with dummies the coefficient on Macedonia, is highest significant coefficient meaning, if we control for Macedonia we will on average find more positive association between growth of GDP and population growth. Hausman test was in favor of fixed effects model, but fixed effects and Random effects model showed that there is positive coefficient between GDP growth and population growth. Coefficient in the FE model was statistically significant, which was not case in RE model. From the Fischer's panel unit root test we reject the null hypothesis that panels contain unit root and we accept the alternative that at least one panel is stationary, for the population growth and GDP growth.

Keywords: Population growth, economic growth, Fixed effects model, Random effects model, OLS with dummies model

Introduction

In the beginning of the theoretical section we will start with (Kremer, (1993))[63] evidence that the relationship between population growth and population is almost linear but also statistically significant. In this section we will use our data on population and population growth (See Section data and methodology for explanations)[64].This data cover 10 Balkan countries ,panel data that cover time period for every of the 10 Balkan countries from 1950 to 2009 The level and growth population are presented in the next scatter

Scatter level of population and population growth



This figure shows strongly positive and as we will see statistically significant relationship between population (in thousands) and growth of population.

A regression on a constant and population (in thousands) yields (See Appendix 1)[65]:

$$popgro = 0.58 + 0.0000196\, pop \qquad (1)$$

$$(0.000) \qquad (0.000)$$

R^2=0.06

[63] Michael Kremer (1993), "Population Growth and Technological Change: One Million B.C. to 1990," **Quarterly Journal of Economics** 108:3 (August), pp. 681-716.
[64] See Section data and methodology for explanations.
[65] See Appendix 1 Regression on population growth and level of population

Here *popgro* is population growth and *pop* is population in thousands, score is positive and statistically significant at all levels of conventional significance. On the next 2 tables we present the data on GDP and Population growth for the 10 Balkan countries from 2001-2010.

Table 1 Population growth in 10 Balkan countries for the period 2001 -2010[66]

Country Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania	0.18	0.40	0.55	0.58	0.54	0.47	0.41	0.37	0.36	0.36
Bosnia and Herzegovina	1.47	0.73	0.18	-0.04	-0.01	0.02	-0.07	-0.13	-0.17	-0.20
Bulgaria	-1.88	-0.52	-0.59	-0.54	-0.53	-0.53	-0.51	-0.48	-0.50	-0.55
Croatia	0.32	0.00	0.00	-0.02	0.07	-0.05	-0.09	-0.05	-0.11	-0.11
Greece	0.30	0.34	0.33	0.35	0.38	0.40	0.40	0.40	0.41	0.32
Macedonia, FYR	0.35	0.31	0.27	0.26	0.25	0.24	0.24	0.22	0.21	0.18
Romania	-1.40	-1.50	-0.28	-0.26	-0.23	-0.22	-0.19	-0.15	-0.15	-0.18
Serbia	-0.17	-0.05	-0.26	-0.23	-0.30	-0.39	-0.41	-0.43	-0.40	-0.39
Slovenia	0.15	0.10	0.09	0.07	0.18	0.32	0.56	0.16	0.90	0.64
Turkey	1.43	1.39	1.36	1.34	1.34	1.34	1.34	1.32	1.29	1.25

Source: World Bank

Table 2 GDP growth in 10 Balkan countries for the period 2001-2010

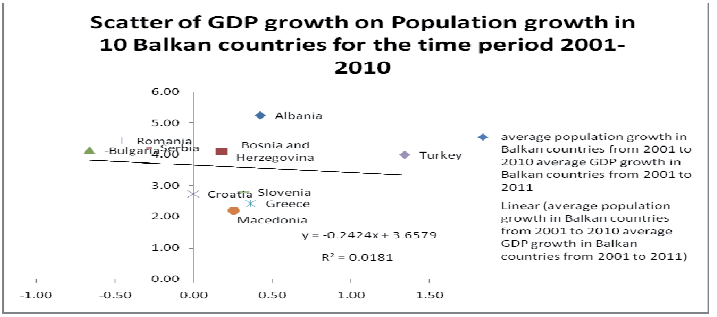
Country Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania	7.00	2.90	5.70	5.90	5.50	5.00	5.90	7.70	3.30	3.50
Bosnia and Herzegovina	4.40	5.30	4.00	6.10	5.00	6.20	6.84	5.42	-3.10	0.80
Bulgaria	4.15	4.65	5.51	6.75	6.36	6.51	6.45	6.22	-5.52	0.20
Croatia	3.66	4.88	5.37	4.13	4.28	4.94	5.06	2.17	-5.99	-1.19
Greece	4.20	3.44	5.94	4.37	2.28	5.17	4.28	1.02	-2.04	-4.47
Macedonia, FYR	-4.53	0.85	2.82	4.09	4.10	3.95	5.90	5.00	-0.90	0.70
Romania	5.70	5.10	5.20	8.40	4.17	7.90	6.00	9.43	-8.50	0.95
Serbia	5.60	3.90	2.40	8.30	5.60	5.23	6.90	5.52	-3.12	1.76
Slovenia	2.85	3.97	2.84	4.29	4.49	5.81	6.80	3.49	-7.80	1.18
Turkey	-5.70	6.16	5.27	9.36	8.40	6.89	4.67	0.66	-4.83	8.95

Source: World Bank

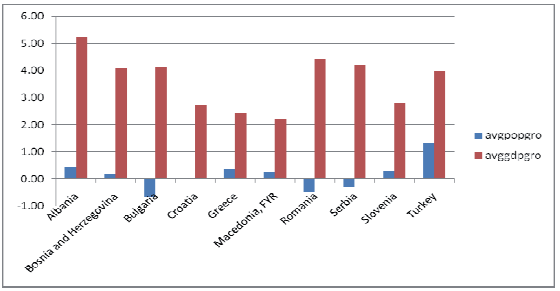
[66] These data are gathered from World Bank data base: http://data.worldbank.org/country.

On the next scatter are presented average growth rates of population and GDP , we add a linear trend to the scatter and GDP growth is negatively correlated with the population growth by -0.24 and intercept is 3.65 .This means that if population increases by 1 percentage point GDP growth on average will decline by 0.24 percentage points.

Scatter GDP growth on population growth



Population growth rate is very slow in the Balkans.Especially in Bulgaria (-0.66), Romania (-0.46), Serbia(-0.30), have negative population growth rate (see chart below).Croatia (0.0) doesn't have population growth, Bosnia and Herzegovina (0.18), Macedonia (0.25), Greece(0.36), Slovenia (0.32), Albania (0.42) and Turkey(1.34).



The demographic structure will be very old in the next decades. This can bring social security problems similar to those of Germany and the other Western European countries.Albania has highest average GDP growth (5.24), followed by Romania(4.43), Serbia(4.21), Bulgaria(4.13), Bosnia and Herzegovina (4.10), Slovenia(2.79), Croatia(2.73), Greece (2.42), Macedonia (2.20). Macedonia has lowest GDP growth from 2001-2010.

Population growth theories

Malthus prediction, made in 1801 that population growth would run up against the fixity of earth's resources and condemn most of the population to poverty and high death rates proved wrong. Kuznets defined growth in 1966 as sustained increase in population attained without any lowering of per capita product, and viewed population growth as positive contributor to economic growth (Birdsall,N.,(1988)[67].

Table 3 Natural increase in population in the World by economies and regions

Birth and death rates of natural increase , by region, 1950-1955 to 1980-85									
	Crude birth rate			Crude death rate			Natural increase		
	1950-55	1960-65	1980-85	1950-55	1960-65	1980-85	1950-55	1960-65	1980-85
Developed countries	22.7	20.3	15.5	10.1	9.0	9.6	1.3	1.1	0.6
Developing countries	44.4	41.9	31.0	24.2	18.3	10.8	2.0	2.4	2.0
Africa	48.3	48.2	45.9	27.1	23.2	16.6	2.1	2.5	2.9
Latin America	42.5	41.0	31.6	15.4	12.2	8.2	2.7	2.9	2.3
East Asia	43.4	39.0	22.5	25.0	17.3	7.7	1.8	2.2	1.5
Other Asia	41.8	40.1	32.8	22.7	18.2	12.3	1.9	2.2	2.1

Source: United Nations, Department of International Economic and Social Affairs, World population prospects as assessed in 1984(printout).

Since 1950's population growth in developing countries has been around 2.0. Most of the Balkan countries belong to this group except Greece that is advanced economy according to IMF and Slovenia (developing country before 2007). In the developed economies since 1950's we have population growth slowdown to 0.6 in the end of 1980's. In the regions Africa has achieved growth in population, Latin America had declined in population growth, and Other than East Asia the other parts of Asia had increased population growth to 2.1 in the end of 1980's. The population growth rate for the developing countries as well for the world, is predicted to decline towards zero rate bringing population stabilization in the twentieth

[67] Birdsall, N., (1988), Handbook of development economics ,Volume 1, edited by T.N.Srinivasan

second century[68].Even with population growth rate decline size of population in the developing countries will continue to rise, and world population to reach 10 billion before 2050. For the next few decades the variance of prediction is small, so we cannot be sure about the precision of these demographic predictions. Industrial countries according to some projections will increase their population for 20% by 2050, and developing countries will double their population by 2050. Assaf Razin and Uri Ben-Zion(1993) have outlined intergenerational model of population .Population was included in social utility function and assumption was made that preferences are same for each generation:

$$V = \sum_{t=0}^{\infty} \beta^t U(c_t, \lambda_t) \qquad (2)$$

Here β is the subjective factor by which current generation discounts utility of the next generation. The inclusion of population growth in the social utility function has also an empirical implication for the measurement of welfare improvement. That is, growth of per capita income, by itself, is an inappropriate measure of welfare improvement, and as a measure it is biased against countries with a high rate of population growth. The decision problem for current generation can be written as :

$$V(k_0) = \max\left\{\sum_{t=0}^{\infty} \beta^t U(c_t, \lambda_t))\right\} \qquad (3)$$

$$0 \le c_t \le k_t \; 0 \le \lambda \le \overline{\lambda}$$

K_t is the capital for the current generation; λ_t is the current level of population growth $\overline{\lambda}$ is the maximum feasible level of population growth. Marginal utilities are positive and diminishing. c_t is per capita life time consumption. Following decision is presented partially derived:

$$\frac{\partial U}{\partial \lambda}(c_t, \lambda_t) = \frac{\beta}{\lambda_t} k_{t+1} \frac{\partial U}{\partial c}(c_{t+1}, \lambda_{t+1}) \qquad (4)$$

$$\frac{\partial U}{\partial \lambda}(c_t, \lambda_t) = \frac{\beta}{\lambda_t} \frac{\partial f}{\partial k}(k_t - c_t) \frac{\partial U}{\partial c}(c_{t+1}, \lambda_{t+1}) \qquad (5)$$

[68] Based on the population projections by World Bank

Equation (4) may be interpreted as describing the optimum decision with respect to the level of population growth λ_t On the one hand an extra unit of λ_t will increase welfare by the marginal utility of population growth, the left-hand side of (4). In the second equation the level of capital is decreased by the consumption of the current generation. And this equation (5) describes the optimal level of consumption.

According to Ramsey (1928)[69], optimal rate of consumption is:

$$u(c) = \frac{dU(c)}{dc} \qquad (6)$$

In the equilibrium there will be no saving and

$$\frac{dc}{dt} = \frac{dk}{dt} = 0 \qquad (7)$$

Marginal productivity of capital is :

$$\frac{\partial f}{\partial k} = \rho \quad [70] \qquad (8)$$

If we take into account intergenerational differences in tastes we get:

$$U(c_0, \lambda_0) = a \log c_0 + v(\lambda_0) \qquad (9)$$

$$U(c_t, \lambda_t) = a \log c_t + v(\lambda_t, \theta), t \geq 1 \qquad (10)$$

Here Θ is parameter in the function v which distinguishes the utility of future generations, derived from population increase, from that of the parents generation .If we include uncertainty in the population growth we get :

$$V(k_0) = E\left\{\sum_{t=0}^{\infty} \beta^t U(c_t, \lambda_t))\right\} \qquad (11)$$

$$0 \leq c_t \leq k_t$$

[69] Ramsey,F.,P.(1928), *A Mathematical theory of saving*, The Economic journal Vol.38 No.152

[70] ρ is the rate of discounting if $\frac{\partial f}{\partial k} > \rho$ there will be saving ,or investment $\frac{\partial f}{\partial k} < \rho$

$$0 \le h_t \le \overline{h}$$

Here E is the expected value of the population growth, expectation operator. Consumption should be greater than zero, and less than total capital of the current generation, and h_t is the variable by which population change is controlled.

Empirical part

Econometric Methodology

Data in this paper are gathered from Penn world Table[71]. Data cover period from 1950 to 2009 for 10 Balkan countries: **Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Romania, Serbia, Slovenia, Turkey**. These are 10 panels 60 observations per panel. But the data set has gaps on average we have 59,6 observations per group, so in 10 panels we have around 596 observations. Mostly data are missing for the GDPPPP (GDP in PPP terms) for the period 1950 to 1969 this is due to lack of data collection by the statistical bureaus in this countries for this period. These data are pooled cross-section time series or panel data. Pooled data are characterized by having repeated observations (most frequently years) on fixed units (most frequently states and nations). This means that pooled arrays of data are one that combines cross-sectional data on N spatial units and T time periods to produce a data set of $N \times T$ observations (Podestà,2002). However, when the cross-section units are more numerous than temporal units (N>T), the pool is often conceptualized as a "cross-sectional dominant". conversely, when the temporal units are more numerous than spatial units (T>N), the pool is called "temporal dominant" (Stimson 1985). The generic pooled linear regression model estimable by Ordinary Least Squares (OLS) procedure is given by the following equation:

$$y_{it} = \beta_1 + \sum_{k=2}^{k} \beta_k x_{kit} + e_{it} \qquad (12)$$

$$\Delta y_i = \delta_0 + \beta_1 \Delta x_i + \Delta u_i \qquad (13)$$

where "Δ" denotes the change from t =1 to t = 2. The unobserved effect, a_i, does not

[71] http://pwt.econ.upenn.edu/php_site/pwt70/pwt70_form.php **Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011.**

appear in (2): it has been "differenced away." Also, the intercept in (2) is actually

the change in the intercept from t =1 to t =2.Equation (2) is simple first differenced pooled cross section regression where each variable is differenced over time. After we apply OLS estimation we will run fixed effects and random effects model

Static two way fixed effect model:

$$y_{it} = \alpha_i + \delta_i t + \rho y_{t-1} + \theta_t + e_{it} \tag{14}$$

$$i = 1,...N \quad t = 1,...T \tag{15}$$

1. α_i unit-specific characteristics
2. γ_i unit-specific deterministic trend parameters
3. μ_t time-specific effects (common to all units)
4. β is common to all units

Next random effects model also is going to be applied. If you have reason to believe that differences across entities have some influence on your dependent variable then you should use random effects.

The random effects model is :

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it} \tag{16}$$

u_{it} is between entity error, ε_{it} is within entity error.

Unobserved model becomes random effects model when we assume that unobserved effect α is uncorrelated with each explanatory variable:

$$\text{cov}(x_{itj}, \alpha_i) = 0, t = 1,2.....T; j = 1,2,...,K \tag{17}$$

If we define composition error term

$$y_{it} = \beta_0 + \beta_1 x_{it1} + ... + \beta_k x_{itk} + v_{it} \qquad v_{it} = \alpha_i + u_{it}: \tag{18}$$

Im, Pesaran and Shin (JE 2003) propose a test based on the average of a augmented Dickey-Fuller tests computed for each panel unit in the model

$$y_{it} = \alpha_i + \delta_i t + \rho y_{it-1} + \theta_t + e_{it} \tag{19}$$

where e_{it} can be:

- Serially correlated
- and heteroscedastic
- but cross-sectional independent apart from the presence of the common time effects θ_t.

The estimating equation is :

$$\Delta y_{it} = \phi_i y_{it-1} + \sum_{k=1}^{K_i} \gamma ki \Delta y_{it-k} + \varepsilon_{it} \tag{20}$$

The null hypothesis of a unit root is tested using $t_{bar} = \frac{1}{N} \sum_{i=1}^{N} t\phi i$

$H_0 : \phi = 0$

against the heterogeneous alternative:

$$H_1 : \begin{cases} \phi < 0 \; for \; i = 1,....N_1 \\ \phi = 0 \; for \; i = N_1 + 1,....N \end{cases} \tag{21}$$

In the panel unit root test in the general model, let us first look at the test $H_0 = \rho = 1$

H_0: unit root Different H_1

$y_{it} = \alpha_i + \delta_i t + \rho y_{it-1} + \delta_i \theta_t + \varepsilon_{it}$ specifications have been proposed for the model:

$$H_1 : \begin{cases} \rho < 1 \quad for \quad all \quad i \\ \rho = 1 \quad for \quad i = N_1 + 1,....N \end{cases} \tag{22}$$

Data

To estimate the following model we define the following set of variables:

Table 1 Variable definitions

Variable	Definition
lgdpgro	Logarithm of growth of GDP per capita PPP converted at 2005 constant prices
lpopgro	Log of growth rate of population in thousands

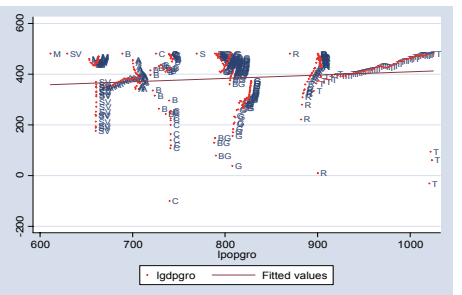
Descriptive statistics of the model

In the descriptive statistics we report the usual number of observations per variable, means, standard deviations, and minimums and maximums. The descriptive statistics of our model for ten countries is given below in a Table 2.

Table 2 Descriptive statistics of the model

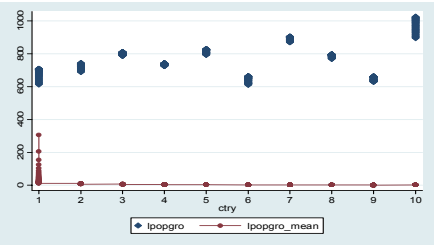
Variable	**Obs.**	**Mean**	**Std.deviation**	**Min**	**Max**
lgdpgro	342	384.5786	98.82886	-100	481.413
lpopgro	596	770.1818	101.867	611.0394	1024.904

For the table of the descriptive statistics of the model we can see that the mean of log of population growth is 770.1818 (thousands), minimum is 611.0394(thousands) while the maximum of this variable is 1024.904(1 million and 24 thousands and 904) . Visually from the next graph we can see that lgdpgro and lpopgro are positively correlated. On this plot we use acronyms for the 10 countries (**Albania-A, Bosnia and Herzegovina-B, Bulgaria-BG, Croatia-C, Greece-G, Macedonia-M, Romania-R, Serbia-S, Slovenia-SV, Turkey-T).**



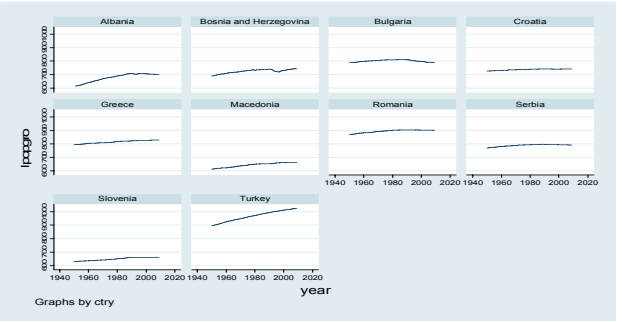
From the graph we can see that substantial part of the observations is below the trend in logarithm of the GDP per capita growth and Turkey has highest population growth from the sample countries while Macedonia some of the lowest, and Croatia and Turkey have experienced negative GDP growth rates. When we try to investigate heterogeneity across countries or entities we do so by creating scatter two way for population growth and country. The resulting scatter from our data I given on the next page. There countries are numbered: **1.Albania 2. Bosnia and Herzegovina, 3.Bulgaria,4. Croatia, 5.Greece,6. Macedonia,7. Romania,8.Serbia, 9.Slovenia, 10. Turkey.**

Scatter: Fixed effects: Heterogeneity across countries (or entities)

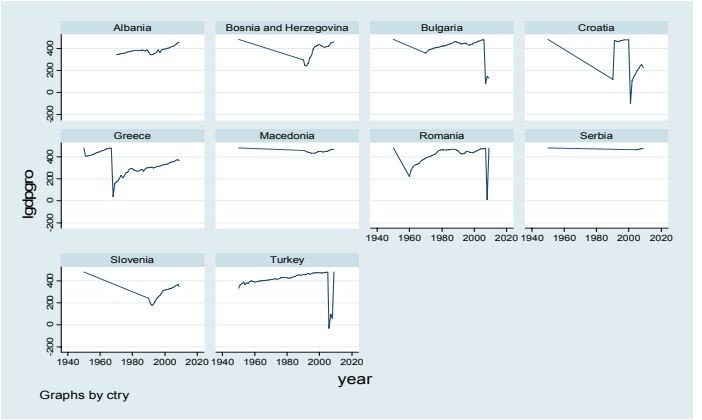


On the scatter is presented logarithm of population growth mean for the 10 countries. Turkey has highest population growth, while Macedonia lowest in the region, together with Slovenia that has little higher growth of population. Log of population growth across Balkan countries si given in the following table of graphs 3

Table of graphs 3



We can create a Table of graphs even for log of GDP per capita growth **Table of graphs 4**



From the scatter we can see that countries like Croatia, Bulgaria, Turkey, Romania have suffered from the economic and financial crisis circa 2007-2008, with a sharp decline in the log of growth of GDP variable.

Least squares dummy variable model (LSDV)

There are several strategies for estimating fixed effect models. The least squares dummy variable model (LSDV) uses dummy variables, whereas the within effect does not. These strategies produce the identical slopes of non-dummy independent variables. The between effect model also does not use dummies, but produces different parameter estimates. There are pros and cons of these strategies .These are presented in the following table

Table 5 Pros and cons of different ways of estimating fixed effects model [72]

	LSDV1	Within effect	Between effect
Functional form	$y_i = i\alpha_i + X_i\beta + \varepsilon_i$	$y_{it} - \bar{y}_{in} = x_{it} - \bar{x}_{in} + \varepsilon_{it} - \bar{\varepsilon}_{in}$	$\bar{y}_{in} = \alpha + \bar{x}_{in} + \varepsilon_i$
Dummy	Yes	No	No
Dummy coefficient	Presented	Need to be computed	N/A
Transformation	No	Deviation from the group means	Group means
Intercept	Yes	No	No
R^2	Correct	Incorrect	
SSE	Correct	Correct	
MSE	Correct	Smaller	
Standard error of β	Correct	Incorrect(smaller)	
DF_{error}	nT-n-k	nT-n-k(Larger)	n-K
Observations	nT	nT	n

Testing for group effects

The null hypothesis is that all dummy parameters except one are zero:

$$H_0 : \mu_1 = ... = \mu_{n-1} = 0 \tag{23}$$

This hypothesis is tested by the F test (Greene ,2008)[73], which is based on loss of goodness-of-fit. The robust model in the following formula is LSDV and the efficient model is the pooled regression.

$$F(n-1, nT-n-K) = \frac{\left(R^2_{LSDV} - R^2_{Pooled}\right)/(n-1)}{\left(1-R^2_{LSDV}\right)/(nT-n-K)} \tag{24}$$

[72] Source: Indiana University Stath/Math center
[73] Greene,H.W.,(2008), Econometric Analysis, Prentice Hall

Here *T*=total number of temporal observations. *n*=the number of groups, and *k*=number of regressors in the model. If we find significant improvements in the R^2, then we have statistically significant group effects.

In Greene (2008) this model in matrix notation is presented as:

$$y = \begin{bmatrix} x & d_1 & d_2 \ldots\ldots d_n \end{bmatrix} \begin{bmatrix} b \\ a \end{bmatrix} + \varepsilon \qquad (25)$$

With assembling all nT rows gives:

$$y = X\beta + D\alpha + \varepsilon \qquad (26)$$

Table 6 OLS regression and OLS with dummies (Appendix 2) [74]

Dependent variable: lgdpgro	Logarithm of growth of GDP per capita PPP	Ordinary least squares	Ordinary least squares with dummies
variables		OLS	OLS_dum
lpopgro	Log of growth rate of population	0.13*	0.06
_Icountry_2	Bosnia and Herzegovina		4.81
_Icountry_3	Bulgaria		23.99
_Icountry_4	Croatia		-61.16*
_Icountry_5	Greece		-55.76
_Icountry_6	Macedonia		71.53**
_Icountry_7	Romania		22.48
_Icountry_8	Serbia		86.1

[74] See Appendix 2

_Icountry_9	Slovenia		-87.8**
_Icountry_10	Turkey		10.79
_cons	Constant	280.31***	341.85
N		339	339
F-statistics (1, 337)			8.40***

legend: * p<0.05; ** p<0.01; *** p<0.001

This OLS model shows that on average in these 10 Balkan countries if the population increases by 1% GDP in these 10 countries will rise by 0.13 percent. This coefficient is significant at 1% level of significance. Dummy variables take values from [0,1],zero if the country is not included in the regression and 1 if the country is in the regression. Dummies for Croatia, Macedonia, and Slovenia are significant at 1%, 5%, and 10% levels of significance. So for instance coefficient on Macedonia is highest significant coefficient meaning if we control for Macedonia we will on average find more positive association between growth of GDP and population growth.

If we include Croatia and Slovenia in the regression growth of population would have been growth detrimental. If Serbia was in the regression we would have on average found more positive association between growth of GDP and population growth, but typically if we control for Serbia in the regression t-statistics will report 0.10 lower.

F-statistics is significant at all levels of conventional significance; this means that we can reject H_0: jointly insignificant dummy variables in favor of the alternative jointly significant dummy variables. By adding the dummy for each country we are estimating the pure effect of lpopgro (by controlling for the unobserved heterogeneity)

Fixed effects model [75]

"**. . .** The fixed-effects model controls for all time-invariant differences between the individuals, so the estimated coefficients of the fixed-effects models cannot be biased because of omitted time-invariant characteristics…[like culture,religion, gender, race, etc] "

To see if time fixed effects are needed when running fixed effect model we will use a joint test to see if the dummies for all years are equal to zero.

The linear regression model with fixed effects is

$$y_{it} = \boldsymbol{\beta}'\mathbf{x}_{it} + \alpha_i + \delta_t + \varepsilon_{it},\ t = 1,...,T(i),\ i = 1,...,N, \qquad (27)$$

$$E[\varepsilon_{it}|\mathbf{x}_{i1},\mathbf{x}_{i2},...,\mathbf{x}_{iT(i)}] = 0,$$

$$\text{Var}[\varepsilon_{it}|\mathbf{x}_{i1},\mathbf{x}_{i2},...,\mathbf{x}_{iT(i)}] = \sigma^2.$$

We have assumed the strictly exogenous regressors case in the conditional moments, [see Woolridge (1995)]. We have not assumed equal sized groups in the panel. The vector $\boldsymbol{\beta}$ is a set of parameters of primary interest, α_i is the group specific heterogeneity. We have included time specific effects but, they are only tangential in what follows. Since the number of periods is usually fairly small, these can usually be accommodated simply by adding a set of time specific dummy variables to the model. Our interest here is in the case in which N is too large to do likewise for the group effects. For example in analyzing census based data sets, N might number in the tens of thousands. The analysis of two way models, both fixed and random effects, has been well worked out in the linear case [See, e.g., Baltagi (1995) and Baltagi, et al. (2005).]. A full extension to the nonlinear models considered in this paper

[75]Greene, W.(2001), **Estimating Econometric Models with Fixed Effects ,** *Department of Economics, Stern School of Business, New York University,*

remains for further research The parameters of the linear model with fixed individual effects can be estimated by the 'least squares dummy variable' (LSDV) or 'within groups' estimator, which we denote $\mathbf{b}_{LSDV}$. This is computed by least squares regression of $y_{it}^* = (y_{it} - \bar{y}_{i.})$ on the same transformation of $\mathbf{x}_{it}$ where the averages are group specific means. The individual specific dummy variable coefficients can be estimated using group specific averages of residuals. [See, e.g., Greene (2000, Chapter 14).] The slope parameters can also be estimated using simple first differences. Under the assumptions, $\mathbf{b}_{LSDV}$ is a consistent estimator of $\boldsymbol{\beta}$. However, the individual effects, α_i, are each estimated with the $T(i)$ group specific observations. Since $T(i)$ might be small, and is, moreover, fixed, the estimator, $a_{i,LSDV}$, is inconsistent. But, the inconsistency of $a_{i,LSDV}$, is not transmitted to $\mathbf{b}_{LSDV}$ because $\bar{y}_{i.}$ is a sufficient statistic. The LSDV estimator $\mathbf{b}_{LSDV}$ is not a function of $a_{i,LSDV}$. There are a few nonlinear models in which a like result appears.

We will define a nonlinear model by the density for an observed random variable, y_{it},

$$f(y_{it} \mid \mathbf{x}_{i1},\mathbf{x}_{i2},\ldots,\mathbf{x}_{iT(i)}) = g(y_{it}, \boldsymbol{\beta}'\mathbf{x}_{it} + \alpha_i, \boldsymbol{\theta}) \qquad (28)$$

where $\boldsymbol{\theta}$ is a vector of ancillary parameters such as a scale parameter, an overdispersion parameter in the Poisson model or the threshold parameters in an ordered probit model. We have narrowed our focus to linear index function models. For the present, we also rule out dynamic effects; $y_{i,t-1}$ does not appear on the right hand side of the equation. [See, e.g., Arellano and Bond (1991), Arellano and Bover (1995), Ahn and Schmidt (1995), Orme (1999), Heckman and MaCurdy (1980)]. However, it does appear that extension of the fixed effects model to dynamic models may well be practical. This, and multiple equation models, such as VAR's are left for later extensions. [See Holtz-Eakin (1988) and Holtz-Eakin, Newey and Rosen (1988, 1989).] Lastly, note that only the current data appear directly in the density for the current y_{it}. We will also be limiting attention to parametric approaches to modeling. The density is assumed to be fully defined.

Many of the models we have studied involve an ancillary parameter vector, $\boldsymbol{\theta}$. No generality is gained by treating $\boldsymbol{\theta}$ separately from $\boldsymbol{\beta}$, so at this point, we will simply group them in the single parameter vector $\boldsymbol{\gamma} = [\boldsymbol{\beta}', \boldsymbol{\theta}']'$. Denote the gradient of the log likelihood by

$$\mathbf{g}_{\gamma} = \frac{\partial \log L}{\partial \boldsymbol{\gamma}} = \sum_{i=1}^{N} \sum_{t=1}^{T(i)} \frac{\partial \log g(y_{it}, \boldsymbol{\gamma}, \mathrm{x}_{it}, \alpha_i)}{\partial \boldsymbol{\gamma}} \text{ (a } K_{\gamma}\times 1 \text{ vector)} \quad (29)$$

$$g_{\alpha i} = \frac{\partial \log L}{\partial \alpha_i} = \sum_{t=1}^{T(i)} \frac{\partial \log g(y_{it}, \boldsymbol{\gamma}, \mathbf{x}_{it}, \alpha_i)}{\partial \alpha_i} \text{ (a scalar)} \quad (30)$$

$$\mathbf{g}_{\alpha} = [g_{\alpha 1}, \ldots, g_{\alpha N}]' \text{ (an } N\times 1 \text{ vector)} \quad (31)$$

$$\mathbf{g} = [\mathbf{g}_{\gamma}', \mathbf{g}_{\alpha}']' \text{ (a } (K_{\gamma}+N)\times 1 \text{ vector).} \quad (32)$$

The full $(K_{\gamma}+N)\times(K_{\gamma}+N)$ Hessian is

$$\mathbf{H} = \begin{bmatrix} \mathrm{H}_{\gamma\gamma} & \mathrm{h}_{\gamma 1} & \mathrm{h}_{\gamma 2} & \cdots & \mathrm{h}_{\gamma N} \\ \mathrm{h}_{\gamma 1}' & h_{11} & 0 & \cdots & 0 \\ \mathrm{h}_{\gamma 2}' & 0 & h_{22} & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & 0 \\ \mathrm{h}_{\gamma N}' & 0 & 0 & 0 & h_{NN} \end{bmatrix}$$

Estimating the Fixed Effects Model

We could just include dummy variables for all but one of the units. This "sweeps out the unit effects" because when you mean deviate variables, you no longer need to include an intercept term. So the model regresses $y_{i,t} - \text{mean}(y_i)$ on $x_{i,t} - \text{mean}(x_i)$. This is often called this "within" estimator because it looks at how changes in the explanatory variables cause y to vary around a mean within the unit.

Random Effects models

Instead of thinking of each unit as having its own systematic baseline, we think of each intercept as the result of a random deviation from some mean intercept. If we have a large N (panel data), we will be able to do this, and random effects will be more efficient than fixed effects. It has N more degrees of freedom, and it also uses information from the "between" estimator (which averages observations over a unit and regresses average y on average x to look at differences across units). If we have a big T (TS-CS data), then the difference between fixed effects and random effects, goes away.

$$y_{i,t} = \mu + \alpha_i + x_{i,t}\beta + e_{i,t} \qquad (33)$$

Table 7 Distinguishing between random effects and fixed effects model[76]

RRandom vs. Fixed	**Definition**
Variables	***Random variable***: (1) is assumed to be measured with measurement error. The scores are a function of a true score and random error; (2) the values come from and are intended to generalize to a much larger population of possible values with a certain probability distribution (e.g., normal distribution); (3) the number of values in the study is small relative to the values of the variable as it appears in the population it is drawn from. ***Fixed variable***: (1) assumed to be measured without measurement error; (2) desired generalization to population or other studies is to the same values; (3) the variable used in the study contains all or most of the variable's values in the population. It is important to distinguish between a variable that is *varying* and a variable that is *random*. A fixed variable can have different values, it is not necessarily invariant (equal) across groups.
EEffects	***Random effect***: (1) different statistical model of regression or ANOVA model which assumes that an independent variable is random; (2) generally used if the levels of the independent variable are thought to be a small subset of the possible values which one wishes to generalize to; (3) will probably produce larger standard errors (less powerful). ***Fixed effect***: (1) statistical model typically used in regression and ANOVA assuming independent variable is fixed; (2) generalization of the results apply to similar values of independent variable in the population or in other studies; (3) will probably produce smaller standard errors (more powerful).

[76] Newsom USP 656 Multilevel Regression Winter 2006

CCoefficients	***Random coefficient:*** term applies only to MLR analyses in which intercepts, slopes, and variances can be assumed to be random. MLR analyses most typically assume random coefficients. One can conceptualize the coefficients obtained from the level-1 regressions as a type of random variable which comes from and generalizes to a distribution of possible values. Groups are conceived of as a subset of the possible groups. ***Fixed coefficient:*** a coefficient can be fixed to be non-varying (invariant) across groups by setting its between group variance to zero. Random coefficients must be variable across groups. Conceptually, fixed coefficients may be invariant *or* varying across groups.

Estimations of random and fixed effects model

In the next Table we will present the results from the fixed and random effect regressions. We will perform a Hausman test. Here we mention that when we do this panel models and regressions on our data independent variables are collinear with the panel variable ctry, so we use second panel variable year because we cannot run the regressions otherwise.

Table 8 Fixed effects model and random effects model (See Appendix 3) [77]

Dependent variable: lgdpgro	Logarithm of growth of GDP per capita PPP	Fixed Effects model	Random Effects model
variables		FE	RE
lpopgro	Log of growth rate of population	0.76	0.28
_Iyear_1951	Dummy 1951	-40.99	-56.28
_Iyear_1952	Dummy 1952	-37.999	-52.399
_Iyear_1953	Dummy 1953	-29.76	-43.268
_Iyear_1954	Dummy 1954	-41.07	-53.69

[77] See Appendix 3 Panel estimation techniques

_Iyear_1955	Dummy 1955	-33.03	-44.74
_Iyear_1956	Dummy 1956	-34.37	-45.16
_Iyear_1957	Dummy 1957	-22.94	-32.79
_Iyear_1958	Dummy 1958	-19.70	-28.55
_Iyear_1959	Dummy 1959	-20.83	-28.67
_Iyear_1960	Dummy 1960	-109.62	-112.96
_Iyear_1961	Dummy 1961	-87.74	-90.35
_Iyear_1962	Dummy 1962	-77.88	-79.88
_Iyear_1963	Dummy 1963	-68.69	-70.14
.....	.....	.....	.....
_Iyear_2007	Dummy 2007	-149.48174***	-130.11**
_Iyear_2008	Dummy 2008	-188.25289***	-168.84***
_Iyear_2009	Dummy 2009	-106.23162*	-86.79*
_cons	Constant	-132.74	256.91
N		339	339

legend: * p<0.05; ** p<0.01; *** p<0.001

In the time fixed effects model lpopgro is statistically significant t=1,75 at 10% level of significance, the coefficient is positive 0.76 , meaning that 1% increase in growth of population will induce GDP growth of 0.76%. This variable in RE model has not got significant coefficient. We set years as number of dummies here. We set null hypothesis here that all dummies are equal to zero and we test with F statistics. Probability exceeding F statistics is 0,8507[78] this means that we cannot reject the null that all years coefficients are zero, therefore no time fixed effects are needed. Hausman test is in favor of Fixed effects model i.e. difference in coefficients is not systematic. Probability >chi2=1.000[79]. Coefficients for the years 2007.2008 and 2009 are highly significant but more negative than other years this is due to financial crisis if we controlled only for these three years on average we will get less positive association between GDP growth and population growth.

[78] See Appendix 3 testparm
[79] See Appendix 3 Hausman test

Panel unit root tests (See Appendix 4)

"xtunitroot performs a variety of tests for unit roots (or stationarity) in panel datasets. The Levin-Lin-Chu (2002), Harris-Tzavalis (1999), Breitung (2000; Breitung and Das 2005), Im-Pesaran-Shin (2003), and Fisher-type (Choi 2001) tests have as the null hypothesis that all the panels contain a unit root. The Hadri (2000) Lagrange multiplier (LM) test has as the null hypothesis that all the panels are (trend) stationary. The top of the output for each test makes explicit the null and alternative hypotheses. Options allow you to include panel-specific means (fixed effects) and time trends in the model of the data-generating process"[80]

xtfisher combines the p-values from N independent unit root tests, as developed by Maddala and Wu (1999). Based on the p-values of individual unit root tests, Fisher's test assumes that all series are non-stationary under the null hypothesis against the alternative that at least one series in the panel is stationary. Unlike the Im-Pesaran-Shin (1997) test (ipshin or xtunitroot ips), Fisher's test does not require a balanced panel. This test is based on augmented Dickey-Fuller tests.

Table 9 Panel Unit root tests Variable gdpgro (Growth of GDP)

Ho: All panels contain unit roots

Ha: At least one panel is stationary

Type of statistic		statistic	p-value	Decision
Inverse chi-squared(20)	P	49.1548	0.0003	Sufficient evidence to accept H_A
Inverse normal	Z	-3.8714	0.0001	Sufficient evidence to accept H_A
Inverse logit t(49)	L*	-4.0690	0.0001	Sufficient evidence to accept H_A
Modified inv. chi-squared	Pm	4.6098	0.0000	Sufficient evidence to accept H_A

[80] Source Stata manual

So we reject the null hypothesis that panels contain unit root and we accept the alternative that at least one panel is stationary.

Table 10 Panel Unit root tests Variable popgro (population growth)

Ho: All panels contain unit roots

Ha: At least one panel is stationary

Type of statistic		statistic	p-value	Decision
Inverse chi-squared(20)	P	61.3497	0.0000	Sufficient evidence to accept H_A
Inverse normal	Z	-4.5153	0.0000	Sufficient evidence to accept H_A
Inverse logit t(54)	L*	-5.0274	0.0000	Sufficient evidence to accept H_A
Modified inv. chi-squared	Pm	6.5380	0.0000	Sufficient evidence to accept H_A

So here also we reject the null hypothesis that panels contain unit root and we accept the alternative that at least one panel is stationary. In conclusion population growth and GDP growth are stationary.

Conclusion

This paper confirmed that for the Balkan countries also applies the rule of linear relationship between population growth and population, but also that demographic structure in the Balkan countries will be very old in the next decades. Optimal population growth depends on capital in the future period and future consumption. Turkey has highest population growth, while Macedonia lowest in the region, together with Slovenia that has little higher growth of

population. In the OLS regression with dummies the coefficient on Macedonia, is highest significant coefficient meaning, if we control for Macedonia we will on average find more positive association between growth of GDP and population growth. Hausman test was in favor of FE model, but FE and RE model showed that there is positive coefficient between GDP growth and population growth. Coefficient in the FE model was statistically significant, which was not case in RE model. From the Fischer's panel unit root test we reject the null hypothesis that panels contain unit root and we accept the alternative that at least one panel is stationary, for the population growth and GDP growth.

Appendix 1 Regression on population growth and level of population

```
. regress popgro   pop

      Source |       SS       df       MS              Number of obs =     590
-------------+------------------------------           F(  1,   588) =   39.93
       Model |  46.4512362     1  46.4512362           Prob > F      =  0.0000
    Residual |  684.078853   588  1.16339941           R-squared     =  0.0636
-------------+------------------------------           Adj R-squared =  0.0620
       Total |  730.530089   589  1.24028878           Root MSE      =  1.0786

------------------------------------------------------------------------------
      popgro |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         pop |   .0000196   3.11e-06     6.32   0.000     .0000135    .0000257
       _cons |    .575368   .0554657    10.37   0.000      .466433    .6843029
------------------------------------------------------------------------------
```

Appendix 2 OLS and OLS_dummies regression

```
---------------------------------------------
    Variable |      ols           ols_dum
-------------+-------------------------------
     lpopgro |  .12929031*      .05814148
 _Icountry_2 |                   4.8024968
 _Icountry_3 |                   23.983916
 _Icountry_4 |                  -61.154368*
 _Icountry_5 |                  -55.759953
 _Icountry_6 |                   71.522809**
 _Icountry_7 |                   22.472556
 _Icountry_8 |                   86.099647
 _Icountry_9 |                  -87.803317**
_Icountry_10 |                   10.780687
       _cons |  280.31333***    341.84296
-------------+-------------------------------
           N |        339             339
---------------------------------------------
      legend: * p<0.05; ** p<0.01; *** p<0.001
```

. xi: regress lgdpgro lpopgro i.country

i.country _Icountry_1-10 (_Icountry_1 for coun~y==Albania omitted)

```
      Source |       SS       df       MS              Number of obs =     339
-------------+------------------------------           F( 10,   328) =    8.40
       Model |   650078.81    10   65007.881           Prob > F      =  0.0000
    Residual |  2537279.52   328   7735.6083           R-squared     =  0.2040
-------------+------------------------------           Adj R-squared =  0.1797
```

```
       Total |  3187358.33   338  9430.05423           Root MSE      =  87.952

------------------------------------------------------------------------------
     lgdpgro |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lpopgro |   .0581415   .2607112     0.22   0.824    -.4547355    .5710185
 _Icountry_2 |   4.802497   25.39018     0.19   0.850    -45.14565    54.75064
 _Icountry_3 |   23.98392   33.98436     0.71   0.481    -42.87089    90.83872
 _Icountry_4 |  -61.15437   26.33497    -2.32   0.021    -112.9611   -9.347613
 _Icountry_5 |  -55.75995   35.73427    -1.56   0.120    -126.0572    14.53731
 _Icountry_6 |   71.52281   25.75835     2.78   0.006     20.85039    122.1952
 _Icountry_7 |   22.47256   55.59951     0.40   0.686    -86.90407    131.8492
 _Icountry_8 |   86.09965   45.34624     1.90   0.058     -3.10652    175.3058
 _Icountry_9 |  -87.80332   26.78825    -3.28   0.001    -140.5018   -35.10485
_Icountry_10 |   10.78069   73.11564     0.15   0.883    -133.0541    154.6154
       _cons |    341.843   181.9686     1.88   0.061    -16.12976    699.8157
------------------------------------------------------------------------------



      Source |       SS       df       MS              Number of obs =     339
-------------+------------------------------           F(  1,   337) =    6.59
       Model |  61128.9658     1  61128.9658           Prob > F      =  0.0107
    Residual |  3126229.37   337    9276.645           R-squared     =  0.0192
-------------+------------------------------           Adj R-squared =  0.0163
       Total |  3187358.33   338  9430.05423           Root MSE      =  96.315

------------------------------------------------------------------------------
     lgdpgro |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lpopgro |   .1292903   .0503661     2.57   0.011     .0302189    .2283618
```

```
       _cons |   280.3133   41.14543     6.81   0.000     199.3791    361.2475
------------------------------------------------------------------------------
```

```
-----------------------------------------------
    Variable |      ols           ols_dum
-------------+---------------------------------
     lpopgro |  .12929031*      .05814148
 _Icountry_2 |                   4.8024968
 _Icountry_3 |                   23.983916
 _Icountry_4 |                  -61.154368*
 _Icountry_5 |                  -55.759953
 _Icountry_6 |                   71.522809**
 _Icountry_7 |                   22.472556
 _Icountry_8 |                   86.099647
 _Icountry_9 |                  -87.803317**
_Icountry_10 |                   10.780687
       _cons |  280.31333***    341.84296
-------------+---------------------------------
           N |        339             339
-----------------------------------------------
      legend: * p<0.05; ** p<0.01; *** p<0.001
```

Appendix 3 Panel estimation techniques

```
. xi: xtreg  lgdpgro lpopgro i.year,fe
i.year            _Iyear_1950-2009    (naturally coded; _Iyear_1950 omitted)

Fixed-effects (within) regression               Number of obs      =       339
Group variable: ctry                            Number of groups   =        10

R-sq:  within  = 0.1490                         Obs per group: min =         6
       between = 0.0464                                        avg =      33.9
       overall = 0.0597                                        max =        60

                                                F(60,269)          =      0.79
corr(u_i, Xb)  = -0.7906                        Prob > F           =    0.8691

------------------------------------------------------------------------------
     lgdpgro |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lpopgro |   .7605937   .4349449     1.75   0.081    -.0957353    1.616923
 _Iyear_1951 |  -40.98947   71.56379    -0.57   0.567    -181.8858    99.90689
 _Iyear_1952 |  -37.99571   71.45078    -0.53   0.595    -178.6696    102.6782
 _Iyear_1953 |  -29.75784   71.34648    -0.42   0.677    -170.2264    110.7107
 _Iyear_1954 |  -41.06829   71.25146    -0.58   0.565    -181.3497    99.21316
 _Iyear_1955 |  -33.02969    71.1641    -0.46   0.643    -173.1391    107.0798
 _Iyear_1956 |  -34.36171   71.08532    -0.48   0.629    -174.3161    105.5926
 _Iyear_1957 |  -22.94429   71.01376    -0.32   0.747    -162.7577    116.8692
 _Iyear_1958 |  -19.70167   70.94973    -0.28   0.781    -159.3891    119.9857
 _Iyear_1959 |  -20.82628   70.89659    -0.29   0.769     -160.409    118.7565
 _Iyear_1960 |  -109.6238    60.4036    -1.81   0.071    -228.5477    9.300167
```

_Iyear_1961	-87.74264	60.40654	-1.45	0.148	-206.6724	31.18708
_Iyear_1962	-77.87545	60.41447	-1.29	0.198	-196.8208	41.06989
_Iyear_1963	-68.6982	60.42612	-1.14	0.257	-187.6665	50.27006
_Iyear_1964	-66.45111	60.44104	-1.10	0.273	-185.4488	52.54655
_Iyear_1965	-62.68548	60.4597	-1.04	0.301	-181.7199	56.34889
_Iyear_1966	-60.85861	60.48429	-1.01	0.315	-179.9414	58.2242
_Iyear_1967	-54.70754	60.51841	-0.90	0.367	-173.8575	64.44242
_Iyear_1968	-198.34	60.56466	-3.27	0.001	-317.581	-79.09895
_Iyear_1969	-156.2577	60.61089	-2.58	0.010	-275.5898	-36.92568
_Iyear_1970	-145.0668	51.06815	-2.84	0.005	-245.6109	-44.5227
_Iyear_1971	-138.3513	51.1494	-2.70	0.007	-239.0554	-37.64727
_Iyear_1972	-129.4338	51.24072	-2.53	0.012	-230.3177	-28.54999
_Iyear_1973	-122.658	51.32261	-2.39	0.018	-223.7031	-21.61294
_Iyear_1974	-125.865	51.42468	-2.45	0.015	-227.111	-24.61893
_Iyear_1975	-119.0212	51.5398	-2.31	0.022	-220.4939	-17.54848
_Iyear_1976	-110.8254	51.6613	-2.15	0.033	-212.5373	-9.113524
_Iyear_1977	-104.646	51.7932	-2.02	0.044	-206.6176	-2.674423
_Iyear_1978	-96.13875	51.91444	-1.85	0.065	-198.349	6.071541
_Iyear_1979	-93.70237	52.03819	-1.80	0.073	-196.1563	8.751567
_Iyear_1980	-93.30143	52.16077	-1.79	0.075	-195.9967	9.393845
_Iyear_1981	-97.08487	52.29739	-1.86	0.064	-200.0491	5.879381
_Iyear_1982	-97.20503	52.42912	-1.85	0.065	-200.4286	6.018566
_Iyear_1983	-97.62817	52.55625	-1.86	0.064	-201.1021	5.845729
_Iyear_1984	-95.16551	52.68298	-1.81	0.072	-198.8889	8.557902
_Iyear_1985	-92.94244	52.81052	-1.76	0.080	-196.9169	11.03207
_Iyear_1986	-88.78871	52.93538	-1.68	0.095	-193.0091	15.43164
_Iyear_1987	-90.26075	53.06046	-1.70	0.090	-194.7273	14.20585
_Iyear_1988	-86.13444	53.18221	-1.62	0.106	-190.8407	18.57186
_Iyear_1989	-84.9631	53.31231	-1.59	0.112	-189.9255	19.99934
_Iyear_1990	-133.1667	45.76825	-2.91	0.004	-223.2762	-43.05715
_Iyear_1991	-109.3995	45.79388	-2.39	0.018	-199.5595	-19.23946
_Iyear_1992	-115.1622	45.67449	-2.52	0.012	-205.0871	-25.23725
_Iyear_1993	-111.2897	45.56029	-2.44	0.015	-200.9898	-21.58964
_Iyear_1994	-101.2953	45.55359	-2.22	0.027	-190.9822	-11.60843

```
 _Iyear_1995 |  -91.89233   45.56847    -2.02   0.045    -181.6085   -2.176119
 _Iyear_1996 |    -80.682   45.56079    -1.77   0.078    -170.3831    9.019093
 _Iyear_1997 |  -79.65478   45.58771    -1.75   0.082    -169.4089    10.09931
 _Iyear_1998 |  -73.52062   45.68832    -1.61   0.109    -163.4728    16.43155
 _Iyear_1999 |  -68.16816   45.75291    -1.49   0.137    -158.2475    21.91118
 _Iyear_2000 |  -63.60586   45.79475    -1.39   0.166    -153.7676    26.55584
 _Iyear_2001 |  -134.7835   47.13355    -2.86   0.005     -227.581   -41.98589
 _Iyear_2002 |  -107.8351   47.17669    -2.29   0.023    -200.7176    -14.9526
 _Iyear_2003 |  -97.18599   45.92017    -2.12   0.035    -187.5946   -6.777339
 _Iyear_2004 |  -90.45919   45.96222    -1.97   0.050    -180.9506    .0322352
 _Iyear_2005 |  -90.43073    45.8519    -1.97   0.050     -180.705   -.1565113
 _Iyear_2006 |  -131.8986   44.79873    -2.94   0.004    -220.0993   -43.69785
 _Iyear_2007 |  -149.4817   44.81625    -3.34   0.001     -237.717   -61.24651
 _Iyear_2008 |  -188.2529   44.82956    -4.20   0.000    -276.5143   -99.99146
 _Iyear_2009 |  -106.2316     44.839    -2.37   0.019    -194.5116   -17.95161
       _cons |  -132.7358   341.1825    -0.39   0.698    -804.4635    538.9918
-------------+----------------------------------------------------------------
     sigma_u |  87.310538
     sigma_e |  89.598029
         rho |   .4870718   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(9, 269) =     8.73                 Prob > F = 0.0000
```

testparm

```
. testparm _Iyear*


 ( 1)  _Iyear_1951 = 0
 ( 2)  _Iyear_1952 = 0
 ( 3)  _Iyear_1953 = 0
 ( 4)  _Iyear_1954 = 0
 ( 5)  _Iyear_1955 = 0
 ( 6)  _Iyear_1956 = 0
 ( 7)  _Iyear_1957 = 0
 ( 8)  _Iyear_1958 = 0
```

```
( 9)  _Iyear_1959 = 0

(10)  _Iyear_1960 = 0

(11)  _Iyear_1961 = 0

(12)  _Iyear_1962 = 0

(13)  _Iyear_1963 = 0

(14)  _Iyear_1964 = 0

(15)  _Iyear_1965 = 0

(16)  _Iyear_1966 = 0

(17)  _Iyear_1967 = 0

(18)  _Iyear_1968 = 0

(19)  _Iyear_1969 = 0

(20)  _Iyear_1970 = 0

(21)  _Iyear_1971 = 0

(22)  _Iyear_1972 = 0

(23)  _Iyear_1973 = 0

(24)  _Iyear_1974 = 0

(25)  _Iyear_1975 = 0

(26)  _Iyear_1976 = 0

(27)  _Iyear_1977 = 0

(28)  _Iyear_1978 = 0

(29)  _Iyear_1979 = 0

(30)  _Iyear_1980 = 0

(31)  _Iyear_1981 = 0

(32)  _Iyear_1982 = 0

(33)  _Iyear_1983 = 0

(34)  _Iyear_1984 = 0

(35)  _Iyear_1985 = 0

(36)  _Iyear_1986 = 0

(37)  _Iyear_1987 = 0

(38)  _Iyear_1988 = 0

(39)  _Iyear_1989 = 0

(40)  _Iyear_1990 = 0

(41)  _Iyear_1991 = 0

(42)  _Iyear_1992 = 0
```

```
 (43)  _Iyear_1993 = 0
 (44)  _Iyear_1994 = 0
 (45)  _Iyear_1995 = 0
 (46)  _Iyear_1996 = 0
 (47)  _Iyear_1997 = 0
 (48)  _Iyear_1998 = 0
 (49)  _Iyear_1999 = 0
 (50)  _Iyear_2000 = 0
 (51)  _Iyear_2001 = 0
 (52)  _Iyear_2002 = 0
 (53)  _Iyear_2003 = 0
 (54)  _Iyear_2004 = 0
 (55)  _Iyear_2005 = 0
 (56)  _Iyear_2006 = 0
 (57)  _Iyear_2007 = 0
 (58)  _Iyear_2008 = 0
 (59)  _Iyear_2009 = 0

       F( 59,   269) =    0.80
            Prob > F =    0.8507
```

. **We failed to reject the null that all years coefficients are jointly equal to zero therefore no time fixedeffects are needed.**

```
. estimates store fixed

. xi: xtreg  lgdpgro lpopgro i.year,re
i.year            _Iyear_1950-2009    (naturally coded; _Iyear_1950 omitted)

Random-effects GLS regression                   Number of obs      =       339
Group variable: ctry                            Number of groups   =        10

R-sq:  within  = 0.1451                         Obs per group: min =         6
       between = 0.0292                                        avg =      33.9
```

```
       overall = 0.1063                                        max =        60

Random effects u_i ~ Gaussian                   Wald chi2(60)      =     45.80
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.9120

------------------------------------------------------------------------------
     lgdpgro |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lpopgro |   .2798707   .2033972     1.38   0.169    -.1187805    .6785219
 _Iyear_1951 |  -56.28473   70.55534    -0.80   0.425    -194.5707    82.00118
 _Iyear_1952 |  -52.39935   70.53754    -0.74   0.458    -190.6504    85.85168
 _Iyear_1953 |   -43.2677   70.52172    -0.61   0.540    -181.4877    94.95233
 _Iyear_1954 |  -53.68698   70.50796    -0.76   0.446      -191.88    84.50609
 _Iyear_1955 |  -44.74231   70.49604    -0.63   0.526     -182.912    93.42739
 _Iyear_1956 |  -45.15891   70.48611    -0.64   0.522    -183.3091    92.99132
 _Iyear_1957 |  -32.79237   70.47806    -0.47   0.642    -170.9268    105.3421
 _Iyear_1958 |  -28.55334   70.47207    -0.41   0.685    -166.6761    109.5694
 _Iyear_1959 |  -28.67037   70.46858    -0.41   0.684    -166.7862    109.4455
 _Iyear_1960 |  -112.9651   60.12139    -1.88   0.060    -230.8009    4.870631
 _Iyear_1961 |  -90.35182   60.12901    -1.50   0.133    -208.2025    27.49888
 _Iyear_1962 |  -79.87784   60.13654    -1.33   0.184    -197.7433    37.98761
 _Iyear_1963 |  -70.14497   60.14439    -1.17   0.244    -188.0258    47.73587
 _Iyear_1964 |  -67.37024    60.1527    -1.12   0.263    -185.2674    50.52689
 _Iyear_1965 |    -63.078   60.16182    -1.05   0.294     -180.993      54.837
 _Iyear_1966 |  -60.67713   60.17269    -1.01   0.313    -178.6134    57.25918
 _Iyear_1967 |  -53.86012   60.18654    -0.89   0.371    -171.8236    64.10332
 _Iyear_1968 |  -196.7322   60.20395    -3.27   0.001    -314.7298   -78.73463
 _Iyear_1969 |  -153.9929   60.22038    -2.56   0.011    -272.0227   -35.96313
 _Iyear_1970 |  -139.9699   50.51022    -2.77   0.006    -238.9681    -40.9717
 _Iyear_1971 |  -132.6094   50.53302    -2.62   0.009    -231.6523   -33.56648
 _Iyear_1972 |  -123.0217   50.55826    -2.43   0.015     -222.114   -23.92932
 _Iyear_1973 |  -115.6844   50.58061    -2.29   0.022    -214.8206   -16.54824
 _Iyear_1974 |  -118.2342   50.60818    -2.34   0.019    -217.4244   -19.04395
 _Iyear_1975 |  -110.6957   50.63897    -2.19   0.029    -209.9463   -11.44513
```

_Iyear_1976	-101.8109	50.67118	-2.01	0.045	-201.1246	-2.497197
_Iyear_1977	-94.92584	50.70588	-1.87	0.061	-194.3075	4.455856
_Iyear_1978	-85.80285	50.73757	-1.69	0.091	-185.2467	13.64096
_Iyear_1979	-82.76576	50.76976	-1.63	0.103	-182.2727	16.74113
_Iyear_1980	-81.79398	50.8015	-1.61	0.107	-181.3631	17.77514
_Iyear_1981	-84.96605	50.83676	-1.67	0.095	-184.6043	14.67216
_Iyear_1982	-84.51868	50.87063	-1.66	0.097	-184.2233	15.18593
_Iyear_1983	-84.41229	50.90325	-1.66	0.097	-184.1808	15.35623
_Iyear_1984	-81.43782	50.93568	-1.60	0.110	-181.2699	18.39429
_Iyear_1985	-78.71435	50.96827	-1.54	0.122	-178.6103	21.18163
_Iyear_1986	-74.08371	51.00012	-1.45	0.146	-174.0421	25.87469
_Iyear_1987	-75.0899	51.03199	-1.47	0.141	-175.1108	24.93096
_Iyear_1988	-70.52065	51.06297	-1.38	0.167	-170.6022	29.56093
_Iyear_1989	-68.88661	51.09605	-1.35	0.178	-169.033	31.25982
_Iyear_1990	-116.5801	43.00243	-2.71	0.007	-200.8633	-32.29684
_Iyear_1991	-92.7368	43.00835	-2.16	0.031	-177.0316	-8.441991
_Iyear_1992	-98.85596	42.98083	-2.30	0.021	-183.0968	-14.61508
_Iyear_1993	-95.33006	42.95457	-2.22	0.026	-179.5195	-11.14065
_Iyear_1994	-85.35618	42.95303	-1.99	0.047	-169.5426	-1.169792
_Iyear_1995	-75.90763	42.95645	-1.77	0.077	-160.1007	8.285464
_Iyear_1996	-64.72078	42.95468	-1.51	0.132	-148.9104	19.46886
_Iyear_1997	-63.61137	42.96087	-1.48	0.139	-147.8131	20.59039
_Iyear_1998	-57.17279	42.98402	-1.33	0.183	-141.4199	27.07433
_Iyear_1999	-51.62716	42.9989	-1.20	0.230	-135.9034	32.64913
_Iyear_2000	-46.94064	43.00855	-1.09	0.275	-131.2358	37.35456
_Iyear_2001	-117.3597	44.41108	-2.64	0.008	-204.4038	-30.31559
_Iyear_2002	-90.2815	44.42131	-2.03	0.042	-177.3457	-3.217338
_Iyear_2003	-80.1525	43.03751	-1.86	0.063	-164.5045	4.199475
_Iyear_2004	-73.3036	43.04724	-1.70	0.089	-157.6746	11.06743
_Iyear_2005	-70.34215	43.00249	-1.64	0.102	-154.6255	13.94118
_Iyear_2006	-112.5712	41.85031	-2.69	0.007	-194.5963	-30.54614
_Iyear_2007	-130.1051	41.8544	-3.11	0.002	-212.1383	-48.07203
_Iyear_2008	-168.8389	41.85751	-4.03	0.000	-250.8782	-86.79974
_Iyear_2009	-86.79124	41.85971	-2.07	0.038	-168.8348	-4.747705

```
       _cons |   256.9051   155.7634     1.65   0.099    -48.38564    562.1958
-------------+----------------------------------------------------------------
     sigma_u |  71.607679
     sigma_e |  89.598029
         rho |  .38977407   (fraction of variance due to u_i)
------------------------------------------------------------------------------

.


. estimates table fixed random, star stats(N r2 r2_a)

-----------------------------------------------
    Variable |     fixed          random
-------------+---------------------------------
     lpopgro |   .7605937       .27987068
 _Iyear_1951 | -40.989471      -56.284735
 _Iyear_1952 | -37.995715       -52.39935
 _Iyear_1953 | -29.757835      -43.267699
 _Iyear_1954 | -41.068291       -53.68698
 _Iyear_1955 | -33.029687      -44.742312
 _Iyear_1956 | -34.361712      -45.158912
 _Iyear_1957 | -22.944289      -32.792366
 _Iyear_1958 | -19.701667      -28.553338
 _Iyear_1959 |  -20.82628      -28.670366
 _Iyear_1960 | -109.62376      -112.96512
 _Iyear_1961 | -87.742636      -90.351818
 _Iyear_1962 | -77.875454      -79.877844
 _Iyear_1963 | -68.698204      -70.144973
 _Iyear_1964 | -66.451109      -67.370239
 _Iyear_1965 | -62.685482         -63.078
 _Iyear_1966 | -60.858608      -60.677127
 _Iyear_1967 | -54.707543      -53.860119
 _Iyear_1968 | -198.33999**     -196.7322**
```

_Iyear_1969	-156.25773*	-153.9929*
_Iyear_1970	-145.0668**	-139.96991**
_Iyear_1971	-138.35133**	-132.60937**
_Iyear_1972	-129.43385*	-123.02167*
_Iyear_1973	-122.65802*	-115.68442*
_Iyear_1974	-125.86497*	-118.23417*
_Iyear_1975	-119.02118*	-110.69569*
_Iyear_1976	-110.82543*	-101.81088*
_Iyear_1977	-104.64602*	-94.925836
_Iyear_1978	-96.138746	-85.802845
_Iyear_1979	-93.702372	-82.765761
_Iyear_1980	-93.301426	-81.79398
_Iyear_1981	-97.084873	-84.966048
_Iyear_1982	-97.205033	-84.518683
_Iyear_1983	-97.628174	-84.412295
_Iyear_1984	-95.165505	-81.437819
_Iyear_1985	-92.942442	-78.714345
_Iyear_1986	-88.788709	-74.083709
_Iyear_1987	-90.260748	-75.089896
_Iyear_1988	-86.134437	-70.520653
_Iyear_1989	-84.963103	-68.886611
_Iyear_1990	-133.16668**	-116.58006**
_Iyear_1991	-109.39946*	-92.736801*
_Iyear_1992	-115.16219*	-98.855958*
_Iyear_1993	-111.28974*	-95.33006*
_Iyear_1994	-101.29533*	-85.356181*
_Iyear_1995	-91.892333*	-75.907629
_Iyear_1996	-80.682	-64.720779
_Iyear_1997	-79.654784	-63.611366
_Iyear_1998	-73.520622	-57.172791
_Iyear_1999	-68.168159	-51.62716
_Iyear_2000	-63.605863	-46.940641
_Iyear_2001	-134.78347**	-117.35971**
_Iyear_2002	-107.8351*	-90.281499*

```
 _Iyear_2003 | -97.185988*     -80.152504
 _Iyear_2004 | -90.459194      -73.303605
 _Iyear_2005 | -90.430732*     -70.342153
 _Iyear_2006 | -131.89859**    -112.57124**
 _Iyear_2007 | -149.48174***   -130.10514**
 _Iyear_2008 | -188.25289***   -168.83895***
 _Iyear_2009 | -106.23162*     -86.791237*
       _cons | -132.73585        256.9051
-------------+------------------------------
           N |        339             339
          r2 |  .14902846
        r2_a | -.06925048
---------------------------------------------
      legend: * p<0.05; ** p<0.01; *** p<0.001
```

.

Hausman test

```
. hausman fixed random

                ---- Coefficients ----
             |      (b)           (B)             (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+------------------------------------------------------------------
     lpopgro |    .7605937     .2798707         .480723        .3844562
 _Iyear_1951 |   -40.98947    -56.28473        15.29526        11.97167
 _Iyear_1952 |   -37.99571    -52.39935        14.40363        11.38728
 _Iyear_1953 |   -29.75784     -43.2677        13.50986        10.81699
 _Iyear_1954 |   -41.06829    -53.68698        12.61869        10.26638
 _Iyear_1955 |   -33.02969    -44.74231        11.71262        9.728177
 _Iyear_1956 |   -34.36171    -45.15891         10.7972        9.210406
 _Iyear_1957 |   -22.94429    -32.79237        9.848077        8.706126
 _Iyear_1958 |   -19.70167    -28.55334        8.851671         8.21897
 _Iyear_1959 |   -20.82628    -28.67037        7.844086        7.778513
```

_Iyear_1960	-109.6238	-112.9651	3.341357	5.832114
_Iyear_1961	-87.74264	-90.35182	2.609181	5.783722
_Iyear_1962	-77.87545	-79.87784	2.00239	5.788372
_Iyear_1963	-68.6982	-70.14497	1.446769	5.828173
_Iyear_1964	-66.45111	-67.37024	.9191297	5.896799
_Iyear_1965	-62.68548	-63.078	.3925173	5.994197
_Iyear_1966	-60.85861	-60.67713	-.1814807	6.131626
_Iyear_1967	-54.70754	-53.86012	-.8474237	6.329167
_Iyear_1968	-198.34	-196.7322	-1.607786	6.600189
_Iyear_1969	-156.2577	-153.9929	-2.264839	6.869222
_Iyear_1970	-145.0668	-139.9699	-5.096894	7.528222
_Iyear_1971	-138.3513	-132.6094	-5.741962	7.916782
_Iyear_1972	-129.4338	-123.0217	-6.412175	8.335137
_Iyear_1973	-122.658	-115.6844	-6.973604	8.69553
_Iyear_1974	-125.865	-118.2342	-7.630801	9.127388
_Iyear_1975	-119.0212	-110.6957	-8.325484	9.594054
_Iyear_1976	-110.8254	-101.8109	-9.014546	10.06587
_Iyear_1977	-104.646	-94.92584	-9.720186	10.55699
_Iyear_1978	-96.13875	-85.80285	-10.3359	10.99127
_Iyear_1979	-93.70237	-82.76576	-10.93661	11.41952
_Iyear_1980	-93.30143	-81.79398	-11.50745	11.83018
_Iyear_1981	-97.08487	-84.96605	-12.11882	12.27361
_Iyear_1982	-97.20503	-84.51868	-12.68635	12.68822
_Iyear_1983	-97.62817	-84.41229	-13.21588	13.07743
_Iyear_1984	-95.16551	-81.43782	-13.72769	13.45557
_Iyear_1985	-92.94244	-78.71435	-14.2281	13.82702
_Iyear_1986	-88.78871	-74.08371	-14.705	14.18247
_Iyear_1987	-90.26075	-75.0899	-15.17085	14.53095
_Iyear_1988	-86.13444	-70.52065	-15.61378	14.86337
_Iyear_1989	-84.9631	-68.88661	-16.07649	15.21169
_Iyear_1990	-133.1667	-116.5801	-16.58663	15.66919
_Iyear_1991	-109.3995	-92.7368	-16.66266	15.72775
_Iyear_1992	-115.1622	-98.85596	-16.30623	15.45338
_Iyear_1993	-111.2897	-95.33006	-15.95968	15.187

```
 _Iyear_1994 |   -101.2953    -85.35618       -15.93915        15.17124
 _Iyear_1995 |   -91.89233    -75.90763        -15.9847        15.20623
 _Iyear_1996 |     -80.682    -64.72078       -15.96122        15.18819
 _Iyear_1997 |   -79.65478    -63.61137       -16.04342        15.25134
 _Iyear_1998 |   -73.52062    -57.17279       -16.34783        15.48539
 _Iyear_1999 |   -68.16816    -51.62716         -16.541        15.63405
 _Iyear_2000 |   -63.60586    -46.94064       -16.66522        15.72972
 _Iyear_2001 |   -134.7835    -117.3597       -17.42376        15.78695
 _Iyear_2002 |   -107.8351     -90.2815        -17.5536        15.88671
 _Iyear_2003 |   -97.18599     -80.1525       -17.03348        16.01358
 _Iyear_2004 |   -90.45919     -73.3036       -17.15559        16.10779
 _Iyear_2005 |   -90.43073    -70.34215       -20.08858         15.9117
 _Iyear_2006 |   -131.8986    -112.5712       -19.32735        15.98369
 _Iyear_2007 |   -149.4817    -130.1051        -19.3766        16.02204
 _Iyear_2008 |   -188.2529    -168.8389       -19.41394        16.05112
 _Iyear_2009 |   -106.2316    -86.79124       -19.44038        16.07172
------------------------------------------------------------------------------
                          b = consistent under Ho and Ha; obtained from xtreg
           B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                 chi2(60) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.92
                Prob>chi2 =      1.0000
```

Appendix 4 Unit root tests

```
. xtunitroot fisher  gdpgro, dfuller trend lags(4)
(1 missing value generated)

Fisher-type unit-root test for gdpgro
Based on augmented Dickey-Fuller tests
---------------------------------------
Ho: All panels contain unit roots           Number of panels       =     10
Ha: At least one panel is stationary        Avg. number of periods =  59.90

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Included
Drift term:   Not included                  ADF regressions: 4 lags
------------------------------------------------------------------------------
                                Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(20)   P        49.1548       0.0003
 Inverse normal            Z        -3.8714       0.0001
 Inverse logit t(49)       L*       -4.0690       0.0001
 Modified inv. chi-squared Pm        4.6098       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
xtunitroot fisher  popgro, dfuller trend lags(4)
(1 missing value generated)

Fisher-type unit-root test for popgro
Based on augmented Dickey-Fuller tests
---------------------------------------
Ho: All panels contain unit roots           Number of panels       =     10
Ha: At least one panel is stationary        Avg. number of periods =  59.90
```

```
AR parameter: Panel-specific               Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Included
Drift term:   Not included                 ADF regressions: 4 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(20)   P        61.3497       0.0000
 Inverse normal            Z        -4.5153       0.0000
 Inverse logit t(54)       L*       -5.0274       0.0000
 Modified inv. chi-squared Pm        6.5380       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

References

[1] Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011.

[2] Assaf Razin and Uri Ben-Zion,(1973), *An intergenerational model of population growth*, Discussion Paper No. 73-34,University of Minnesota

[3] Badi H. Baltagi,(2008), *Econometric Analysis of Panel Data*,Wiley

[4] Birdsall, N., (1988), Handbook of development economics ,Volume 1, edited by T.N.Srinivasan

[5] Greene ,William H.,(2008), *Econometric analysis,* Upper Saddle River, N.J. : Prentice Hall, 2008

[6] Greene, W.(2001), Estimating Econometric Models with Fixed Effects **,** *Department of Economics, Stern School of Business, New York University*

[7] Michael Kremer (1993), "Population Growth and Technological Change: One Million B.C. to 1990," **Quarterly Journal of Economics** 108:3 (August), pp. 681-716.

[8] Ramsey,F.,P.(1928), *A Mathematical theory of saving*, The Economic journal Vol.38 No.152

[9] Paul R. Ehrlich and John P. Holdren,(1971), Impact of Population Growth, Science, New Series, Vol. 171, No. 3977 (Mar. 26, 1971), pp. 1212-1217

[10] Podestà,F.(2002),Recent developments in quantitative comparative methodology: The case of pooled time series cross-section analysis, DSS PAPERS SOC 3-02

[11] Wooldridge, J.M., 1995, Selection corrections for panel data models under conditional mean independence assumptions, Journal of Econometrics 68, 115-132.