This book contains seven essays in applied economics and public economics that also cover public administration themes.Themes covered are following: New Keynesian macroeconomics without the LM curve applied on a CESEE countries, second New-Keynesian models with algebraic notations.Third, Problems in mathematical economics such a optimization are also covered. Also this book covers themes from personnel economics and their policy effects which is also part of public administration as a science.

Dushko Josheski was born on 29.08.1983 in Bitola R.Macedonia. In 2008 he did his Msc in Economics for business analysis at Staffordshire University , UK. In 2009 he won the award for best young researcher in Macroeconomics awarded by the National bank of Republic of Macedonia.Since 2009 he works at Goce Delcev university, R.Macedonia.

978-3-659-46923-7

Dushko Josheski

# Essays in applied macroeconomics and public (administration) economics

LAP LAMBERT Academic Publishing

**Dushko Josheski**

# Essays in applied macroeconomics and public (administration) economics

**Dushko Josheski**

# Essays in applied macroeconomics and public (administration) economics

**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
OmniScriptum 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: 978-3-659-46923-7**

# Essays in applied macroeconomics and public (administration) economics

Dushko Josheski

University Goce Delcev-Stip,R.Macedonia

# Table of contents

## contents

# Keynesian macroeconomics without the LM curve: IS-MP-IA model and Taylor rule applied to some CESEE economies

Dushko Josheski

Researcher in the field of applied economics and macroeconomics

Abstract

Applying IS-MP-IA model and the Taylor rule, this study finds that for selected CESEE economies (Albania, Bosnia and Herzegovina, Macedonia and Serbia), lower expected inflation rate, real appreciation a lower world interest rate which is calculated like a federal funds rate minus inflation in US, and more world output would help to increase output of the selected economies in the sample. A lower ratio of government consumption spending to GDP would also increase the output of the selected economies. Hence, fiscal prudence is needed, and the conventional approach of real depreciation to stimulate exports and raise real output does not apply to the selected CESEE economies. When private household consumption is in the model the coefficient on government spending to nominal GDP is insignificant implying that Ricardian equivalence does hold for the selected countries. These results are robust because they are controlled in the period of four decades from 1969 to 2013. Study uses 4 dummies that control for each decade.

Keywords: IS-MP-IA, Taylor Rule, Inflation targeting, monetary policy function, government spending to nominal GDP, world interest rates

## 1. Introduction

Romer (2000)[1], proposed an alternative to the IS-LM model and AS-AD model. This model makes assumption that Central banks in the world follow interest rate rule rather than targeting money supply. This model is also known as AD-IA, or aggregate demand inflation adjustments model. This assumption also is known as interest rate rule, that is also known as Taylor rule[2] which states that federal funds rate, (which usually is taken as proxy world interest rate after we subtract Producer Price Index in US manufacturing form it ) is set by Central banks according to:

$$i_t = 2 + \pi_t + \gamma(\pi_t - \pi_t^*) + \vartheta(y_t - y_t^*) \quad \textbf{(1)}$$

[1] Romer, D.,(2000),***Keynesian macroeconomics without the LM curve***, *Journal of Economic Perspectives—Volume 14, Number 2—Spring 2000—Pages 149*

[2] Taylor, John B. (1993). ***"Discretion versus Policy Rules in Practice"***. *Carnegie-Rochester Conference Series on Public Policy* **39**: 195–214. (The rule is introduced on page 202.)

In the previous expression $i_t$ is the prescribed interest rate in the period t, $\pi_t$ is the actual inflation rate and $\pi_t - \pi_t^*$ is the deviation of actual inflation from its target rate $\pi^*$ t,and $y_t - y_t^*$ is the deviation of actual output to its potential output (output gap). In the previous expression $\gamma > 0; \vartheta > 0$. The assumption that central banks follow a interest rate rule is far more realistic than assumption that central banks target money supply. In the Romer's approach aggregate demand relates to output and inflation. According to Romer (2000), target rate equals to last period inflation $\pi_t^* = \pi_{t-1}$.This assumption also means that inflation rises when output is above its own natural rate, and inflation falls when output is below its natural rate. We apply this models to Central and Eastern and South Eastern Europe (CESEE) countries from Balkan peninsula, namely Albania, Bosnia and Herzegovina, Macedonia and Serbia. Albanian economic policy in the previous two decades aimed at maintaining macroeconomic stability, and non-inflationary policies and achieving fiscal consolidation through public debt reduction. Albania reduced its budget deficit for the 2010 to 3.2% of GDP and previously in 1990's budget deficit was 9.6%[3]. Fiscal policy has been more prudent in the last 20 years and as a result, total public debt to GDP ratio has shown declining tendency from 35% in 1990's to 29% in 2010. Current expenditures to GDP ratio have also diminished from 29% in 1990's to 24% in 2010. About the exchange rate which is one of the most important macroeconomic variables, Albania opted for flexible exchange rate regime in the beginning of the transition process, rationale for this decision was to avoid costly adjustments of possible exchange rate misalignments that usually characterize pegged rate regimes, Ljuci, Vika(2011)[4]. Bosnia and Herzegovina is a small open economy, that its GDP was deteriorated and reduced during the Bosnian war (1992-1995), according to Causevic (2012)[5], country's GDP had been reduced from 10.7 US billion dollars in 1992 to 3.2 US billion dollars in 1996. And from 2000 tom 2010 succeed in increasing its' own GDP per capita 3 times. In this small open economies fiscal policy is the only active segment of macroeconomic policy. In Bosnia and Herzegovina

[3] Shijaku,G.,Gjokuta,A.,(2013), ***Fiscal policy and economic growth: the case of Albania***, Bank of Albania
[4] Ljuci, E.,Vika, I.,(2011), The equilibrium real exchange rate of lek vis-à-vis euro: is it much misaligned?, Bank of Greece discussion papers
[5] Cuasevic, F.,(2012), ***Economic perspectives on Bosnia and Herzegovina in the period of global crisis,*** St Antony's College University of Oxford

exchange rate and interest rate are passive instruments[6], and money supply is determined by the currency board. The only monetary instrument which is available to the Central bank of Bosnia which is established as a currency board is required reserves ratio. The bank cannot influence the interest rates and the money supply. Bosnia and Herzegovina had an average budget surplus of 2.2% of GDP for the period 2003-2005, and this country compared to other Central and Eastern and South Eastern Europe (CESEE) had highest public spending that averaged 44.7% of GDP, *i.e.* 18% above from the regional average. In Macedonia the aim of NBRM (National Bank of the Republic of Macedonia), is price stability, low and stable inflation. Its operational target are interest rates and liquidity, intermediate target is exchange rate this are identified channels by the economic literature through which central bank affects price stability, Besimi, Pugh Adnett (2006)[7].Exchange rate in Macedonia is fixed, Balassa- Samuelson effect, in the process of catching up with the level of productivity causes higher inflation rate, and if there is fixed exchange rate, cause real appreciation of the domestic currency; Besimi, (2004)[8]. In Serbia, for the last decades experienced macroeconomic but also political instability. Serbia hasn't achieved one digit rate of inflation which is a key indicator for macroeconomic stability. Public spending to GDP is 43.6% of GDP in 2009. This is due to increased revenues from privatization which lead to larger government spending, Pavlovic, Zivkov, Kolar(2011)[9]. Fiscal deficit in Serbia as percentage has increased from -0.9% to -4.2%. About the monetary policy in Serbia, core purpose of National bank is to provide monetary and financial stability, by which is meant stable financial system. The National bank of Serbia manages interest rates in order to provide low and stable inflation rate, also NBS (National Bank of Serbia) protects the citizen's living standard, and NBS also manages foreign exchange reserves.

## 2. Mathematical model

[6] Exchange rate in Bosnia and Herzegovina is determined by a hard peg.

[7] Besimi, F., Pugh, G., Adnett, N.(2006),***The monetary transmission mechanism in Macedonia: implications for monetary policy***, working papers : centre for research on emerging economies

[8] Besimi,F.,(2004), **The role of the exchange rate stability in a small and open economy: the case of the republic of Macedonia,** NBRM working paper

[9] Pavlovic, J.,Zivkov D.,Kolar, S.,(2011), ***Macroeconomic performance and political business cycles in Serbia (2000-2009)*** International Conference On Applied Economics – ICOAE 2011

Now, like in Romer (2006) let's suppose that aggregate demand spending is determined by the real output, real interest rate, government spending and government tax revenues, i.e.:

$$E = E(Y, i - \pi^e, G, T)$$

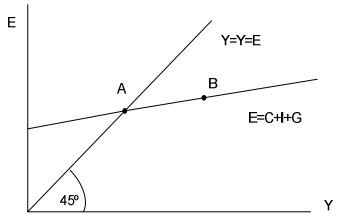
(2)

In the previous expression E-denotes expenditures; they are expected value of the real output, and real interest rate which is derived when from the nominal interest rate one subtracts expected inflation[10], and aggregate expenditures are function of government spending which is financed by the taxes. Planned real expenditure is presented as:

$$E = C(Y - T) + I(i - \pi^e) + G$$

(3)

In the previous expression C is a consumption function, I is investment. From the *Keynesian cross* in the equilibrium planned expenditure equals the actual expenditure:




So, if **E=Y** than we can rewrite the first expression as:

$$Y = E(Y, R - \pi^e, G, T) \qquad (4)$$

The extended monetary policy function according to Hsing Yu et al, (2009)[11], can be presented as:

$$R = R(\pi - \pi^e, Y - \overline{Y}, ER - ER^e, \mathrm{i}^{\mathrm{W}}) \qquad (5)$$

[10] Expected inflation one can derive by lagging inflation variable once.

[11] Hsing, Yu, Hsieh, W., (2009), ***Response of output in Romania to macroeconomic policies and conditions***, Preliminary paper.

In the extended monetary policy model $\pi^e$ is targeted inflation or equilibrium inflation, $\bar{Y}$ is the potential output or this presents trend output, $ER^e$ represents expected exchange rate, or lagged real exchange rate, and $i^W$ represents world interest rate. For the Inflation adjustment we have:

$$\pi = \pi^e + \alpha(Y - \bar{Y}) + ER^{no\min al} \tag{6}$$

From the previous expression inflation equal targeted inflation + output gap+nominal exchange rate, its increase means appreciation. And for the real effective exchange rate model states that:

$$ER = f(i - i^W, ER^e) \tag{7}$$

So, real effective exchange rate is a function of real interest rate minus world interest rate and expected exchange rate, i.e. lagged exchange rate. This is known as IS-MP-IA model originating in the work of David Romer (2000)[12], in his paper so inspiringly entitled: Keynesian macroeconomics without the LM curve.

### 3. From mathematical to econometric model

Econometric model that is being estimated in this paper in its general form is presented as:

$$\begin{aligned}\log Y_{it} &= \log GY_{it} + \log ER^e{}_{it} + \log R^W + \\ &\log Y^W + \log \pi^e_{it} + \log POP_{it} + \log EMP_{it} + Dummy\,\text{var}\,iables + errorterm_{it}\end{aligned} \tag{8}$$

In the previous expression $\log Y_{it}$ is logarithm of the output (real GDP where 2005=100, billions of US dollars from 2005 as base), $\log GY_{it}$ is ratio of government consumption spending $\log R^W$ is the world interest rate $\log Y^W$ is the logarithm of world output, $\log POP_{it}$ is the logarithm of population , $\log EMP_{it}$ is logarithm of employment , and Dummy variables are D1=1 if sample covered is from 1969-1980, otherwise 0; D2=1 if sample covered in the regression is 1981-1990,otherwise 0; D3=1 if sample covered in the regression is 1991-2001,otherwise 0; and D3=1 if sample covered in the regression is 2001-2013, otherwise 0. The ratio of logarithm of government consumption spending to nominal GDP ($\log GY_{it}$) is used as a proxy for fiscal policy. The effective real

[12] Romer, D.,(2000), ***Keynesian macroeconomics without the LM curve***, *Journal of Economic Perspectives—Volume 14, Number 2—Spring 2000—Pages 149–169*

exchange rate is based on a trade weighted measure, and here is presented in the regression in its lagged form $\log ER^{e}_{it}$, $\log \pi^{e}_{it}$ is logarithm of expected inflation. Expected inflation is also inflation at Lag=1. Expected inflation is used as a proxy for inflation adjustment in the model. $\log R^{W}$ is the world interest rate , this variable is in the model because of its influence on the monetary policy of the selected countries. World interest rate is derived when US Federal funds rate is subtracted by the Producer Price Index in US manufacturing, which proxies for US inflation. This variables proxies for monetary policy conditions, same as exchange rate does. $\log POP_{it}$ and $\log EMP$ variables serve as proxies for macroeconomic conditions. $\log POP_{it}$ is the logarithm of population in the selected countries, while $\log EMP$ is the logarithm of employment in the selected countries, this variables are genuinely measured in millions and thousand persons respectively. Dummy variables serve to see whether macroeconomic policies and macroeconomic conditions differed throughout decades 1970's, 1980's, 1990's, and from 2001 to 2013.

## 4. Data and methodology

In this paper data for 4 countries are being used: Albania, Bosnia and Herzegovina, Macedonia, and Serbia. Data covers period from 1969 to 2013. Sources of the data are: World Bank development indicators, International financial statistics of IMF, Oxford economic forecasting. All of the data are converted to a 2005 base year[13]. Data on US federal funds rate and US Producer Price Index for all commodities (which served for world interest rate derivation) are obtained by the FRED (Federal Reserve Bank of St.Louis) data base[14].Constructed data base consists of 180 observations, for 4 countries. Panel is strongly balanced. This means that each panel contains exactly the same time points, i.e. $T_{ij} = T$, where T is the number of observations per panel. Main model has been tested for serial correlation by using Wooldridge test, and the result proved that there is very small probability of making type I error if we reject the null hypothesis, no first-order autocorrelation[15], Results from the test are also presented in

[13] International macroeconomic data set, by d-r Mathew Shane

[14] Data on PPI are obtained also by U.S. department of labor: Bureau of labor statistics

[15] Probability of making type I error was only 0.0059

Appendix 1. If there is no prersence of autocorrelation we can use OLS to obtain estimates otherwise we use Prais-Winsten estimation. This techniques in order to eliminate serial correlation multiplies the equation $y_{it} = a_i + \beta_1 X_{it} + u_{it}$ by $(1-\rho^2)^{1/2}$, this is because $\sigma_u^2 = \text{var}(u_{it}) = \sigma_e^2/(1-\rho^2)$ and so the result is:

$$y_{it}(1-\rho^2)^{1/2} = (1-\rho^2)^{1/2} a_i + \beta_1 (1-\rho^2)^{1/2} X_{it} + (1-\rho^2)^{1/2} u_{it} \quad (9)$$

When there are more than two periods in the panel one can write:

$$y_{it-1} = a_i + \beta_1 X_{it-1} + u_{it-1}$$
$$y_{it} = a_i + \beta_1 X_{it} + u_{it}$$
(10)

If one multiplies by ρ the first equation and subtract first from second equation, result is:

$$y_{it} - \rho y_{it-1} = (1-\rho) a_i + \beta_1 (X_{it} - \rho X_{it-1}) + \varepsilon_{it}, t \geq 2 \quad (11)$$

Because $\varepsilon_{it} = u_{it} - \rho u_{it-1}$, one can write:

$$\tilde{y}_{it} = (1-\rho) a_i + \beta_1 \tilde{X}_{it} + \varepsilon_{it}, t \geq 2 \quad (12)$$

In Appendix 2 Graphically are depicted some of the variables.

## 5. Econometric results

In this section results from econometric estimations are presented. Dependent variable is logarithm of output, Real GDP in 2005 US dollars. In Table 1 it is presented the result form the estimation of the first model that takes into account all of the observations, i.e. takes observations from 1969 to 2013. In the next 4 models decadal dummies control for different decades; D1 controls for period from 1969 to 1980, D2 controls for period from 1981 to 1990, D3 controls for the decade 1990's , i.e. for period from 1991 to 2001. And finally the model augmented with the dummy variable D4 controls for period from 2001 to 2013.

**Table 1** Estimated Regression of log(Y) for the 4 countries Albania, Bosnia and Herzegovina, Macedonia and Serbia: 1969-2013

| **Dependent variable $logY_{it}$, Log of country's output** | **Variable description** | **Coefficient** |
|---|---|---|
| $logGY_{it}$ | Government consumption spending to GDP | -0.0002*** |
| $logER^{e}$ it | expected exchange rate ,log | 0.1007*** |
| $R^{W}$ | World interest rate | -0.0148*** |
| $Y^{W}$ | World output, log | 0.5186*** |
| log $\pi^{e}_{it}$ | expected inflation ,log | -0.0556*** |
| $logW_{it}$ | Gross fixed capital formation, i.e. country's wealth | 1.13e-06*** |
| $logPOP_{it}$ | Population , log | 0.1915*** |
| $logEMP_{it}$ | Employment , log | -0.0928*** |
| C | Constant | -4.0168*** |
| R-squared | | 0.5233 |
| Wald chi2(8) | | 0.0000 |

***Note*** **:***** statistical significance at all levels of significance;** statistical significance at 5%,*statistical significance at 10%.

From the Table 1 we can see that for the regression for the whole time period 1969-2013, government consumption in relation to nominal GDP does negatively and statistically significantly enters in the regression with the logarithm of output. In the first model all of the coefficients are significant at 1%,5%, and 10% levels of significance , i.e. all of the coefficients are significant at all levels of statistical significance. Table 1 presents estimated coefficients, t-statistics, $R^2$, and other related statistics. The equilibrium Real GDP is positively associated with the appreciation of expected real effective exchange rate coefficient is 0.1007, and this coefficient is significant at all levels of statistical significance. Also positive and statistically significant relationship exists between world output and output of the countries members of the panel. Logarithm of the expected inflation is negatively associated with equilibrium output of the countries, the coefficient is of size -0.0556 and it is statistically significant at all levels of significance. Gross fixed capital formation which proxies for country's wealth i.e. productive and non-productive capacities of the country is positively associated with the output though the coefficient is of very small size 1.13e-06. World interest rate does negatively and statistically significantly enters in the relationship with the equilibrium output. Second, the conventional wisdom to devalue a currency to stimulate net exports and aggregate expenditures would not apply to these 4

countries. Instead appreciation of real effective exchange rate will increase output of these countries. Third a higher world interest rate would reduce Real GDP of the countries in the panel, because their National banks would respond positively to higher world interest rate by raising its own monetary policy rate. Inflation would reduce Real GDP of the selected countries mainly because National banks would raise real interest rates I order to pursue inflation targets. Increase in the logarithm of population would increase output, while increase in employment would reduce real GDP

**Table 2** Estimated Regression of log(Y) for the 4 countries Albania, Bosnia and Herzegovina, Macedonia and Serbia: 1969-1980

| **Dependent variable $logY_{it}$, Log of country's output** | **Variable description** | **Coefficient** |
|---|---|---|
| $logGY_{it}$ | Government consumption spending to GDP | -0.00015*** |
| $logER^{e}_{it}$ | expected exchange rate ,log | 0.105*** |
| $R^{W}$ | World interest rate | -0.001 |
| $Y^{W}$ | World output, log | 1.127*** |
| $\log \pi^{e}_{it}$ | expected inflation ,log | -0.073*** |
| $logW_{it}$ | Gross fixed capital formation, i.e. country's wealth | 9.58E-07*** |
| $logPOP_{it}$ | Population , log | 0.2491*** |
| $logEMP_{it}$ | Employment , log | -0.1242*** |
| D1 | Dummy variable =1 if years in the sample range from 1969-1980 | 0.6442*** |
| C | Constant | -10.53*** |
| R-squared | | 0.5573 |
| Wald chi2(8) | | 0.000 |

***Note*** **:***** statistical significance at all levels of significance;** statistical significance at 5%,*statistical significance at 10%.

In the decade 1970's, *i.e.* from 1969 to 1980 world interest rate does not influence log of real GDP ,the sign on the variable as expected is negative but insignificant. So, in the 1970's world interest rate did not influenced output of the 4 countries in the panel. Inflation did influenced negatively on the output of the countries in the panel, mainly through higher interest rate as response to higher inflation, so that consumption will be slowed down. In 1970's decade devaluation of currency for stimulation of net exports and aggregate expenditures does not hold for these four countries. Relationship between

output and employment is a relationship between productivity and number of persons engaged in the manufacturing. For a individual companies, higher productivity leads to loss of jobs, for instance in typewriter industry introduction of computers lead to decline in employment, Nordhaus(2005)[16].But it is that employment does not lead to productivity or either way productivity does not determine employment rater macroeconomic policies determine rate of employment. Dummy variable that control for this decade is positive and statistically significant, meaning that controlling for 1970's we get more positive results for output. Next, results for the regression that controls for 1980's decade are given.

**Table 3** Estimated Regression of log(Y) for the 4 countries Albania, Bosnia and Herzegovina, Macedonia and Serbia: 1981-1990

| Dependent variable $logY_{it}$, Log of country's output | Variable description | Coefficient |
|---|---|---|
| $logGY_{it}$ | Government consumption spending to GDP | -0.000167*** |
| $logER^{e}$ it | expected exchange rate ,log | 0.0967*** |
| $R^{W}$ | World interest rate | -0.0139* |
| $Y^{W}$ | World output, log | 0.5376*** |
| log $\pi^{e}_{it}$ | expected inflation ,log | -0.0573*** |
| logW | Gross fixed capital formation, i.e. country's wealth | 1.15E-06*** |
| $logPOP_{it}$ | Population , log | 0.189*** |
| $logEMP_{it}$ | Employment , log | -0.096*** |
| D2 | Dummy variable =1 if years in the sample range from 1981-1990 | -0.039 |
| C | Constant | -4.175** |
| R-squared | | 0.5235 |
| Wald chi2(8) | | 0.000 |

***Note* :***** statistical significance at all levels of significance;** statistical significance at 5%,*statistical significance at 10%.

In 1980's decade government consumption ratio to nominal GDP has smaller coefficient with respect to the 1970's, negative coefficient and statistically significant on this variable to GDP suggests that prudent fiscal policy will be appropriate for this countries. In this countries in 1980's monetary policy has been more dependent on

[16] Nordhaus, W.,(2005), ***The sources of the productivity rebound and the manufacturing employment puzzle***, NBER working paper

world interest rate and now the coefficient on this variable I statistically significant and negative to GDP at 10% level of statistical significance. Negative influence on expected inflation on GDP this decade is smaller than that of 1970's inflation. This coefficient is negative and statistically significant at all levels of significance. The influence on wealth of the countries on productivity is greater in this decade than in 1970's which is expected because of the building of new capacities in course of the years. But the coefficient on the dummy variable that controls for the 1990's is insignificant though positive. Employment is also negatively associated with the output but the coefficient is of smaller size. The sign on the excepted effective exchange rate is also positive and statistically significant, again implying appreciation as good policy for the output of Albania, Macedonia, Bosnia and Herzegovina and Serbia. R-squared of the regression is 0.5235, while the Wald test that tests the influence of the independent variables on the dependent variables has probability of type I error of 0.000 so one can reject the null hypothesis of independent variables insignificance.

**Table 4** Estimated Regression of log(Y) for the 4 countries Albania, Bosnia and Herzegovina, Macedonia and Serbia: 1991-2001

| Dependent variable $logY_{it}$, Log of country's output | Variable description | Coefficient |
|---|---|---|
| $logGY_{it}$ | Government consumption spending to GDP | -0.0002*** |
| $logER^{e}$ it | expected exchange rate ,log | 0.149*** |
| $R^{W}$ | World interest rate | -0.007 |
| $Y^{W}$ | World output, log | 0.250 |
| log $\pi^{e}_{it}$ | expected inflation ,log | -0.050*** |
| $logW_{it}$ | Gross fixed capital formation, i.e. country's wealth | 4.94E-07 |
| $logPOP_{it}$ | Population , log | 0.300*** |
| $logEMP_{it}$ | Employment , log | -0.085*** |
| D3 | Dummy variable =1 if years in the sample range from 1991-2001 | -0.35*** |
| C | Constant | -1.620*** |
| R-squared | | 0.5578 |
| Wald chi2(8) | | 0.000 |

***Note*** **:***** statistical significance at all levels of significance;** statistical significance at 5%,*statistical significance at 10%.

In the decade of 1990's one can see from the table of results that real GDP of the countries in the panel is not affected by the world interest rate and world output. The sign on the government spending to nominal GDP is negative and significant at all levels of significance, coefficient size is -0.0002. This is to say again that prudent fiscal policy is required for these countries that is that fiscal policy should be designed to maintain stable allocation of public sector resources[17] Expected inflation also negatively is associated with the economic growth as well as logarithm of employment. Coefficients on these variables are statistically significant as well. Coefficient on the gross capital formation is lower than its own size in 1980's this is due to the fact that some of the productive capacities were destroyed in wars in Bosnia and Herzegovina and privatization in Macedonia, and Albania and similar occasions in Serbia. But also this coefficient is statistically insignificant.

**Table 4** Estimated Regression of log(Y) for the 4 countries Albania, Bosnia and Herzegovina, Macedonia and Serbia: 2001-2013

| Dependent variable $logY_{it}$, Log of country's output | Variable description | Coefficient |
|---|---|---|
| $logGY_{it}$ | Government consumption spending to GDP | -0.000168*** |
| $logER^{e}$ it | expected exchange rate ,log | 0.11*** |
| $R^{W}$ | World interest rate | -0.01 |
| $Y^{W}$ | World output, log | 0.09 |
| log $\pi^{e}_{it}$ | expected inflation ,log | -0.06*** |
| $logW_{it}$ | Gross fixed capital formation, i.e. country's wealth | 8.07E-07*** |
| $logPOP_{it}$ | Population , log | 0.244*** |
| $logEMP_{it}$ | Employment , log | -0.099*** |
| D4 | Dummy variable =1 if years in the sample range from 2001-2013 | 0.352*** |
| C | Constant | 0.161 |
| R-squared | | 0.5410 |
| Wald chi2(8) | | 0.000 |

***Note*** **:***** statistical significance at all levels of significance;** statistical significance at 5%,*statistical significance at 10%.

[17] Golden rule states that during ups and downs of an economic cycle the government should borrow only to pay for the investment benefits of future generations.

All of the previous results apply for the time period 2001-2013, and the coefficients on world output and world interest rates are insignificant. Appreciation of exchange rate is again suggested policy for output increase. The negative sign on the coefficient of the expected inflation is statistically significant at all levels of statistical significance. Dummy variable that controls for this decade has positive and statistically significant result.

**Table 5** Estimated Regression of log(Y) for the 4 countries Albania, Bosnia and Herzegovina, Macedonia and Serbia: 1969-2013

| Dependent variable $logY_{it}$, Log of country's output | Variable description | Coefficient |
|---|---|---|
| $logGY_{it}$ | Government consumption spending to GDP | -0.009 |
| $logER^{e}$ it | expected exchange rate ,log | 0.092*** |
| $R^{W}$ | World interest rate | -0.015*** |
| $Y^{W}$ | World output, log | 0.397 |
| log $\pi^{e}$ it | expected inflation ,log | -0.074 |
| $logW_{it}$ | Gross fixed capital formation, i.e. country's wealth | 6.57E-07*** |
| $logPOP_{it}$ | Population , log | 0.281*** |
| $logEMP_{it}$ | Employment , log | -0.074* |
| Log C | Logarithm of household consumption | 0.041* |
| C | Constant | -3.422 |
| R-squared | | 0.5428 |
| Wald chi2(8) | | 0.000 |

***Note*** **:***** statistical significance at all levels of significance;** statistical significance at 5%,*statistical significance at 10%.

In the presence of logarithm of household consumption government consumption spending to GDP is insignificant. Insignificance of this coefficient may suggest that ***Ricardian equivalence hypothesis*** may be applicable to the four countries in the panel. In presence of consumption, world output and expected inflation does not influence the dependent variable, i.e. their influence is statistically insignificant. World interest rate does have negative and statistically significant influence on the output.

## 6. Summary and conclusions

This paper has examined the short term output fluctuations to major macroeconomic variables. The estimation results suggest that the change of the effective exchange rate affects output positively, while the change of the world interest rate affects output negatively or it does not affect the output at all, i.e. that variable is insignificant. From the results also, relatively low world real interest rates and the expected world economic recovery would help increase real GDP whereas expected real depreciation of the national currencies of the countries in the panel would have negative effect on the real GDP. The ratio of government deficit to nominal GDP should be below 3% to meet the EU convergence criterion. This countries are not yet members of EU, but in some foreseeable future they may become and they will must fulfil the debt to GDP ratio criterion as well as inflation target range between 2.5% and 4.5%.

## References


1. Besimi, F., Pugh, G., Adnett, N.(2006),***The monetary transmission mechanism in Macedonia: implications for monetary policy***, working papers : centre for research on emerging economies
2. Besimi,F.,(2004), **The role of the exchange rate stability in a small and open economy: the case of the republic of Macedonia,** NBRM working paper
3. Cuasevic, F.,(2012), ***Economic perspectives on Bosnia and Herzegovina in the period of global crisis,*** St Antony's College University of Oxford
4. Hsing, Yu, Hsieh, W., (2009), ***Response of output in Romania to macroeconomic policies and conditions***, Preliminary paper.
5. Ljuci, E.,Vika, I.,(2011), The equilibrium real exchange rate of lek vis-à-vis euro: is it much misaligned?, Bank of Greece discussion papers
6. Nordhaus, W.,(2005), ***The sources of the productivity rebound and the manufacturing employment puzzle***, NBER working paper
7. Pavlovic, J.,Zivkov D.,Kolar, S.,(2011), ***Macroeconomic performance and political business cycles in Serbia (2000-2009)*** International Conference On Applied Economics – ICOAE 2011
8. Romer, D.,(2000),***Keynesian macroeconomics without the LM curve***, *Journal of Economic Perspectives—Volume 14, Number 2—Spring 2000—Pages 149*
9. Shijaku,G.,Gjokuta,A.,(2013), ***Fiscal policy and economic growth: the case of Albania***, Bank of Albania
10. Taylor, John B. (1993). ***"Discretion versus Policy Rules in Practice***". *Carnegie-Rochester Conference Series on Public Policy* **39**: 195–214. (The rule is introduced on page 202.)

**APPENDICES**

**Appendix 1**

Wooldridge test for autocorrelation in panel data

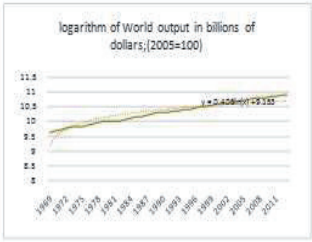
$H_0$: no first-order autocorrelation

F(1,3) =49.655

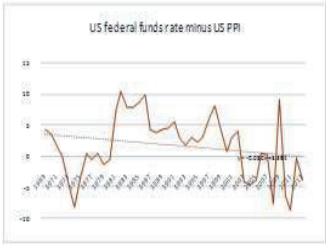
Prob > F =0.0059

Appendix 2

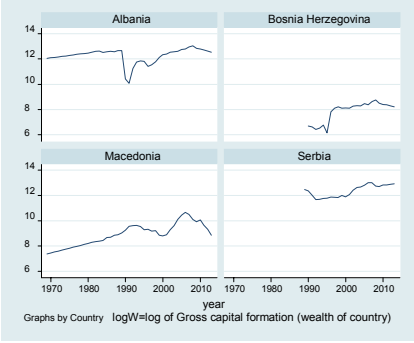
Logarithm of world output (2005=100)



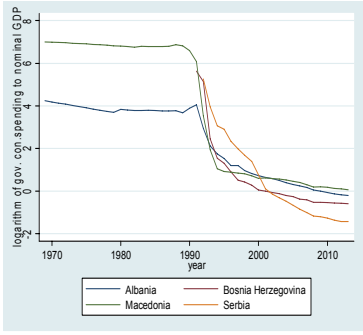

Logarithm of world interest rate



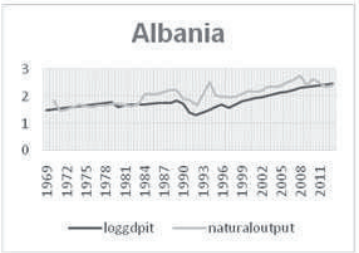

Logarithm of world capital formation

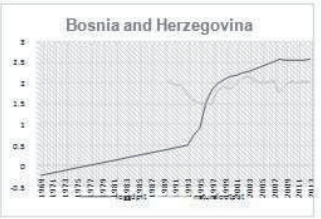


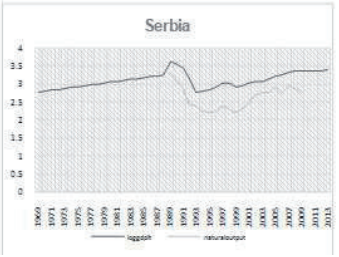

Log. of gov. spending to nominal GDP

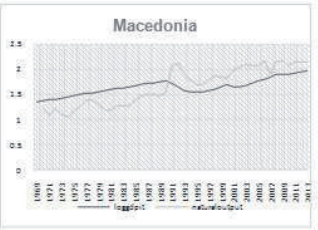


**Natural (trend) and actual output plots**



# New-Keynesian economics tales with some algebraic notations

**DushkoJosheski**[18]

Researcher in the field of applied economics, and small Keynesian macroeconomic models

**Abstract**

In this paper are outlined some new-keynesian economic models along with their micro foundations. At first small model of interest rate consumption income and savings has been outlined.Modigliani-Millermodel follows as one of the five neutralities in macroeconomics, and demand for money by Miller and Orr. Also Baumol-Tobin models with its extensions by Jovanovic and Romer has been subject to investigation. Issues in monetary policy such as printing money and government revenues of printing money are been subject to discussion too. In the last section Diamond-Dybvig model on bank runs is being outlined.

**Keywords**: New-Keynesian economics, interest rate, monetary policy, money demand, bank runs

[18] Correspondent author email: dushkojosheski@gmail.com

## 1. Introduction

Keynesian economics since *The General Theory* revealed one fundamental error of classical economics that equilibria in a capitalist economy can persist but with high involuntary unemployment. But also Keynes showed that aggregate demand play crucial role in determining the output and employment. Keynesian economics it is said that violates the assumptionthat good economics is conditioned by, and that is the notion that microeconomic foundation are based on perfectly rational economic agents, Akerlof, Yelen (1980)[19].During the decade of 1960's and 1970's Keynesians have struggled to formulate micro foundations for their Keynesian models and they were relaxing the Walrasian assumptions by introducing market imperfections such asasymmetric informations,Akerlof(1970)[20],Stiglitz(1976)[21],staggered contracts,Taylor(1980)[22], transaction cost theories papers such as: Baumol(1952)[23],Tobin(1956)[24].Now, in the following sections of the paper are explained some of the new-keynesian economics tale along with some proofs.

.

## 2. Interest rate consumption income and savings

A representative consumer maximizes:

$\int_0^{\infty} u[c(t)]e^{-\delta t}dt$(1)

Subject to

$\dot{a} = y + ra - c$, a(0) is givenwhere y and rare constant through time, y is perishable output, and a represents a stock of interest-bearing real financial assets. We do not necessarilyimpose that the subjective discount rate $\delta$is equal to the market real interest rate r. A no-Ponzi condition also is imposed on

[19]Akerlof, George A &Yellen, Janet L, (1987). "***Rational Models of Irrational Behavior***," American Economic Review, American Economic Association, vol. 77(2), pages 137-42, May

[20]Akerlof, George A, 1970. "***The Market for 'Lemons': Quality Uncertainty and the Market Mechanism***," The Quarterly Journal of Economics, MIT Press, vol. 84(3), pages 488-500, August.

[21] M. Rothschild, J. E. Stiglitz: "***Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information***", Quarterly Journal of Economics, 90, 1976, 629–649.

[22]Taylor,B.,J.,(1980), ***Aggregate dynamics and staggered contracts***, The journal of political economy ,Vol.88

[23]Baumol, William J., (1952), "***The Transactions Demand for Cash: An Inventory Theoretic Approach"***, *Quarterly Journal of Economics*, November, vol. 66, pp. 545–556.

[24]Tobin, James, (1956), "***The Interest Elasticity of the Transactions Demand for Cash***", *Review of Economics and Statistics*, August, vol. 38, no. 3, pp. 241–247.

the problem. This means that for a consumer with a market discount factor $\rho_t$ we have the following budget constraint:

$$B_t \leq E_t \sum_{s=0}^{\infty} \beta^s \frac{\rho_{t+s}}{\rho_t}(Y_{t+s} - C_{t+s}) \quad (2)$$

This corresponds to a period budget constraint and no –ponzi condition of form:

$$C_t \leq Y_t - \beta^{-1}\rho_t^{-1}B_{t-1} + B_t (3)$$

$$\lim_{T\to\infty} E_t[\beta^T \rho_{t+T} B_{t+T}] (4)$$

For the isoelastic function we have

$$u(c) = \frac{c^{1-\frac{1}{\sigma}}-1}{1-\frac{1}{\sigma}} (5)$$ y and r , are constant through time

Hamiltonian for this problem is:

$$H = u(c) + \lambda(y + ra - c) (6)$$

First order conditions are:

$$\frac{\partial H}{\partial c} = u'(c) - \lambda = 0 \quad (7)$$

$$\dot{\lambda} = \lambda\delta - \frac{\partial H}{\partial c} = \lambda(\delta - r) (8)$$

$$0 = \lim_{t\to\infty} e^{-\delta t}\lambda(t)a(t) (9)$$

First derivative of consumption is:

$$u'(c) = c^{-1/\sigma} (10)$$

The last equation can be written as:

$$u''(c)\dot{c} = u'(c)(\delta - r) (11)$$

Or as

$$\frac{\dot{c}}{c} = \frac{-u'(c)}{cu''(c)}(\delta - r) = \sigma(r - \delta) (12)$$

The solution for linear differential equation describing consumption path is:

$$c(t) = c(0)e^{\sigma(r-\delta)t} (13)$$

integrating a(0) , and imposing no-ponzi condition preventing unlimited debt, the intertemporal budget constraint is :

$$a(0) = \int_0^{\infty} [c(t) - y]e^{-rt}dt (14)$$

if we substitute the equation for $c(t)$ in the last equation than we need to solve the equation:

$$a(0) = \int_0^{\infty} \left[c(0)e^{\sigma(r-\delta)t} - y\right]e^{-rt}dt (15)$$

$$c(0) = \frac{a(0)+\left(\frac{Y}{r}\right)}{\int_0^{\infty}\left[e^{\sigma(r-\delta)t}\right]e^{-rt}dt} = \frac{a(0)+\left(\frac{Y}{r}\right)}{\int_0^{\infty} e^{\sigma(r-\delta)t-rt}dt} = \frac{a(0)+\left(\frac{Y}{r}\right)}{\left[\sigma(r-\delta)-r\right]^{-1}\left[e^{\left[\sigma(r-\delta)t-rt\right]}\right]_0^{\infty}} = [\sigma\delta - (\sigma-1)r]\left[a(0) + \left(\frac{Y}{r}\right)\right]$$
(16)

The assumption that $(\sigma - 1)r - \sigma\delta = \sigma(r - \delta) < 0$, $\lim_{t\to\infty} e^{[\sigma(r-\delta)t-r]t} = 0$

Looking at the preceding consumption function, we see the three ways a rise in the interest rate r will affect saving:

The marginal propensity to consume out of total wealth is $\sigma\delta - (\sigma - 1)r$ : When r rises, that coefficient falls with an effect proportional to σ. This is the substitution effect.The substitution effect is counteracted by an effect proportional to unity that tends to make $\sigma\delta - (\sigma - 1)r$ to rise when r rises. This is the income effect. The coefficient $(\sigma - 1)$in the marginal propensity $\sigma\delta - (\sigma - 1)r$ captures the balance between the substitution and income effects. In addition, y/r falls when r rises - there is a fall in lifetime wealth and so consumption falls. This is the wealth effect.

### 3. Modigliani –Miller theorem

Firms raise capital by issuing debt as well as equity too. So the firm can issue equity shares E, and bonds B, to finance its investment in capital K. Forms can find itself in two states S, and in two periods. The payoff to the investment tomorrow is $A(s)F(K)$for$s \in S$. For simplicity assumption of depreciation of capital is that$\delta = 1$. Risk free interest rate on the markets is, firms borrowing rate is $\tilde{r}$. The firm will owe to its bondholders $(1+\tilde{r})B$ in every state but the bankruptcy states are given as $S_B$ and non-bankruptcy states are given as$S_{NB}$. And the total set of states is the one that consists of bankruptcy and non-bankruptcy states$S = S_B \cup S_{NB}$. When in bankruptcy, the total output of the firm is insufficient to cover debt payments; so$(s)F(K) < (1+\tilde{r})B$. In this case bondholders are senior claimants and get whatever there it is while equity holders get nothing.

$$\text{equity holder payoff} = \begin{cases} A(s)F(K)-(1+\tilde{r})B \ \forall s \in S_{NB} \\ 0 \forall s \in S_B \end{cases}$$

$$\text{bond holder payoff} = \begin{cases} (1+\tilde{r})B \ \forall s \in S_{NB} \\ A(s)F(K) \forall s \in S_B \end{cases}$$

The value of the equity of the firm is given as:

$$E = \sum_{s \in S_{NB}} \frac{p(s)(A(s)F(K)-(1+\tilde{r})B)}{1+r} = K - B$$

(17)

In order lenders to get the same rate of return as they would in risk free lending we can write;

$$\sum_{s \in S_{NB}} \frac{p(s)(1+\tilde{r})B}{1+r} + \sum_{s \in S_B} \frac{p(s)A(s)F(K)}{1+r} = B$$

(18)

$$1+\tilde{r} = \frac{B-\sum_{s \in S_B} \frac{p(s)A(s)F(K)}{1+r}}{\sum_{s \in S_{NB}} \frac{p(s)(1+\tilde{r})B}{1+r}} \quad (19)$$

$$V = E + B = \sum_{s \in S_{NB}} \frac{p(s)A(s)F(K) - (1+\dot{K})B}{1+r} + \sum_{S \in S_{NB}} \frac{p(s)(1+\dot{K})B}{1+r} + \sum_{S \in S_B} \frac{p(s)A(S)F(K)}{1+r} = \sum_{S \in S} \frac{p(s)A(S)F(K)}{1+r} = K$$

(20)

Previous expression is the basic Modigliani-Miller theorem, the firm's market value is simply the value of its outputs across future states of nature. The division of claims between equity and debt is irrelevant. Also, this theorem is irrelevant for the investment rule, i.e. investment rule is unaffected by the mode of finance, debt or equity. The Tobin's q is more sophisticated it assumes that capital is costly to install. Key assumption of the model is that there exist convex installation costs $\frac{\chi}{2}(I^2/K)$. This are the cost that incur for the installing the new capital. So, therefore firm's discounted profit stream at date t can be presented:

$$\Pi(t) = \int_t^{\infty} e^{-r(s-t)}[A(s)F(K(s),L(s)) - w(s)L(s) - I(s) - \frac{\chi}{2}(I(s)^2/K(s)]ds$$

(21)

The last expression is maximized subject to constraint, $\dot{K}(s) = I(s)$.The interest rate is assumed to be constant. Hamiltonian for this case is:

$$H = AF(K,L) - wL - I - \frac{\chi}{2}(I^2/K) + qI$$

(22)

We differentiate with respect to the two controls setting the result to zero, to obtain:

$$AF_L(K,L) = w$$

$$\frac{I}{K} = \frac{q-1}{\chi} \quad (23)$$

Investment is positive when the value of installed capital exceeds the replacement cost.

$$\dot{q} - rq = -\frac{\partial H}{\partial K} \quad (24)$$

That is by:

$$\dot{q} - rq = -AF_K(K,L) - \frac{\chi}{2}(I/K)^2 \quad (25)$$

Dynamic equations of the model can be written as:

$$\dot{q} - rq = -AF_K(K,L) - \frac{(q-1)^2}{2\chi} \quad (26)$$

$$\dot{K} = \left(\frac{q-1}{\chi}\right)K (27)$$

The steady state of the models incur where $\bar{q} = 1$ and $AF_K(K,L) = r$.Now, the general solution for a constant interest rate is given as:

$$q(t) = \int_t^{\infty} e^{-rs}\left[AF_K\left(K(s),L(s)\right) + \frac{\chi^2}{2}\left(\frac{I(s)}{K(s)}\right)^2\right]ds + be^{rt} \quad (28)$$

Where we have made substitution

$$\frac{(q-1)^2}{2\chi} = \frac{\chi}{2}\left(\frac{I}{K}\right)^2 (29)$$

The economically relevant solution imposes the transversality condition:

$$\lim_{t\to\infty} e^{-rt}q(t)K(t) = 0 (30)$$

Which obliges us to set b=0 in that case:

$$q(t) = \int_t^{\infty} e^{-rs}\left[AF_K\left(K(s),L(s)\right) + \frac{\chi^2}{2}\left(\frac{I(s)}{K(s)}\right)^2\right]ds \quad (31)$$

This way defined is marginal q, the relationship between average and marginal q I given this way:

$$\frac{d(qK)}{dt} = q\dot{K} + \dot{q}K = rqK\left(AF_K K + \frac{\chi I^2}{2K}\right) + qI = rqK - \left[AF(K,L) - wL + \frac{\chi I^2}{2K}\right] + I\left(1 + \chi\frac{I}{K}\right) = r(qK) - \left[AF(K,L) - wL - I - \chi\frac{I^2}{2K}\right]$$
(32)

Imposing the transversality condition

$$q(t)K(t) = \int_t^{\infty} e^{-r(s-t)}\left[A(s)FK(s),L(s) - w(s)L(s) - I(s) - \frac{\chi}{2}\left(\frac{I(s)^2}{K(s)}\right)\right]ds = \Pi(t) (33)$$

From the previous expression one can see that marginal q and average q are equal i.e.:

$$q = \frac{\Pi}{K} .(34)4. \textbf{Miller-Orr model}$$

This is inventory model of the demand for money. Following Miller &Orr (1966)[25] model and Baumol(1952) and Tobin (1956), now generalizing Irving Fischer, Akerlof (1969)[26], lets demand for money to be written as:

$$L = L(P, S) \quad (35)$$

Where P are autonomous payment flows, actually P is a vector of probabilities of nonzero autonomous payments, S is representing policies whereby bank accounts are monitored, or S are the monitoring rules whereby banks are monitored to have them prevented of them having too high or too low balance. Irving Fischer S, is a vector of time intervals that present average lag which purchases follow autonomous receipts in different banks. In the standard monetarist theory of Irving Fisher persons receive money on their bank accounts. The flows are proportional to income.

$$L = L\left(Y, \frac{P(Y,r,E)}{Y}, S\right) \quad (36)$$

In the previous expression Y denotes aggregate income, r is the rate of interest and E is the vector of aggregate expenditures, the probabilities of non-zero transactions depend on income, interest rate and expenditures so: $P = P(Y, E, r)$.Most theories on demand for money state:

$$L = L(P(Y), S(Y, r)) \quad (37)$$

S in the previous expression is the monitoring rule. If the monitoring rule is constant and income changes, the demand for money will change proportionately. The implication is that short run demand for money is proportional to income, so this will make LM curve vertical in the short run so shifts in IS curve have no effect on equilibrium. We can modify Miller &Orr model so that :

$$p + q + s = 1 \quad (38)$$

Where p is probability of getting one dollar, q is probability of losing one dollar, s is the probability of no transition. So, that expected value of autonomous payments and

[25]Miller, M. & Orr, D. (1966). ***A model of the demand for money by firms***. The Quarterly Journal of Economics, 81, 413-435

[26]Akerlof, George A, 1979. ***Irving Fisher on His Head: The Consequences of Constant Threshold-Target Monitoring of Money Holdings***, The Quarterly Journal of Economics, MIT Press, vol. 93(2), pages 169-87, May.

expected value of induced payments is zero. First let's consider the distribution of money holdings:

$$f|p, q, s, h, z \quad (39)$$

f(x) is dependent only on p/q, h and z. One can find this by setting f(x,t) = p f(x-1, t-1) + sf(x,t-1), + qf(x+1, t-1) . Now if we denote long run demand for money as $m_t^s$, and demand for money in the previous period as $m_{t-1}$. So that $m_t$ is the geometric mean of real money balances. This means that:

$$m_t = (m_t^s)^Y (m_{t-1})^{1-Y} \quad (40)$$

Suppose that long run demand for money depends upon income and interest:

$$m_t^s = y_t^a + r_t^{-\beta} \quad (41)$$

Where in the previous expression $m_t^s$ is the L-R demand, $a$ is the L-R income elasticity of demand, $\beta$is the L-R interest elasticity of demand. Then we can write like:

$$m_t = y_t^{aY} r_t^{a\beta} m_{t-1}^{1-Y} \quad (42)$$

And if we put the previous expression in logarithm:

$$\ln m_t = a\gamma \ln Y_t - \beta\gamma \ln r_t + (1-\gamma)\ln m_{t-1} \quad (43)$$

In the previous expression $\gamma$ is the rate of adjustment, $a\gamma$ represents short run income elasticity of the demand, $\beta\gamma$ is the short-run elasticity of the demand, $a$ represents long-run income elasticity of the demand, $\beta$ represents long run interest elasticity of the demand. Ignoring the constant term one can write following equation:

$$\ln m_t = \alpha\gamma \sum_{i=0}^{\infty} (1-\gamma)^i \ln y_{t-1} - \beta\gamma \sum_{i=0}^{\infty} (1-\gamma)^i \ln r_{t-1} \quad (44)$$

Now, the level of investment is the constant fraction of the deviation of the capital stock from the optimum:

$$I_t = K_t - K_{t-1} = \alpha(K_t^* - K_{t-1}) \quad (45)$$

In the previous expression $K_t^*$ is some function, let us say of income, the cost of capital, and maybe cost of labor. Caballero, Engel, and Haltiwanger (1997)[27], call the deviation from desired capital stock from actual "mandated investment". In the previous expression $K_t^* - K_{t-1}$ is the mandated investment. If the fraction of investment gap between $K_t^* - K_{t-1}$ is named$A(x)$, in other words the investment rate of the firm than will be:

$\frac{1}{K} = A(x)$xor

$I = \int A(x)f(x)dx$(46)Proportional money supply is $p^*$ , and this proportional money supply$p^* = m$, also $p^*$ is the long run optimal price, and the loss of non-setting the optimal price is:

$k(p - p*)^2$(47)

Let's suppose that there is fixed costs of changing price, denoted a .Now, let's suppose that log of the money supply follows random walk. With, probability ½ the gap p-p* rises by 1. And with probability ½ p-p* falls by 1. Than the optimal policy has upper threshold: p*+U at which p is set to equal its target value p*. A, symmetric lower threshold is: p*-U. So, an optimal cash policy according to Miller and Orr (1966)[28], will ask for an investment in a periodical receipts in the earning assets followed by regular timed sequence of security transfers

## 5. Issues in monetary policy

In general central government has monopoly power to issue money, and also this privilege is a source of revenue. Now, if the private sector is willing to hold paper money that the government supplies, the government can buy real goods and services that the private sector produces with money that is costless for government top print. Money that is not backed by some real commodity are called *fiat money*. The real resources that government acquires by printing fiat money are equal to its *seigniorage* revenue. To define the seignoriage, we first need to know why the private sector is

[27] Caballero, Ricardo J & Engel, Eduardo M R A &Haltiwanger, John, (1997). ***Aggregate Employment Dynamics: Building from Microeconomic Evidence***, American Economic Review, American Economic Association, vol. 87(1), and pages 115-37, March.

[28] Miller, M.,Orr,D.,(2000), ***Amodel of the demand for money by firms***, Quarterly Journal of Economics

willing to accept the government's fiat money, all that matters is that there is demand for it. Seigniorage in period t is given by the expression:

$\frac{M_t - M_{t-1}}{P_t}$(49)

From the last expression one can see that real resources that government acquires through increases in the nominal money balances the public is willing to hold. A useful way to rewrite this is to write:

$\frac{M_t - M_{t-1}}{P_t} = \pi m_{t-1} + (m_t - m_{t-1})$(50)

In the previous expression $\pi_t = \frac{P_t - P_{t-1}}{P_t}$, and money demand is $m = \frac{M}{P}$, this expression emphasizes two distinct sources of seigniorage. First, the inflation tax, the amount people must give to the government to hold their real money balances constant in that face of rising prices. Second, it is the public desire to alter its real money holdings, given the inflation rate. Seigniorage at time t is:

$\frac{\dot{M}(t)}{P(t)} = \pi(t)m(t) + \dot{m}(t)$(51)

We observe that seigniorage need not to equal the inflation. In the classic application of the interrelatedness between seigniorage and monetary policy by Sargent and Walace (1981)[29], it is said that monetary base is closely connected to the inflation, represented by the price level, and that the monetary authority can raise seignorage, by which is meant revenues from creation of money. We know the following identity: $i = r + \pi$, i.e. that nominal interest rate equals real plus the inflation, so one can solve:

$\frac{d}{d\pi}\pi m(r + \pi) = 0$(52)

The last expression yields the following result:

$m + \pi m'(i) = 0$(53)

[29]Thomas J. Sargent & Neil Wallace, 1981. "***Some unpleasant monetarist arithmetic***," Quarterly Review, Federal Reserve Bank of Minneapolis, issue Fall.

Or this can be rewritten:

$$-\frac{\pi m'(i)}{m} = 1 \quad (54)$$

From the last formula one can point out to the money demand curve where the inflation elasticity is 1. This is standard formula that instruct us to look at money demand curve where the inflation elasticity is 1. And also standard formula where marginal costs of producing money equals to marginal revenue from creating it. Nominal money supply M is not changed at time t=0 when $\pi$ rises.

$$m'(i) = \frac{dm}{d\pi} = \frac{-M}{P^2}\frac{dP}{d\pi} = -\frac{1}{P}\frac{dP}{d\pi}m \quad (55)$$

The equation for the total discounted seigniorage revenue reduces to:

$$\int_0^{\infty} e^{-rt}[(m + \pi m'(i)]dt \quad (56)$$

This solution is somewhat problematic because it entails an unexpected expropriation of private sector wealth to:

$$\frac{1}{P}\frac{dP}{\pi}m \quad (57)$$

Let's suppose that the government has promised to avoid surprise changes in the value of real balances, so in such a case small rise in inflation would rise government seigniorage revenue by:

$$m'(i) + \int_0^{\infty} e^{-rt}[(m + \pi m'(i)]dt \quad (58)$$

The reason to ensure $dP = 0$ when inflation rises, the government must reduce the nominal supply sharply, it might finance this loss in seigniorage by selling bonds, and it cannot finance it by a surprise inflation tax on the private sector as before. If we set the last expression to be equal to zero one can find that:

$$m'(i) + \frac{m + \pi m'(i)}{r} = 0 \quad (59)$$

Or after the simplification:

$$-\frac{\pi m'(i)}{m} = 1 \quad (60)$$

This is the solution which sets interest elasticity of the demand for money to be equal to 1. Now, if the initial private money balances are $m_0$, and initial price level, at different levels of $i$. Now, one can find that:

$$\int_0^{\infty} e^{-rt} im(i)\,dt - m_0 \quad (61)$$

And the economy wide resource constraint one can set by the following formulation:

$$f(0) = \int_0^{\infty} e^{-rt}[c(t) + g(t) - y(t)]dt \quad (62)$$

this constraint comes from the fact that domestic money is not held by foreigners, and domestic residents hold no money issued by foreign governments.

## 6. Baumol-Tobin model

Baumol-Tobin model is and economic model of transaction demand[30],this model was developed by Baumol(1952),and Tobin (1956). Later was extended by Jovanovic(1982)[31] and Romer (1986). First,one can start by using the utility function from Romer (1987)[32]

$$U = \int_{t=0}^{T} \ln c\,(t)\,dt - an \quad (63)$$

In the previous expression capital letter T is the life time of the consumer, C(t) is the consumption at some age t, that lies in the interval between 0 and T. Also, $a$ is the interval between withdrawals money from bank $a \in [0, \tau]$. While, n is the total number of conversions of bank deposits into money that individual makes throughout his life time. Now in the equilibrium model one must introduce inflation $\pi(t)$ and interest rate $i(t)$ .Now, if the nominal interest rate is constant the number of trips to the bank would be given as per this expression:

$$\tau = \sqrt{\frac{2a}{i}} \quad (64)$$

[30] Transaction demand in Keynesian economics is one of the determinants of the demand for money.

[31] Jovanovic, Boyan, (1982), "***Inflation and Welfare in the Steady State***", *Journal of Political Economy*, vol. 90, no. 3, pp. 561–577.

[32] Romer,D.,(1987), ***The monetary transmission mechanism in a general equilibrium version of the Tobin-Baumol model***, Journal of Monetary Economics, 20(1987

But if one solves the utility function will get following result:

$U = T\ln c(t) - an$(65)

Higher inflation on the other hand makes it more costly one to hold money, so the real money balances are reduced by an increase in frequency in which people convert their capital into money.

$\frac{\partial \tau}{\partial \pi} < 0$(66)

Real money balances are equal to $= \bar{x} - b$ , where m are real money balances or $\frac{m}{p}$; $\bar{x}$ represents the capital that has been bought $b$ represents the cost of marketing the capital. This marketing cost in Jovanovic (1982) model represents same as brokerage fee in Tobin and Baumol models. Otherwise government expands or shrinks the money supply by constant rate $\pi$ ,the period during which an individual is using his real money balances is $\tau$ . Now let:

$m = c(m, \pi, \tau) \int_0^{\tau} e^{\pi t}\, dt$(67)

now when solving the integral $\int_0^{\tau} e^{\pi t}\, dt$ with replacing $u = \pi t$ and $du = \pi dt$ or $\frac{du}{\pi} = d\tau$,and if one replace $\int_0^{\tau} e^{u} \frac{1}{\pi} du$ we can simplify so that $\int \frac{e^u}{\pi} du$now the result from last expression is $\frac{e^u}{\pi}$ , now if one replace $u = \pi\tau$and solves for $\frac{e^{\pi t}}{\pi} + C$ , and with upper minus lower bound the result is $\frac{e^{\pi t} - 1}{\pi}$ . And now one can write:

$m = c(m, \pi, \tau) \frac{e^{\pi \tau} - 1}{\pi}$ (68)

or:

$c(m, \pi, \tau) = \frac{m\pi}{e^{\pi \tau} - 1}$(69)

so when inflation is $\pi > 0$,inflation erodes purchasing power parity of money and so $c(m, \pi, \tau) < \frac{m}{\tau}$(70)

Inflation also is greater or equal to the negative rate of time preferences$a$

$\pi \geq -a$(71)

The brokers fee that individual pays for withdrawal of assets is given as $\frac{bT}{c}$ ,and if he holds cash his annual interest cost than will be $\frac{ic}{2}$.Now in order to find minimal costs in order individual to pay for his we apply first derivative with respect to *c* on $\frac{bT}{c}+\frac{ic}{2}$

$$-\frac{bT}{c^2}+\frac{i}{2}=0 \quad (72)$$

or of one simplifies for c in the last expression one can get:

$$c=\sqrt{\frac{2bT}{i}} \quad (73)$$

or either way the general solution in the inventory models for demand of money is given by the expression, Baumol,Tobin(1989)[33]:

$$\frac{M}{m}=\sqrt{\frac{rV}{2im}} \quad (74)$$

Now for a micro-foundations of the previous equation. Here shortly will be introduced the model by Miguel Sidrauski(1968)[34].This model is about individual household utility ,total welfare of the family is given by :

$$W=\int_0^{\infty}[U(c_t,m_t)]\,e^{-\alpha t}dt \quad (75)$$

The previous equation input can be presented as:

$$W=\int_0^{\infty}\frac{[U(c_t,m_t)]}{e^{\alpha t}}dt \quad (76)$$ or:

$$\int_0^{\infty}[U(c_t,m_t)]\,e^{-\alpha t}dt=\frac{[U(c_t,m_t)]}{\alpha} \quad (77)$$

The last expression means that wealth of households depends on utility proportionally, but it decreases as subjective time preferences of the family grow. Utility depends on real money balances. The following identity it has been imposed:

[33]Baumol, William J. and Tobin, James (1989), "***The Optimal Cash Balance Proposition: Maurice Allais***' Priority", *Journal of Economic Literature*, September, Vol. 27, No. 3, pp. 1160–1162.

[34]Sidrauski, Miguel (May 1967). "***Rational Choice and Patterns of Growth in a Monetary Economy***". *American Economic Review* **57** (2): 534–544.

$y(k_t) + g_t = c_t + s_t$(78)

$y(k_t)$ is the homogenous output that is produced by the capital stock, $g_t$ are the government transfers, $c_t + s_t$ is the real consumption plus gross real savings. Rate of time preferences can be presented by the following equation[35]:

$e^{-\alpha n} = 1 - \alpha n$(79)

And the interval between trips to bank $\tau$ can be presented by the following formulation:

$\tau = \frac{T}{n+1} = \sqrt{\frac{2\alpha}{t}}$(80)Which is the expression that previously has been derived. Now consumer spends in different ages of his life time. The utility maximization principle requires that at the margin individual is indifferent whether he or she will spend at $t_o$ or at some later time t, i.e. $t_0 < t < t_1$ , individual withdraw money at $t_0$ and spends it at $t_1$.

$\frac{U'(c(t_0))}{p(t_0)} = \frac{U'(c(t))}{p(t)}$(81)

In the previous expression *p*, represents the nominal price of the consumption good. In this version output can be written as in usual way $= f(k)$ , and the usual assumptions here hold that $f'(\cdot) > 0$ ,$f''^{(\cdot)} < 0$, $f'(0) = \infty$ and $f''(\infty) = 0$. The real interest rate is $r = f'(k)$. The wage is $E = y - rk$. Now if W is the individual wealth or that is $W = E + S$, where is the initial Endowment that person receives at his/hers birth and S are the lump sum transfers that individual receives throughout his/hers lifetime. And, $w = \frac{W}{T}$, or $w = \frac{E+S}{T}$, consumption also at age t is given by the expression:

$c(t) = we^{rj\tau}e^{-r(t-j\tau)}$(82)

In the previous expression $j\tau$ is the time interval where $j\tau < t < (j+1)\tau$ , last expression implies abot the contribution of generations to the total consumption:

$C_j = \frac{1}{T}\int_0^{(j+1)\tau} we^{rj\tau}e^{-r(t-j\tau)}dt = \frac{1}{T}\frac{1-e^{-r\tau}}{r}e^{rj\tau}w$(83)

[35] Romer,D.(1986), ***A simple general equilibrium version of the baumol-tobin model****, The quarterly journal of economics

The total consumption is $C = \sum_{j=0}^{n} C_j = \left[\frac{1-e^{-n\tau}}{n}\right]\left[\frac{e^{rT}-1}{e^{\tau}-1}\frac{\tau}{T}\right]w$ , and for $= \frac{w}{r}\left[\frac{\tau}{T}\frac{e^{rT}-1}{e^{rT}-1} - 1\right]$ , now substituting the last two expressions in :

$$\frac{1}{T}\int_0^T C(t)dt = \frac{E}{T} + r_0\frac{1}{T}\int_0^T K(t)dt \qquad (84)$$

One can get

$$w = \frac{E+S}{T} = \frac{n\tau}{1-e^{-n\tau}}\frac{E}{T} \qquad (85)$$

Now in the extension Romer inserts government in the model. Government can inject money not by transferring to individuals but by purchasing goods. So, now the extension of the models looks a like this:

$$G = \frac{E}{T} + r_0\frac{1}{T}\int_0^T K(t)dt - \frac{1}{T}\int_0^T C(t)dt \qquad (86)$$

In this economy there are no lump sum transfer so $w = \frac{E}{T}$ , and equilibrium life time endowments can be presented such as:

$$w^* = \frac{1}{T}\int_0^T W(t)e^{-rt}dt \qquad (87)$$

Aggregate money holdings between ages $j\tau$ and $(j+1)\tau$ are:

$$m_j = \int_{j\tau}^{(j+1)\tau} W_j\frac{(j+1)\tau - t}{\tau}e^{-n(t-j\tau)}dt = W_j\frac{e^{-n\tau} + n\tau - 1}{n^2\tau} \qquad (88)$$

In general Romer (1986) version, is general equilibrium model, where one can see and study money demand, the effect on inflation on consumption the optimum quantity of money.

## 7. Financial instability and Diamond-Dybvig model

In the Diamond-Dybvig model (1983)[36] banks as financial intermediaries promote risk sharing among individuals, but also they are subject of intermediary panics. Authors at first explain that bank runs are common feature of extreme crises in monetary history. In the model there are three periods, i.e. $T = 1,2,3$. Also there are two existing and possible technologies. Investment of one unit of output at T=0, yields one unit of output

[36] Diamond DW, Dybvig PH (1983). "***Bank runs, deposit insurance, and liquidity***". *Journal of Political Economy* **91** (3)

in period 0 and one unit of output in period 2. This is when one uses short technology to produce, but when one uses long technology to produce at T=0, this yields 0 units of output in period one and more than one r>1 units in period 2. Individuals need not to specify the technology that they are using or *exante* choosing. The idea is that more roundabout technologies are more productive. They opt for a short run or long run technology depending on the harvesting of yield in period 1 or period 2. There exist two types of utility functions:

$$U(c_1; c_2; 1) = U(c_1) \quad (89)$$

$$U(c_1; c_2; 2) = U(c_1 + c_2) \quad (90)$$

In the previous expression $\lim_{c\to\infty} u'(c) = \infty$ and $\lim_{c\to\infty} u'(c) = 0$; $-\frac{cu''(c)}{u'(c)} > 1$.

The person will choose $c_1 = 1$ if turns out to be impatient and $c_2 = r$ if patient.

Expected or average utility of that person is given by the following expression:

$$EU = pu(1) + (1-p)u(r) \quad (91)$$

So, agents (people) can do better than this if there are intermediaries. And, now some benevolent social planner would withdraw 1-x from the investment on T=1, so as to maximize the expected utility of a representative individual.

$$pu(c_1^1) + (1-p)u(c_1^2 + c_2^2) \quad (92)$$

Previous expression is subject to resource constraint:

$$p(c_1^1) + (1-p)(c_1^2) = 1 - x \quad (93)$$

$$(1-p)(c_1^2) = rx$$

In the previous expression in general $c_i^j$ are the resources that type *i* consumes in period *j*. It is always optimal that $c_1^2 = 0$. Now the simpler problem to maximize is given by:

$$\max_{c_1^1, c_2^2} pu(c_1^1) + (1-p)u(c_2^2) \quad (94)$$

The last expression is being maximized subject to:

$$p(c_1^1) + (1-p)\frac{(c_2^2)}{r} = 1 \quad (95)$$

and if $\lambda$ is the Lagrangian,the first order conditions for maximization are given by the expression:

$$u'(c_1^1) = \lambda$$

$$u'(c_2^2) = \lambda/r \quad (96)$$

$$\frac{u'(c_1^1)}{u'(c_2^2)} = r$$

The budget constraint of the social planner is given by the following expression:

$$c_2^2 = \frac{r}{1-p} - \frac{pr}{1-p} c_1^1 \quad (97)$$

Now, there are banks in our economy as they exist in reality too. Let's consider that there exists bank contracts. Such a contract so that everyone deposits their resources in the bank at time T=0.So, those that are patient people can withdraw money $r_1 > 1$ in period 1. Their withdrawals will be monitored by the bank. Patient depositors will get their pro rata of what is left after period one withdrawal. Banks will implement social optimum $r_1 = c_1^{1*}$ , where in the previous expression asterisk denotes social optimum. But some fraction of the depositors, those impatient will withdraw money at period, then the patient consume balance $\frac{r(1-p\,c_1^{1*})}{1-p} = c_2^{2*}$. Now, lets suppose that $V_1$ is the payoff one gets when one withdraws in period one, $V_2$ is the payoff that one gets in period two if one does not withdraw in period one. Because the payoff depends on the place one has in the line, if $f_j$denotes the number of the depositors served before depositor j on date one, and if $f$ represents the total number of withdrawals on date one than one can have:

$$V_1(f_j, r_1) = \begin{cases} r_1 \text{ if } f_j r_1 < 1 \\ 0 \text{ if } f_j r_1 \geq 1 \end{cases} \quad (98)$$

And if:

$$V_2(f, r_1) = \max\left\{\frac{r(1-r_1 f)}{1-f}, 0\right\} \quad (99)$$

The first best equilibrium is such that $f = p$:

$$V_2(f,r_1) = V_2(f,c_1^{1*}) = \frac{r(1-pc_1^{1*})}{1-p} = c_2^{2*}$$

(100)

So now if $r_1 = 1$ then we would have $V_2(f,1) = \max\{r,0\} = r$and the patient types of depositors would never have incentive to withdraw at period one. To do better we need r>1,either way banks would never be better than autarky. So when r>1 there would be a depositor panic and run on the bank. Now if $= \frac{1}{r_1}$ , the depositors one can expect to withdraw all of their deposits at T=1,thus making $V\left(\frac{1}{r_1}, r_1\right) = 0$,so now every depositor has incentive to join the front of the queue of depositors in front of the bank ,in hope one to get his money out. So in this equilibrium everyone will do the same and some depositors will be left empty handed. No depositor will get money at T=2.The bank thus will have failed. Now, will get back shortly the notion that by assumption that relative risk aversion$pr > 1$ ,and since relative risk aversion always exceeds 1, the optimal consumption levels will satisfy these conditions:

$c_1^{1*} > 1$ and$c_2^{2*} > r$

The proof for the last according to the Diamond and Dybvig (1983)

$$pru'(r) < ru'(r)$$

$$= 1 * u'(1) + \int_{\varphi=1}^{r} \frac{\partial}{\partial\varphi}[\varphi u'(\varphi)]d\varphi$$

$$= u'(1) + \int_{\varphi=1}^{r}[u'(\varphi) + u''(\varphi)]d\varphi < u'(1) \qquad (101)$$

Because$u' > 0$ and for all $(\forall\varphi) - \frac{u''(\varphi)\varphi}{u'(\varphi)} > 1$.

## 8. Conclusion

In the late 1970's most of the economist declared as new-classical. It seems that all of the best macroeconomics were at new-classical economics side,Gordon(1990)[37].Yet, Keynesian macroeconomics reemerged again. Nowadays, it is proven in 1990's and 2000's also that the new–classical macroeconomics prove to be very wrong. Nowadays good guys in economics are new-keynesians and not new-classical economists. It seems that just when the new Keynesian economics was been declared dead, the best papers in Keynesian economics and in economics in general had been written by Keynesian economists. Neo-classical synthesis long run, might just be too long so government and central bank policies are needed.

***References***


[1] Akerlof, George A &Yellen, Janet L, (1987). "***Rational Models of Irrational Behavior***," American Economic Review, American Economic Association, vol. 77(2), pages 137-42, May

[2] Akerlof, George A, (1970). "***The Market for 'Lemons': Quality Uncertainty and the Market Mechanism***," The Quarterly Journal of Economics, MIT Press, vol. 84(3), pages 488-500, August.

[3] Akerlof, George A, (1979). ***Irving Fisher on His Head: The Consequences of Constant Threshold-Target Monitoring of Money Holdings***, The Quarterly Journal of Economics, MIT Press, vol. 93(2), pages 169-87, May.

[4] Baumol, William J. and Tobin, James (1989), "***The Optimal Cash Balance Proposition: Maurice Allais***' Priority", *Journal of Economic Literature*, September, Vol. 27, No. 3, pp. 1160–1162

[5] Baumol, William J., (1952), "***The Transactions Demand for Cash: An Inventory Theoretic Approach"***, *Quarterly Journal of Economics*, November, vol. 66, pp. 545–556.

[6] Caballero, Ricardo J & Engel, Eduardo M R A &Haltiwanger, John, (1997). ***Aggregate Employment Dynamics: Building from Microeconomic Evidence***, American Economic Review, American Economic Association, vol. 87(1), and pages 115-37, March.


[37] Gordon,J.,R.,(1990), ***What is New-Keynesian Economics***?, Journal of economics literature, Vol. XXVIII

[7] Diamond DW, Dybvig PH (1983). "***Bank runs, deposit insurance, and liquidity***". *Journal of Political Economy* **91** (3): 401–419. doi:10.1086/261155. JSTOR 1837095. Reprinted (2000) *Fed Res Bank Mn Q Rev* **24** (1), 14–23.

[8] Gordon,J.,R.,(1990), ***What is New-Keynesian Economics***?, Journal of economics literature, Vol. XXVIII

[9] Jovanovic, Boyan, (1982), "***Inflation and Welfare in the Steady State***", *Journal of Political Economy*, vol. 90, no. 3, pp. 561–577.

[10] Miller, M. & Orr, D. (1966). ***A model of the demand for money by firms***. The Quarterly Journal of Economics, 81, 413-435

[11] Romer,D.(1986), ***A simple general equilibrium version of the baumol-tobin model****, The quarterly journal of economics

[12] Romer,D.,(1987), ***The monetary transmission mechanism in a general equilibrium version of the Tobin-Baumol model***, Journal of Monetary Economics, 20(1987

[13] Rothschild, M. , J. E. Stiglitz: (1976), "***Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information***", Quarterly Journal of Economics, 90, 1976, 629–649.

[14] Sidrauski, Miguel (1967). "***Rational Choice and Patterns of Growth in a Monetary Economy***". *American Economic Review* **57** (2): 534–544.

[15] Taylor,B.,J.,(1980), ***Aggregate dynamics and staggered contracts***, The journal of political economy ,Vol.88

[16] Thomas J. Sargent & Neil Wallace, (1981). "***Some unpleasant monetarist arithmetic***," Quarterly Review, Federal Reserve Bank of Minneapolis, issue Fall

[17] Tobin, James, (1956), "***The Interest Elasticity of the Transactions Demand for Cash***", *Review of Economics and Statistics*, August, vol. 38, no. 3, pp. 241–247.

# Linear and Non-linear transportation problem: the issue of the translocation of masses

Dushko Josheski * Elena Gelova

"Goce Delcev" University, Stip, R. Macedonia

Abstract

This paper investigates the issue of transportation problem in mathematical economics. The case with the linear and non-linear cost functions are being presented. The issue of transportation problem is in the field of optimization theory. The purpose of the programing is to find a best solution subject to some constraint. In this case the purpose of linear and non-linear transportation problem is to find the optimal transportation and allocation of resources.

Keywords: Monge–Kantorovich transportation problem, Kantorovich–Rubinstein Theorem, non-linear transportation problem,

## Introduction

In this paper the issue of nonlinear and linear transportation problem has been investigated. The problem has been formalized by the mathematician Gaspard Monde in 1781.This problem has been used in economics as well in mathematics in order to study the optimal allocation of resources and optimal transportation. Managers are facing problem how to allocate resources among various activities and projects. And, one of the most important and successful applications of quantitative analysis is in solving business problems in the physical distribution of products, this is commonly referred to as transportation problem. This paper only presents nonlinear and linear transportation problem without explanation of the solutions. With the major contributions by Kantorovich this problem is known already as **Monge–Kantorovich transportation problem.** This problem is augmented with the ***Kantorovich–Rubinstein Theorem*** which states that the minimal $\ell_1$ metric is identical to Lipchitz metric for all $P_1, P_2 \in M(U)$.

* corresponding author email: dushkojosheski@gmail.com

**Nonlinear transport problem**

Transport issues in most cases bound for selecting the best alternative transportation that provides the transport costs to be minimal in terms of certain road and transport assets. However today under the term means and tasks for optimal displacement machines, ancillary services, power stations, etc. in order to achieve greater efficiency of work and time. The classical transportation problem consists in finding the most economical plan of shipping the product of a kind of place of its production to the point of spending. If in $m$-warehouses there are $a_1, a_2, ..., a_m$ quantities, and in $n-$ stores looking for $b_1, b_2$ ..., $b_n$ quantities of a product and the cost of transportation is $c_{ij}$, $(i = 1,2,...,m)$ and $(j = 1,2,...,n)$, for unit product of $i$-th warehouse to $j$- store, the problem of finding economical transportation plan boils down to solving the task

$$\min F(x_{ij}) = \min \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij} \tag{1}$$

with restrictions

$$\sum_{j=1}^{n} x_{ij} = a_i, \qquad \sum_{i=1}^{m} x_{ij} = b_j, \tag{2}$$

where $x_{ij}$ is the amount of product which must be transported from the $i$-th warehouse to $j$-th store. In addition $x_{ij} \geq 0$. The resulting problem is a linear programming problem in which transportation costs $\varphi_{ij}(x)$ are proportional to the respective amounts $x_{ij}$ which are transported i.e.

$$\varphi_{ij}(x) = c_{ij}\ x_{ij}\ . \tag{3}$$

This assumption leads appropriate target function to get a linear dependence.

$$F = \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij}. \tag{4}$$

However, in a series of practical tasks pertaining to solving transportation problems, for the assumption in question before, because it is a cost that is linear in terms of the amount of goods transported, target function is nonlinear function. For example, the cost of transporting the route $(i - j)$ can be changed per square law

$$\varphi_{ij}(x) = a_{ij}\ x_{ij}^{\ 2} + b_{ij} x_{ij}\ , \tag{5}$$

Where the target function can be written in the form

$$F = \sum_{i=1}^{m} \sum_{j=1}^{n} \left( a_{ij}\ x_{ij}^{\ 2} + b_{ij} x_{ij} \right) \tag{6}$$

The target function, depending on the nature of the transport problem can be another form of the nonlinear function. In some cases, it may be given with set discrete values, wherein for certain values $x$ have defaults $\varphi_{ij}(x)$. In this case the analytical dependence $\varphi_{ij}(x)$ is determined by interpolation.

Regardless of what the nonlinear objective function is running, the task of finding the optimal transport plan is reduced to minimization of a given target function with form

$$F = \sum_{i=1}^{m}\sum_{j=1}^{n}\varphi_{ij}(x_{ij}), \tag{7}$$

where $\varphi_{ij}(x_{ij})$ given nonlinear functions that depend on one argument $x_{ij}$ (i.e. separable functions), wherein the unknown $x_{ij}$ must satisfy the set of constraints form

$$\sum_{j=1}^{n} x_{ij} = a_i, \quad (i = 1,.....m) \tag{8}$$

$$\sum_{i=1}^{m} x_{ij} = b_j, \quad (j = 1,....n), \tag{9}$$

$$x_{ij} \geq 0 \tag{10}$$

This formulated task falls in the class of nonlinear programming tasks and called nonlinear transport task.

**The linear mass transportation problem**

Kantorovich (1942)[38], first introduced the problem of optimal mass transport:

$$\int c(x,y)d\mu(x,y) = \inf_{\mu \in M(P_1,P_2)} =: \hat{\mu}_c(P_1,P_2)$$

(11)

in the previous expression $c : U_x \times U_y \to R \cup \{+\infty\}$ [39] is the real cost function R , which is measurable , $P_i \in M(U_i)$ are probability measures of $U_i$. The translocation form x to y, which we denote as $\psi$ will be potential if there exist function

[38] Kantorovich,L.,(1958), ***On the Translocation of Masses***, Management Science, Vol. 5, No. 1 (Oct., 1958), pp. 1-4

[39] Here $U_x \times U_y$ are neighborhoods of the points x and y.

$U_x$ such that $U_y - U_x = r(x,y)$, when $x \to y$, here $r(x,y)$ is continuous nonnegative function, and second condition $U_x - U_y \le r(x,y)$. $\hat{\mu}_c$ is called **Monge-Kantorovich** functional. Or, $\mu$ is a measure called Borel measure, which is defined on σ algebra[40] of Borel sets. Given this function $\int c(x,y)d\mu(x,y)$ that is supposed to be minimized with Monge Kantorovich marginals.

This is done by minimizing cost function $c : U_x \times U_y \to R \cup \{+\infty\}$, and finite positive Borel measures, $\sigma_1 x = \sigma_2 y$ Levin (2006)[41]. In the Borel measures $\sigma_1 = \pi_1 \mu_1$, while $\sigma_2 = \pi_2 \mu_2$ ,and this $\pi_1 \mu_1$ and $\pi_2 \mu_2$ are marginal measures of $\mu$. For any Borel sets $B_1 \subseteq X, B_2 \subseteq Y$, $(\pi_1 \mu)(B_1) = \mu(B_1 \times Y)$ and $(\pi_2 \mu)(B_2) = \mu(B_2 \times X)$. Kantorovich (1942), set $U(y) = \sum_1^n r(x_{i-1}, y_{i-1}) - \sum_1^n r(x_i, y_i)$, and now we suppose that $U$ function is already defined on the domains $D_0, D_1, ....., D_{n-1}$ .Next, about the optimization in transport, and duality theory which is the basis for determining optimal transportation plans and optimal couplings. First, minimal probability metrics $\ell_1$, here $(U, d)$ will be separable metric space (M), and $P_1, P_2 \in M(U)$ will be Borel σ-algebra. Here minimal probability $\ell_1$ metric will be presented as Ruschendorf (2005)[42]:

$$\ell_1(P_1, P_2) = \inf\left\{\int d(x,y)d\mu(x,y); \mu \in M(P_1, P_2)\right\} \quad (12)$$

In the previous expression $\ell_1$ is the minimal version of $L_1$ metric:

[40] σ algebra on a set, is collection of subsets satisfying certain properties.

[41] Levin,V.,(2006), ***Abstract Convexity and the Monge-Kantorovich Duality***, Lecture Notes in Economics and Mathematical Systems Volume 583, 2006, pp 33-72

[42] Rusendorf, L.,(2005), ***Monge–Kantorovich transportation problem and optimal couplings***, Mathematical Stochastics, University of Freiburg, Germany

$$\mathrm{L}_1(X,Y) = Ed(X,Y) \tag{13}$$

And is identical with the solution of transportation problem i.e. $c = d$ [43]. And the *Lipschitz metric* is defined as $\mu_L(P_1,P_2) = \sup(\left\{\int fd(P_1 - P_2); Lip \quad f \le 1\right\}$. And the ***Kantorovich–Rubinstein Theorem*****,** states that the minimal $\ell_1$ metric is identical to Lipchitz metric for all $P_1, P_2 \in M(U)$

$$\ell \ (P_1,P_2) = \mu_L M(P_1,P_2) \tag{14}$$

Next, about the leveling of the land area, the expression before and after the leveling is

$$\iint f(x,y)dxdy = \iint f_1(x,y)dxdy \tag{15}$$

So given this previous expression and the cost of transportation on $1m^3$, of earth from point $(x,y)$ to point $(x_1,y_1)$,will be used to find optimal transportation plan of the masses with a least total expense.

**Conclusion**

The transportation problem was first introduced by Gaspard Monge in 1781. And major contributions were made during the Second World War by Russian mathematician Kantorovich. Consequently this problem has been named Monge-Kantorovich problem. The Monge-Kantorovich mass transportation problem has been shown in recent years to be most fundamental for various problems in analysis and geometry. This paper provides some insight in this theories which are generally considered to be a major work in the field of linear programming. But also in the previous section it has been presented transportation problem with non-linear costs but the solutions of the linear and non-linear transportation problems will be subject of another paper.

[43] Here real costs of transportation are equal to distance, i.e. this is a solution to the transportation problem.

**References**


1. Kantorovich,L.,(1958), ***On the Translocation of Masses***, Management Science, Vol. 5, No. 1 (Oct., 1958), pp. 1-4
2. Kuhn H.Tucker A., Non-Linear Programming, Proceedings of the Second Berkeley , University of California Press, Berkeley, California, 1950 Cowles Commission Discussion Paper in Mathematics, No. 403, 1950
3. Levin,V.,(2006), ***Abstract Convexity and the Monge-Kantorovich Duality***, Lecture Notes in Economics and Mathematical Systems Volume 583, 2006, pp 33-72
4. Rusendorf, L.,(2005), ***Monge–Kantorovich transportation problem and optimal couplings***, Mathematical Stochastics, University of Freiburg, Germany
5. Sanjo Zlobec, Jovan Petrić, Nelinearno programiranje, Naučna knjiga, Beograd,
6. Slater M. Lagrange Multipliers Revisited, A Contribution to Nonlinear Programming, Symposium on Mathematical Statistics and Probality, University of California Press,

# Personnel economics issues: What causes increasing work intensity, and what are the policy responses?

**Dushko Josheski**[44]

Researcher in the field of applied economics mainly, also covers topics from wide area of macroeconomics, international trade and econometrics.

University Goce Delcev-Stip

Abstract

In this paper the issue from personnel economics such as work intensity has been investigated. George Akerlof back in 1976 argued that the real life failed to correspond to the standard general equilibrium model set by Arrow-Debreu. In the real life information is neither complete nor it's costless. In real life workers tend to work in harsh conditions, and put more efforts in order to receive better wages, also they have incentives to educate themselves more, as better educated employees are more productive. More productive means that they work faster as the rat's race to the cheese and faster rats will get to the cheese first and get more cheese than slower rats. In reality workers do not want to share their output with slower workers. But it is because of bad norms that firms sets or taxes that government imposes that workers tend to work suboptimal i.e. work more than what is required in equilibrium, or work less than the equilibrium socially optimal required effort. The problem also arises when firms compare worker and pick ''average'' worker, nowadays in OECD (rich) countries club, workers tend to get paid more and get spurious data on increased productivity and the measure average effort to be biased, so wage function will then be biased $w=w(\bar{e}, t)$, wage is function of average effort and time needed to produce output.

Keywords: Rat race equilibrium, labour market regulation policies, job satisfaction, workers performance

JEL codes: M50, M51, M52

## 1. Outline of the alternative explanations for the apparent increase in intensity of work examined by Green (2004).And examination of the degree of empirical support for six hypotheses.

Green argues that one important explanation for intensification of work lays in *technological changes* of recent decades like "just in time" (JIT) production methods and total quality management (TQM), which reduce monitoring cost and which are *effort biased* that is to say; they have increased the marginal productivity of change. Second aspect of JIT and TQM production methods is that closer matching between available labour with required workflow has its consequence to make better productive

[44] Authors email: dushkojosheski@gmail.com

use of workers as long they supply high effort, while the productivity of low effort workers remained the same or raised much less. *High-commitment Human Resource Policies .Human Resource Management and work effort* .

These techniques aimed at increased commitment by employees, which is manifested in increased levels of effort. *Effort incentives* By offering appropriate rewards (performance related pay, bonuses, effort related promotion), employers can induce employees to supply higher levels of effort. *Declining Union Power and Raising Job Insecurity* which says firms found themselves to reduce costs and raise quality when union power is lower; also work intensification is adjunct of a job loss brought by declining benefit/wage ratio and *Sectorial differences* manifested in declining public to private sector workers average pay.

From the preceding discussion Greene proposes following six hypotheses that work is more likely to have been intensified at workplaces : **1**.that experienced technical and organizational changes **2**.that have introduced multiskilling and improved task flexibility.**3**.that have initiated human resources management techniques designed to endanger greater worker involvement.**4**.that have increased their usage of effort incentives.**5**.wher the power unions have decrease **6**.where there is rising job insecurity. To test this hypothesis Green used data from cross-sectional Workplace Employee Relations Survey (1998). He specifies model[45] where dependent variable change in effort is regressed on the variables change in: technology, flexibility, high involvement policies, effort incentives, union power and insecurity. In Table 4 [46] Column (1) shows that technical innovations and changes in work organization have positive and significant effect on work intensification in small establishments and large establishments in service sector, consistent with [**hypothesis 1**], also Column (2) shows strong link between increases in task flexibility and work intensification consistent with [**hypothesis 2**] but reduces the significance of the coefficients.

While the role of changes in work organization, is evident in small establishments especially in production sector .The introduction of high-commitment (involvement initiatives and performance related pay) policies have positive and significant effect in small service enterprises, and performance related is indeed significant factor in large production establishments consistent with[**hypotheses 3&4**]. Finding shows that there are different factors that determine effort in small and large establishments. The decline in use of collective bargaining has expected positive association with work intensification consistent with [**hypotheses 5**]. Still, the impact is not all that well defined because variable is specified too general.

Use of Fix-term workers and part time workers is not associated with effort increase, while use of temporary workers and contractors show has an association with effort increase in larger and in small production establishments, but not in small service sector

[45] $\Delta E = \alpha\Delta TECH + \beta\Delta FLEX + \gamma\Delta HIGHINV + \delta\Delta INCENTIVES + \varepsilon UNIONDOWN + \phi\Delta INSECURITY + u$

[46] See Appendix 1 (Table 4 & 6)

establishments. This provides weak support for a link between insecurity and hard work consistent with [**Hypotheses 6**].Work intensification is higher in public and in service sector than in private sector. From **Table 6** (according to 33.5% managers and 26.3%workplace representatives) introduction of new technology is the main factor of effort change, followed by changes in work organization which are two most important set of factors that can be identified as having raised work intensity.

2. **Why does Clark (2005) suggest that the recent rise in real wages and lower working hours in most OECD countries may provide a false image of overall labour market performance and job quality?**

Clark (2005) suggests that concentration on rise in real wages and lower working hours can give biased picture of how jobs are perceived by the workers. Overall job satisfaction can be usefully thought as a weighted sum of Job Outcomes. The weights are Job Values, which refer to how much workers care about the different job outcomes. Survey data (International Social Survey Programme-ISSP) in table 2[47] showed that workers (Men& Women), rate Job security and Job interest as most important job values. Table 3 shows security as most preferable outcome. Clark (2005) uses two sets of data: ISSP multy-country and repeated cross-section and British Household Panel Survey (BHPS) ; single –country panel.

In **Table 4(ISSP)**, is designed to find out whether overall job satisfaction is higher in 1997 than it was in 1989.In the equation are included set of structural variables such as sex, age, and education. In addition there are country dummies and dummy variable for 1997. Also, wage data are not available for Netherlands in 1997; hours are not available for Hungary in 1989. Therefore there are two specifications: one with and one without wages and hours. The results in column 1 show that coefficient on "1997" variable is negative ,but insignificant, in this column hours and income are not controlled for. This coefficient on 1997 variable is negative and significant in column 2; an employee with same hours and real wage is less satisfied in 1997 than in 1989.In **Table 5** takes various measures of job outcome such as: high income, hours preferences, advancement opportunities, secure job, hard work, good job content, good relations at work again there are used two specifications. In row 1 are reproduce the estimated coefficients on the 1997 year dummy form **Table 4**, hours preference variable is ordered, higher values indicate relative desire for greater hours of work. These findings are similar to base regression, and show that in seven OECD countries, there is little evidence of rise in job quality. Equality feeling of job security fell between 1989 and 1997 and there is no significant change in job content. In this regression a number of measures of job quality have trended downwards.

In **Table 6(BHPS)** first column shows results from ordered probit estimation of pooled data(as if each observation comes from a different individual) and second column panel data(same individuals are interviewed every year),the estimated coefficients on wave dummies are all negative and jointly significant suggesting overall decline in job

[47] See Appendix 2 Tables (2,3,4,5,6)

satisfaction,1992 is a base year. Results in regressions that are done for other job outcomes and the results are more lees the same in the regressions that do not control for hours. There is negative correlation between job satisfaction and firm size, and job satisfaction minimizes at about 40 in pooled regression.

3. **What is meant by the term rat race equilibrium in Lander et al.? What are the characteristics of large law firms that favour such equilibrium?**

"Rat race" equilibrium is a suboptimum situation in which employees work inefficiently long hours. Given that firms use willingness to work long hours, as an indicator for hiring or promoting employees, issues on adverse selection and asymmetric information may appear in determination of work hours. Employees desiring short hours will have an incentive to camouflage themselves as long hour-worker accepting to work longer they prefer. Firms will respond by establishing work norms with hours long enough to discourage a shot-hour employee from pretending to be long-run employee. The result is that employees will work inefficiently long hours; opposite of full information equilibrium situation (Stiglitz 1976); when no actor has incentive to alter his behaviour. Now they will work more hours then utility maximizing number of hours conditional on their wage. Large law firm have simple internal structure i.e. associates and partners.

Promotion decision allows associates to purchase an equity stake in the enterprise. Second and more important feature is that there is always some degree of revenue sharing among partners. Income sharing characteristics of partnerships creates strong incentives to screen potential partners for their propensity to work hard. Rat race equilibrium is expected in any group where group members benefit from the productivity of other group members, the output of the group can be significantly influenced by the work effort of individual members and where the members of group can establish norms. In Table 2[48] nearly2/3 (65.41%) of the associates indicated they would prefer *reducing* work hours and keeping income unchanged over the coming year. Only 25,56% of respondents wanted to keep hours unchanged and enjoy 5% raise in income.

The statistics in Table 2 is not consistent with the conventional labour supply model when a large fraction of associate lawyers are on the backward bending portion of their labour supply curves. However, in the model labour supply elasticity is 10 times larger than reported in the literature. Second, backward bending labour supply curve suggests that associates should cut back their hours as wage rise. In the surveyed firms salaries increase by 7% per year, but there is no evidence of reduction o billable and non-billable hours among the senior associates. Third, backward bending supply curve suggests associates who want to reduce their hours have, on average, higher income than associates who want to keep their current hours. The data suggests that average income for these two groups is virtually identical. In Panel A(Preferences when others

[48] See Appendix 3 Tables 2&7

increase hours by 5%) in Table 7 we observed that significant number of respondents wanted to increase the desired level of work hours if others were doing the same.

Indeed the hypothesis that the distribution of original hour's preferences was identical with the distribution of preferences when other associates increase work hours is strongly rejected. In Panel B (Preferences when others reduce hours by 5%).The associates who like their current hours and the desirability of these hours only increased as others reduce hours. And only small portion of associates changed their choice. This is consistent with the explanation that associates want to work long hours (Rat race equilibrium hypothesis). Alternatively the explanation might be in the coordination problem; i.e. .when associates are working face- to- face 5% increase in working hours would require other group members to increase hours 5%.Which is not possible because the type of activity consist of solitary library work on legal research in writing and this does not require face-to-face contact.

4. **Summary and answer to a question: Can, and should, labour market regulation or other policies address this issue?**

Technical innovations and new forms of organization have been associated with greater managerial control over the labour process which can bring higher effort levels and are *effort biased* i.e. productivity is more dependent upon the effort level. Second explanation of work intensification is the use of high commitment policies, and decline in collective bargaining which is found to raise effort.

Job values Clark (2005) shows that are stable, so they are unlikely to explain movements in overall job satisfaction. Overall measures of job outcomes are either flat or falling, despite favourable movements in hours, wages, and job security. Third, there is no evidence of increasing inequality in some measures of job outcomes, as revealed by index of ordinal variation. Also there is no further erosion in job satisfaction gap between union members and non-members in Great Britain, except job security on the union member's side. Satisfaction with work itself has moved sharply downwards Good jobs are being replaced by the bad jobs due to changes in job content.

Another suboptimal solution is "Rat Race" equilibrium when employees work inefficiently long hour's conditional on their wages. Since the overall effect will have detrimental effect upon welfare society labour market regulatory policy should address these issues. Overworking can be restricted by setting maximum hours. The inefficient mix of job outcomes should be changed by increasing the efficacy of Job security and Job Interest, which are valued higher by workers.

# Appendices

**Appendix 1** Table 4

**Determinants of Work Intensification , 1993-1998**

| | (1)Small | (2)Small | (3)Large | (4)Large | (5)Production small | (6)Production large | (7)Service small | (8)Service large |
|---|---|---|---|---|---|---|---|---|
| **Technological change** | | | | | | | | |
| Technical innovation | 0.158* (0.086) | 0.113 (0.085) | 0.312*** (0.086) | 0.272*** (0.087) | 0.319 (0.226) | 0.312* (0.180) | 0.146 (0.092) | 0.311*** (0.098) |
| New work organization | 0.289*** (0.088) | 0.199*** (0.094) | 0.101 (0.097) | 0.053 (0.100) | 0.477* (0.245) | 0.012 (0.218) | 0.258*** (0.097) | 0.143 (0.106) |
| Greater task flexibilty | | 0.494*** (0.087) | | 0.401*** (0.090) | | | | |
| **High commitment** | | | | | | | | |
| Involvement | 0.289*** (0.088) | 0.275*** (0.089) | 0.018 (0.080) | 0.005 (0.081) | 0.321 (0.217) | 0.118 (0.167) | 0.291*** (0.095) | -0.031 (0.092) |
| More use of performance related pay | 0.267*** (0.090) | 0.196** (0.090) | 0.150* (0.080) | 0.118 (0.080) | 0.620*** (0.204) | 0.041 (0.152) | 0.228*** (0.101) | 0.171* (0.094) |
| **Workforce structures** | | | | | | | | |
| Less bargaining | 0.247* (0.146) | 0.222 (0.148) | 0.211* (0.114) | 0.194* (0.113) | 0.190 (0.314) | 0.266 (0.220) | 0.272 (0.173) | 0.195 (0.134) |
| **Increases in use of** | | | | | | | | |
| Fix-term workers | - 0.037 (0.109) | - 0.011 (0.108) | 0.023 (0.089) | 0.024 (0.089) | 0.063 (0.267) | -0.069 ( 0.182) | -0.059 (0.116) | 0.078 (0.101) |
| Temporary workers | 0.198* (0.116) | 0.195* (0.117) | 0.189** (0.088) | 0.196** (0.089) | -0.205 (0.263) | 0.270* (0.163) | 0.278** (0.134) | 0.162 (0.104) |
| Contractors | -0.008 (0.093) | -0.039 (0.094) | 0.321*** (0.085) | 0.309*** (0.086) | 0.555* (0.284) | 0.312** (0.156) | -0.068 (0.097) | 0.313*** (0.101) |
| Part time workers | 0.062 (0.085) | 0.022 (0.085) | 0.093 (0.079) | 0.101 (0.079) | 0.033 (0.243) | 0.045 (0.168) | 0.103 (0.091) | 0.105 (0.088) |
| **Other** | | | | | | | | |
| Privatized firm | 0.679 (0.615) | 0.809 (0.545) | 0.971* (0.522) | 0.989** (0.502) | | | | |
| Public sector | 0.389*** (0.099) | 0.421*** (0.101) | 0.285*** (0.089) | 0.303*** (0.089) | 0.451 (1.035) | 0.212 (0.465) | 0.369*** (0.097) | 0.259*** (0.091) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Production sector | -0.228** (0.102) | -0.300*** (0.102) | -0.247*** (0.092) | -0.288*** (0.092) | | | | |
| N | 857 | 856 | 951 | 951 | 127 | 240 | 742 | 726 |
| Pseudo-R-squared | 0.059 | 0.076 | 0.049 | 0.059 | 0.131 | 0.035 | 0.05 | 0.043 |
| Wald chi-square | 113.32 | 143.62 | 93.85 | 123.73 | 31.6 | 18.7 | 84.9 | 62.6 |

**Table 6 Changes with greatest impact on Employees: Respondent's Opinions**

| Changes in: | According to managers(Percent of Establishments) | According to Workplace Representatives(Percent of Establishments) |
|---|---|---|
| Payment system | 4.5 | 5.4 |
| New technology | 33.5 | 26.3 |
| Working time arrangements | 7.8 | 17.2 |
| Organization of work | 18.6 | 23.6 |
| Work techniques and procedures | 14.2 | 18.5 |
| Introduction of initiatives to involve employees | 11.2 | 4.1 |
| Introduction of new product or service | 10.3 | 4.8 |

**Appendix 2 Table 2 Job Values**

| ISSP 1989-1997 | | | | |
|---|---|---|---|---|
| Job values: Percentage Saying "Very Important" | | | | |
| | **Women** | | **Men** | |
| | 1989 | 1997 | 1989 | 1997 |
| **High Income** | 19.6 | 18.2 | 23.6 | 21 |
| **Flexible working hours** | 20.3 | 20.2 | 14.6 | 15.5 |
| **Good opportunitie** | 23.0 | 20.2 | 24.3 | 20.1 |

| | | | | |
|---|---|---|---|---|
| **s for work advancemen t** | | | | |
| Job security | 58.7 | 57.7 | 55.5 | 55.4 |
| Interestng job | 47.9 | 47.8 | 45.3 | 46.9 |
| Allows to wrok independentl y | 29.1 | 31.3 | 33.4 | 33.4 |
| Allows to help other people | 23.4 | 25.3 | 16.5 | 16.8 |
| Useful to society | 25.5 | 23.9 | 21.8 | 16.8 |

**Table 2 British Household Panel Survey**

| **BHPS 1991-1999** | | | | |
|---|---|---|---|---|
| **Job values: Percentage Saying CHARACTERISTICS IS MOST IMPORTANT** | | | | |
| | **Women** | | **Men** | |
| | **1991** | **1999** | **1991** | **1999** |
| Promotion prospects | 2.1 | 2.4 | 3.6 | 3.3 |
| Total Pay | 13.6 | 19.1 | 19.1 | 25.7 |
| Good relations with manager | 10.8 | 11.3 | 4.8 | 5.1 |
| Job security | 24 | 17.9 | 35.6 | 31.1 |
| Using initiative | 7.5 | 9.9 | 9.3 | 10.1 |
| Actual work | 34.4 | 31.4 | 24.1 | 33.4 |
| Hours worked | 6 | 6.3 | 1.2 | 1.2 |

| | | | | |
|---|---|---|---|---|
| Something else | 1.6 | 1.6 | 2.5 | 1.6 |

**Table3.Job Outcomes**

| ISSP 1989-1997 | | | | |
|---|---|---|---|---|
| Job Outcomes :Percentage Reporting characteristics in Question | | | | |
| | **Women** | | **Men** | |
| | **1989** | **1997** | **1989** | **1997** |
| **Income is high** | 15.8 | 16.7 | 25.6 | 25.3 |
| **Prefer to spend less time in their job** | 33.7 | 40.3 | 36.2 | 41.5 |
| **Prefer to spend more time in their work** | 13.5 | 9.9 | 11.4 | 10.8 |
| **Opportunities for advancement is high** | 17.6 | 17.9 | 24.3 | 23 |
| **Job is secure** | 71.8 | 66.4 | 70.9 | 64.7 |
| **Hard work** | 35.4 | 39.2 | 49.6 | 48.1 |
| **Good job content** | 40.6 | 46.1 | 38.3 | 41.6 |
| **Good relations at work** | 67.0 | 66.9 | 65.1 | 63.8 |
| **High job satisfaction** | 39.0 | 39.7 | 37.7 | 37.6 |

**Table 3 BHPS 1992-1999**

| Job Outcomes: Average Satisfaction and Hours preferences | | | | |
|---|---|---|---|---|
| | Women | | Men | |
| | 1992 | 1999 | 1992 | 1999 |
| **Satisfaction with pay** | 4.93 | 5.00 | 4.56 | 4.82 |
| **Satisfaction with security** | 5.3 | 5.48 | 4.88 | 5.27 |
| **Satisfaction with work itself** | 5.78 | 5.44 | 5.54 | 5.31 |
| **Satisfaction with hours** | 5.54 | 5.30 | 5.05 | 4.97 |
| **Overall Satisfaction** | 5.75 | 5.45 | 5.27 | 5.17 |
| **Prefer to work fewer hours** | 27.30% | 31.90% | 32.50% | 38.40% |
| **Prefer to work more hours** | 10.90% | 7.00% | 8.70% | 6.50% |

**Table 4. Overall Job Satisfaction Regressions . ISSP 1989-1997**

| | Standard | With income and hours |
|---|---|---|
| 1997 | -0.032<br>(0.022) | -0.069*<br>(0.027) |
| Male | -0.068**<br>(0.021) | -0.149**<br>(0.029) |
| 30 to 44 | 0.028<br>(0.028) | 0.016<br>(0.036) |
| 45 to 65 | 0,.158**<br>(0.030) | 0.123**<br>(0.038) |
| Married | 0.102**<br>(0.024) | 0.089**<br>(0.030) |
| Years of Education | -0.002<br>(0.003) | -0.007<br>(0.005) |
| Earnings($000)per month | - | 0.071**<br>(0.016) |
| Hour per week | - | 0.003*<br>(0.001) |
| West Germany | -0.012<br>(0.038) | -0.024<br>(0.041) |

| | | |
|---|---|---|
| Great Britain | -0.097*<br>(0.038) | -0.084<br>(0.040) |
| USA | 0.139**<br>(0.035) | 0.124**<br>(0.038) |
| Hungary | -0.452**<br>(0.038) | |
| Netherlands | 0.109**<br>(0.035) | |
| Italy | -0.086*<br>(0.039) | -0.119**<br>(0.044) |
| Observations | 10041 | 6468 |
| Log-Likelihood | -14301.93 | -9302.44 |
| Log-likelihood at zero | -14467.97 | -9366.07 |

Note : Standard errors in parantheses.* significant at 5%**significant at 1%

**Table 5 Estimated Changes over Time in Various Outcome Measures**.

**ISSP 1989-1997**

| Estimated coefficient on "1997" | | |
|---|---|---|
| | Standard | With income and hours |
| Job satisfaction | -0.032<br>(0.022) | -0.069*<br>(0.027) |
| Income is high | -0.042<br>(0.022) | -0.088**<br>(0.028) |
| Hours preferences | -0.094**<br>(0.022) | -0.094**<br>(0.028) |
| Opportunities for advancement are high | -0.010<br>(0.022) | -0.034<br>(0.028) |
| Job is secure | -0.213**<br>(0.022) | -0.189**<br>(0.028)_ |
| Hard work | 0.131**<br>(0.024) | 0.159**<br>(0.032) |
| Good job content | 0.007<br>(0.023) | 0.005<br>(0.029) |
| Good relations at work | 0.014<br>(0.026) | 0.047<br>(0.033) |

Table 6 **Overall Job Satisfaction Regressions. BHPS 1992-2002**

| | | |
|---|---|---|
| 1993 | -0.079*(0.033) | -0.164**(0.042) |
| 1994 | -0.127**(0.033) | -0.241**(0.054) |
| 1995 | -0142**(0.033) | -0.256**(0.069) |
| 1996 | -0.116**(0.032) | -0.231**(0.085) |
| 1997 | -0.067*(0.032) | -0.195(0.103) |
| 1998 | -0.171**(0.032) | -0.278*(0.121) |
| 1999 | -0.204**(0.031) | -0.355*(0.139) |
| 2000 | -0.206**(0.031) | -0.333*(0.157) |
| 2001 | -0.169**(0.031) | -0.307(0.178) |
| 2002 | -0.200***(0.032) | -0.362(0.197) |
| Male | -0.208**(0.010) | |
| Age | -0.061**(0.003) | -0.009(0.021) |
| Age-squared/100 | 0.079**(0.004) | 0.014(0.010) |
| High educaion | -0.208**(0.014) | |
| Medium education | -0.153**(0.013) | |
| Separated | 0.005(0.031) | 0.121*(0.047) |
| Divorced | -0.040*(0.017) | 0.028(0.039) |
| Widowed | 0.056(0.040) | 0.099(0.103) |
| Single | -0.116**(0.014) | -0.094**(0.033) |
| Central government | -0.098**(0.023) | 0.046(0.049) |
| Local government | 0.083**(0.015) | 0.250**(0.035) |
| NHS/Higher education | 0.079**(0.019) | 0.261**(0.043) |
| Nationalised industry | -0.264**(0.049) | -0.076*(0.070) |
| Non-profit | 0.128**(0.027) | 0.272**(0.047) |
| Army | -0.010(0.066) | -0.185(0.130) |
| Other | 0.252**(0.051) | 0.199**(0.067) |
| Firm size<25 | 0.174**(0.012) | 0.046*(0.020) |
| Firm size 25-199 | 0.042**(0.011) | -0.004**(0.018) |
| Temporary job | -0.151**(0.018) | -0.106**(0.026) |

| | | |
|---|---|---|
| Region dummies | YES | YES |
| Number of children dummies | YES | YES |
| Occupation dummies | YES | YES |
| Constant | | 5867**(0.634) |
| Observations | 56639 | 57277 |

Standard errors in parentheses * significant at 5%**significant at 1%

**Appendix 3** Table 2-How Associates Would Choose to Use a Hypothetical 5percent wage increase*

| | | Associates | | |
|---|---|---|---|---|
| | | Married whose spouse work full time | | |
| Choices | All | With children | No Children | With Children |
| 1.**Reduce** billable and nonbillable work hours by **5-Percent with no change** in annual salary | | | | |
| percentage | 65.41 | 60.47 | 78.57 | 76.19 |
| Number of associates | 87 | 26 | 33 | 16 |
| 2.Continue working the same number of hours with a **5-percent increas**e in annual salary | | | | |
| percentage | 25.56 | 25.56 | 9.52 | 23.81 |
| Number of associates | 34 | 13 | 4 | 5 |
| 3.Increase billable and nonbillable work hours by **5-percent increase with a 10-percent increase** in annual salary | | | | |
| percentage | 9.02 | 9.02 | 11.90 | 0.00 |

| ***Panel A*** : Preferences when others increase hours[b] | Original hour preferences [a] | | |
|---|---|---|---|
| | Reduce hours 5 percent (1) | Keep current hours (2) | Increase hours 5 percent (3) |
| Reduce hours 5 percent | 51.35 | 0 | 0 |
| Keep current hours | 35.14 | 35.71 | 0 |
| Increase hours 5 percent | 13.51 | 64.29 | 100.00 |
| Column total | 100.00 | 100.00 | 100.00 |
| Number of Observations | 37 | 14 | 6 |

| | | | | |
|---|---|---|---|---|
| Number of associates | 12 | 4 | 5 | 0 |
| Number of Observations | 133 | 43 | 42 | 21 |

| ***Panel B***: Preferences when others reduce hours[c] | Reduce hours 5 percent (1) | Keep current hours (2) | Increase hours 5 percent (3) |
|---|---|---|---|
| Reduce hours 5 percent | 100.00 | 15 | 0.00 |
| Keep current hours | 0 | 85 | 16.67 |
| Increase hours 5 percent | 0 | 0 | 83.33 |
| Column total | 100.00 | 100.00 | 100.000 |
| Number of Observations | 50 | 20 | 6 |

These results ae response to following question:"This question asks you to consider *hypothetical* five percent change in your work hours over the coming year. You can use the table of the following page to get a sense of what a 5% change in work hours may mean for you. Please indicate which of the following alternatives you would be most likely to choose " "The table on the following page refers to a chart that presented following calculation. If an associate's average billable and non-billable work hours total 160 hours per month, then 5-percent change in billable and nonbillable hours would be equivalent to an increase of one eight-hour day per month on 12 eight hour days over 12 months. Similar calculations were presented for associates working 200,240 and 280 hours per month.

Table 7 –Changes in Hours Preferences of Associates as the Distribution of Hours in the Firm Shifts

[a] This is how associates would choose to respond to a 5-percent wage increase

[b] This is how associates would choose to respond to a 5-percent wage increase if the majority of other associates in the firm increased hours by 5 –percent

[c] This is how associates would choose to respond to a 5-percent wage increase if the majority of other associates reduced hours by 5 percent.

## *References*


1. Akerlof,G.,(1976), ***The economics of caste and of the Rat race and other woeful tales***, The quarterly journal of economicsVol.90 no.4

2. Clark, A.E. (2005), "**Your Money or Your Life: Changing Job Quality in OECD Countries**",*British Journal of Industrial Relations*, No. 43, pp. 377-400.

3. Green, F. (2004), "***Why has effort become more intense***?", *Industrial Relations,* Vol. 43, pp. 709-41.

4. Landers,R., Rebitzer,J., Taylor,L.,(1996) "***Rat Race Redux: Adverse Selection in the Determination of Work Hours in Law Firms***," *American Economic Review*, 86 (June 1996): 329-48.

# Energy consumption, economic development and prices: Time series evidence in CESEE countries

Dushko Josheski, University Goce Delcev-Stip

Abstract

This paper estimates the causal relationships between energy consumption and income for Albania, Bosnia and Herzegovina, Serbia, and Macedonia (CESEE - Central, Eastern and Southeastern Europe countries), using cointegration and error-correction modelling techniques. The results indicate that energy consumption, income and prices are second order cointegrated, except for Albania where there exist only one cointegration relationship. In the error correction mechanism on the long run the results show that for the selected countries in the cointegration relationship only inflation does seems to enter significantly in the equation. On a short run also only inflation seems to affect energy consumption, while energy consumption seems to affect income on short run, but only in Albania. This study supports the view that energy and income are neutral. This means that in these countries there is scope for energy conservation measures without severe impact on their economic growth.

**Keywords:** energy consumption, income, prices

## 1. Introduction

In the previous two decades the association between energy consumption and economic growth, with either income or employment as proxy for the latter. Empirical findings had been conflicting and confusing. Seminal article was written by Kraft and Kraft (1978)[49].These two authors found out evidence on the causality running from GDP to energy consumption, this finding was for United States data. Later, Akarca and Long (1979), were supportive of the Kraft and Kraft study, when they found evidence of the association between employment and energy consumption. But, Yu and Choi (1985)[50], and previously Yu and Hwang (1984) [51], found no causal relationship between income and energy consumption. Reason, why there was such a inconsistency in the results was

[49] Kraft, J., Kraft, A., (1978). ***On the relationship between energy and GNP***. J. Energy Dev. 3, 401-403.

[50] Yu, E.S.H., Choi, J.Y., 1985. T***he causal relationship between energy and GNP: an international comparison***. J. Energy Dev. 10, 249]272

[51] Yu, E.S.H., Hwang, B.K., (1984). ***The relationship between energy and GNP: further results***. Energy Econ. 6, 186-190

because earlier studies employed OLS, not taking into account different nature of times series, and previously was not known that in levels series are not stationary, Granger, Newbold(1974)[52].Regressions with high value fo fit as measured by $R^2$ and low measure of Durbin-Watson statistic. Low Durbin statistics means autocorrelation, in her presence error are autocorelated.

## 2. Methodology and data

In this paper we are testing the association between income and energy consumption, also in the model inflation is present. The modeling strategy that was adopted, is based on widely used Granger methodology, Engle,Granger (1981)[53].Though Johansen test[54] was adopted later because it allows for more than one cointegrating relationship. But first we sue the simplest approach to test for a unit root and that is AR(1) model :

$$Y_t = \theta_0 + \phi Y_{t-1} + \varepsilon_t$$

(1)

On the previous expression residuals follow normal distribution, i.e. $\varepsilon \sim \left(0, \sigma_a^2\right)$. The null hypothesis that we are testing is:

$$H_0 : |\phi| = 1 \Rightarrow Y_t \sim I(1)$$
$$H_1 : |\phi| < 1 \Rightarrow Y_t \sim I(0)$$

(2)

Now one to simplify the computation:

[52] Granger, C., Newbold, P., (1974). ***Spurious regressions in econometrics***. J. Econometrics 2, 111]120

[53] Granger, Clive (1981). "***Some Properties of Time Series Data and Their Use in Econometric Model Specification***". *Journal of Econometrics* **16** (1): 121–130.

[54] Johansen, Soren (1991). "***Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models***". *Econometrica* **59** (6): 1551–1580. JSTOR 2938278.

$$Y_t - Y_{t-1} = \theta_0 - \underbrace{(1-\phi)}_{\delta} Y_{t-1} + a_t$$
$$\Delta Y_t = \theta_0 - \delta Y_{t-1} + a_t$$

(3)

And, if $\delta=0$, system has a unit root.

$$H_0 : \delta = 0$$
$$H_1 : \delta < 0$$

(4)

In the second part of the empirical chapter one can use Johansen procedure fopr testing of the cointegration rank between the variables. This approach is similar to augmented Dickey-Fuller test but it requires for VAR approach.

$$x_t = A_1 x_{t-1} + \varepsilon_t$$
$$\Delta x_t = (A_1 - IDmatrix) x_{t-1} + \varepsilon_t$$
$$\Delta x_t = \nu \; x_{t-1} + \varepsilon_t$$
$$where \quad \nu = A_1 - IDmatrix$$

(5)

So in Johansen cointegrating relationship IDmatrix is identity matrix, $A_1$ is a g × g matrix, $x_t$ and $y_t$ are cointegratinge vectors . The rank of v is the number of cointegrating relationships. After one determines the number of cointegrating relationships ,one can use VECM model to capture the long run relationship between variables in the model.Vector Error Correction Models (VECM) are the basic VAR, with an error correction term incorporated into the model and as with bivariate cointegration, multivariate cointegration implies an appropriate VECM can be formed. We are estimating the error correction mechanism by using the lagged residuals $u_{t-1}$.

$$\Delta \mathrm{Y_t} = \beta_0 + \beta_1 \Delta X_t - \beta_2 (Y_{t-1} - C - \beta X_{t-1})$$

(6)

Now the error correction mechanism is :

$$EC = (Y_{t-1} - C - \beta X_{t-1})$$

(7)

In the cointegrating regression

$$Y_t = C + X_t + u_t$$
$$u_t = Y_t - C - X_t \Longrightarrow u_{t-1} = Y_{t-1} - C - \beta X_{t-1}$$

(8)

$u_{t-1}$ in the last expression represents error correction mechanism. Data used in this paper are gathered from World Bank and World development indicators published by the World Bank. The precise definitions of the variables are as follows:

***LogGDP***-logarithm of GDP in current US dollars.

***Logenergyuse***-logarithm of Energy use (kg of oil equivalent per capita)

***LogCPI***-Logarithm of inflation, consumer prices annual percentage

Here we set the hypothesis that energy efficiency measures in the countries of the sample will not deteriorate growth.

## 3. Energy sectors and energy efficiency measures in selected CESEE economies

Energy efficiency represents the using of less quantities of energy for executing the same activity or function as such heating to a certain area, lighting, the production of other elements, cooling to a certain area, etc. Energy efficiency is not the same as the saving of energy. Energy efficiency is related to the efficient use of energy and the saving of energy the usual is related with waiver of certain executing or spending. Energy efficiency is an important element in energy policy in each national economy because a efficient use of energy is aimed at reducing the consumption for produce the

same quantities a certain products or service that the other side contributes to the reduction of financial expenses. Each country implements strategies for energy efficiency, but also leads to policy and implementation of directives for energy efficiency. Measures that are necessary for the implementation the policy on energy efficiency in the Republic of Serbia represent the adoption of the necessary legislation for the efficient use of energy, the implementation of a system for managing energy, introduction of subsidies and rebates for the implementation of projects for energy efficiency and increase in public awareness among the population of the importance and efficiency using of energy. The same is imposes itself as a necessity in the Republic of Macedonia, because statistical data show that the use of energy in the Republic of Macedonia has an impact on the environment as a result of the pollution of fuel, cutting in the forest, land degradation, health problems and low energy efficiency. The energy sector in the Republic of Macedonia depends of the import of oil. Every penny intended for the payment of the import of the energy is lost a penny to the national economy. According to the published statistical data, the highest consumer of the geothermal energy in 2010 is the agricultural sector which participates with 83.4 % in the consumption and other sectors participate with 16.6 % in the consumption and losses in the distribution of energy equalling 10.45%. Therefore the increase in energy efficiency and the achievement of sustainable development should be made through implementation of the system and projects in which priority will have total consumption, distribution and providing of energy. The energy sector in Bosnia and Herzegovina represents one of the most important part of the economy. Bosnia and Herzegovina has important hydropower potential that is used about 40 %, and oil and gas imported. The energy intensity of the economy is expected to be 2.5 times higher than the EU average as an indicator of the high potential for improving the energy efficiency. In Bosnia and Herzegovina in progress is a process of adaptation of the energy system to the international standards and best practices of the European Union. In Albania, the energy sector is also one of the most important sectors. Energy sources basically are based on hydro energy, which represents the primary source of energy and the demand for energy is characterized by a tendency to increase. Satisfying the energy needs of Albania is projected to be realized through the improvement of control an

increase in the consumption, reducing the energy dependency and interventions for improve the energy efficiency.

## 4. Empirical section results

In this part first the results from the Dickey-Fuller test are being presented in Table 1.

**Table 1 Results from the empirical testing Dickey –Fuller test**

| Country/variable | Levels | First difference |
|---|---|---|
| **Albania** | | |
| LogGDP | -0.424 | -4.425 |
| Log energyuse | -1.580 | -4.126 |
| LogCPI | -2.910 | -4.400 |
| **Bosnia and Herzegovina** | | |
| LogGDP | -2.288 | -4.629 |
| Log energyuse | 0.989 | -0.989 |
| LogCPI | -1.557 | -5.908 |
| **Macedonia** | | |
| LogGDP | -0.494 | -4.035 |
| Log energyuse | -3.227 | -3.227 |
| LogCPI | -3.004 | -6.986 |
| **Serbia** | | |
| LogGDP | -1.522 | -4.816 |
| Log energyuse | -2.817 | -2.817 |
| LogCPI | -1.751 | -5.084 |
| **Critical values** | | |
| 10% | -3.750 | -3.730 |
| 5% | -3.000 | -2.999 |
| 1% | -2.630 | -2.630 |

From the previous Table 1 one can see that all variables contain unit root when in levels, but when first differenced all are stationary. Now, since all variables are I(1), ie.e integrated of order one, one can check whether they are cointegrated.Cointegration tests are performed with all three variables in the model, logGDP, logcpi, and logenergy use. Johansen maximum likelihood test has been put in use here.

**Table 3 Results from Johansen Maximum likelihood test**

| Country/null hypothesis | eingevalue | SBIC | HQIC |
|---|---|---|---|
| **Albania** | | | |
| r=0 | | 2.258129 | 2.14727 |
| r=1 | 0.73001 | 1.630374* | 1.334749* |
| r=2 | 0.23371 | 1.773157 | 1.366673 |
| **Bosnia and Herzegovina** | | | |
| r=0 | | 8.711394 | 8.600535 |
| r=1 | 0.62871 | 8.402257 | 8.106632 |
| r=2 | 0.34679 | 8.385375* | 7.978892* |
| **SERBIA** | | | |
| r=0 | | 6.708554 | 6.597694 |
| r=1 | 0.59 | 6.4749 | 6.179276 |
| r=2 | 0.42 | 6.336627* | 5.930143* |
| **Macedonia** | | | |
| r=0 | | 2.72616 | 2.615301 |
| r=1 | 0.46826 | 2.77619 | 2.480565 |
| r=2 | 0.40176 | 2.671407* | 2.264924* |

Note:* denotes statistical significance of the criteria.in this paper as more reliable Hannan-Quinn and Schwarz Bayesian criterion had been used.

From the Johansen text for cointegration rank one can see that except for Albania, where there exist one cointegrationn equation for the variables of interest, in all other countries there exist two cointegration relationships.This means that for Bosnia, Macedonia and Serbia we will estimate two cointegration equations in the error correction mechanism. And in Albania only one equation.

## 5. VECM models

Next, we present the results from the Vector error correction mechanism. First for Albania there exist one cointegrating relationship.

**Albania –One cointegrating equation**

$$ec_t^{fgls} = \log energyuse - \underset{(0.145)}{0.0729}\log GDP + \underset{(0.000)}{0.3024}\log CPI - 5.063972$$

(9)

If one rearranges the last expression for logarithm of energy use can get :

$$\log \text{energyuse} = 5.063972 + \underset{(0.145)}{0.0729}\log GDP - \underset{(0.000)}{0.3024}\log CPI + ec_t^{fgls}$$

(10)

From the above equation one can see that if inflation increases by 1% , energy consumption will fall by 0.3%,coefficient on GDP is positive but insignificant at long run.

**Bosnia and Herzegovina -2 cointegrating equations**

$$ec_t^{fgls} = \log energyuse - \underset{(n.a)}{6.94e-18}\log GDP + \underset{(0.000)}{0.0856}\log CPI - 7.463977$$

(11)

If one rearranges the last expression for logarithm of energy use can get :

$$\log energyuse = \underset{(n.a)}{6.94e-18}\log GDP - \underset{(0.000)}{0.0856}\log CPI + ec_t^{fgls} + 7.463977$$

(12)

Second cointegrating equation for Bosnia and Herzegovina:

$$ec_t^{fgls} = \log GDP + \underset{(0.073)}{0.5497}\log CPI - 26.60594$$

(13)

In the last equation energy use variable had been omitted.

$$\log GDP = 26.60594 - \underset{(0.073)}{0.5497}\log CPI + ec_t^{fgls}$$

(14)

In Bosnia there existed two cointegrating relationships, sign on inflation in relation to energy consumption is negative and significant, and the coefficient on GDP when in relation to log of energy use is insignificant, this is for the first equation. And, for the second equation, when logGDP is dependent variable, logCPI is negative and significant and energy consumption variable is omitted from the regression.

**Macedonia -2 cointegrating equations**

$$ec_t^{fgls} = \log energyuse - \underset{(n.a)}{1.39E-17}\log GDP + \underset{(0.004)}{0.1231}\log CPI - 7.4279$$

(15)

If one rearranges the last expression for logarithm of energy use can get :

$$\log energyuse = 7.42799 + \underset{(n.a)}{1.39E-17}\log GDP - \underset{(0.004)}{0.1231}\log CPI + ec_t^{fgls}$$

(16)

Second cointegrating equation for Macedonia is:

$$ec_t^{fgls} = \log GDP + \underset{(n.a.)}{7.11e-15}\log energyuse + \underset{(0.004)}{1.637}\log CPI - 25.47$$

(17)

In the last equation energy use variable had been omitted.

$$\log GDP = 25.47 - 7.11e - 15\log energyuse - \underset{(0.004)}{1.637}\log CPI + ec_t^{fgls}$$

(18)

As for Macedonia there also existed two cointegrating equations. Log GDP is positively associated with the energy consumption but the coefficient is insignificant.Inflation in the two equations is negatively and statistically significantly associated with the energy consumption and GDP.

**Serbia -2 cointegrating equations**

$$ec_t^{fgls} = \log energyuse + \underset{(0.000)}{0.0349418}\log CPI \text{ - } 7..88$$

(19)

In the previous expression log of GDP is omitted,If one rearranges the last expression for logarithm of energy use can get :

$$\log energyuse = 7.88 - \underset{(0.000)}{0.0349418}\ \log CPI + ec_t^{fgls}$$

(20)

Second cointegrating equation for Macedonia is:

$$ec_t^{fgls} = \log GDP + \underset{(0.000)}{2.07}\ \log CPI \text{ - } 29.30$$

(21)

In the last equation energy use variable had been omitted.

$$\log GDP = 29.30 - \underset{(0.000)}{2.07}\ \log CPI + ec_t^{fgls}$$

(22)

As for Macedonia there also existed two cointegrating equations. Log GDP is omitted when energy consumption is dependent variable. Also energy consumption is omitted from the model when log GDP is dependent variable. Inflation in the two equations is

negatively and statistically significantly associated with the energy consumption and GDP.

## 6. Conclusion

The purpose of this paper was to test the association and causality between income (GDP), energy consumption (use of oil kg/per capita), and prices represented through inflation. Maximum likelihood procedures were used one to analyses time series properties of the variables, and error correction models in order to see the long run relationship between the variables. From the results one can see that in Albania there exists one directional causality from prices to energy consumption. In Bosnia and Herzegovina there exist two one way relationships between inflation and energy consumption, and prices and income (i.e. GDP).In Macedonia. In Macedonia there exists two way association between energy consumption and GDP, but the statistical significance of that causality is unknown. Also, in Macedonia there exist two one way relationships between inflation and energy consumption, and prices and income (i.e. GDP).Price effects are very significant in the causality equations. Our results suggest that in some cases, energy consumption, income and price are endogenous and therefore single equation forecasts of one or the other could be misleading. This notion is the same as in the study of Adyaye (2000)[55].This means that in these countries there is scope for energy conservation measures without severe impact on their economic growth.

***References***

[1].Adjaye,J.A.,(2000***), The relationship between energy consumption, energy prices and economic growth: time series evidence from Asian developing countries***, Energy Economics 22 2000. 615-625,Elsevier.

[55] Adjaye,J.A.,(2000***), The relationship between energy consumption, energy prices and economic growth: time series evidence from Asian developing countries***, Energy Economics 22 2000. 615-625,Elsevier.

[2]. Granger, C., Newbold, P., (1974). ***Spurious regressions in econometrics***. J. Econometrics 2, 111]120

[3]. Granger, Clive (1981). "***Some Properties of Time Series Data and Their Use in Econometric Model Specification***". *Journal of Econometrics* **16** (1): 121–130.

[4]. Johansen, Soren (1991). "***Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models***". *Econometrica* **59** (6): 1551–1580. JSTOR 2938278.

[5]. Kraft, J., Kraft, A., (1978)***. On the relationship between energy and GNP***. J. Energy Dev. 3, 401-403.

[6]. Yu, E.S.H., Choi, J.Y., 1985. T***he causal relationship between energy and GNP: an international comparison***. J. Energy Dev. 10, 249]272

[7]. Yu, E.S.H., Hwang, B.K., (1984). ***The relationship between energy and GNP: further results***. Energy Econ. 6.

# Personnel Economics essay: Issues in Human Capital Theory, training and earnings of workers

DushkoJosheski[56]

Researcher in the field of applied economics mainly also covers topics from wide area of macroeconomics and international trade and econometrics,

University GoceDelcev-Stip, R.Macedonia

**Abstract**

In this paper the issues from the personnel economics has been investigated. The issues such as training of workers from Becker's human capital theory and their association with the workers' productivity. In the second part of the paper the issue of grooming has been investigated in relation with earnings for which there exist and it is presented empirical evidence. In the equation as regressors are also present Mincerian variables: age, marital status and others. Also the four puzzles in the empirical literature about the determinants of earnings has been investigated. And how the empirical literature helps in resolving them.

**Keywords:** Personnel economics, training, earnings, grooming

## 1. Investigation of the two puzzles which Becker's human capital theory of training does not explain. Examination whether the presence of oligopsony and asymmetric information resolves them?

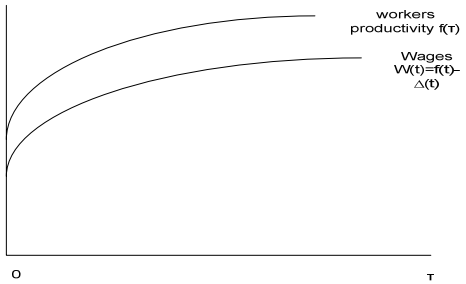
Becker's human capital theory recognizes two types of training- *general* and *specific*.*General training* is transferable across companies as individuals change jobs, worker gets allthereturns and he is the one that finances the training. Table 1.1[57] row 1clarifies that according to human capital theory in perfect competition, there is no difference between wages and the productivity during the training in period of lower productivity workers are compensated by lower wages and afterwards they are compensated by higher wages. Post-training wages are same across the subsequent firms as they are in the current firm.*Specific training* increases productivity only in the currentfirm. In row 3 from table 1 firm and the worker share the cost and the returns of the training investment to avoid hold-up problems. Wages are above the productivity during the training and below marginal productivity after the training. Because it is not transferable across the firms wages at subsequent firms are lower than marginal productivity. In row 2 from table 1 human capital theory recognizes divergence between wages and net marginal productivity when firms decide to *participate* in financing of general training when workers face credit constraints i.e. they are not able to borrow.Firm pays workers more than marginal productivity during the training and less afterwards. Firm acts as lender, but in a situation only if there is apprenticeship contract,

[56]Authors email: dushkojosheski@gmail.com

[57]See Appendix 1

to bind the workers after the training until the loan has been paid back. And second puzzle that cannot be explained within the human capital theory framework is that workers do not receive *wage cuts* during the training. Theory of oligopsony provides insights that can explain these two puzzles. According to the classical theory of oligopsony firms have market power in setting the wages because they are the only employer. By the new theory oligopsony arises through product differentiation and imperfect information.*Product differentiation* requires from workers ,working in such companies to possess specific skills which increases the costs of mobility of workers and workers ,and workers do not have incentives to invest in general training. *Asymmetric information*exists in case when firm knows the value of itsgeneral training but other firms do not. If outsiders assign zero value to the training –such training is in effect specific for the training firm. As, post productivity returns to training are higher than wage returns, firms find profitable to pay for the general training as can be seen in fig1 and in column 5 from table 1.1.

Figure 1 **Post productivity returns to training are higher than wage returns**




In Oligopsonistic labour market wages are lower than marginal productivity.

2.**Can economics analysis provide additional insights into why workers "invest" in grooming? What are the main limitations of this analysis?**

Economics literature has focused almost exclusively on the effect of innate(exogenous)beauty on market outcomes; other disciplines have considered effect on grooming as (endogenous) aspect of physical appearance to be important to all the manners of social and economic life. Businesses recognize the importance of what the literature refers to as "personal branding". Grooming can provide powerful market signals. Workers who spend more effort grooming will enjoy more favourable market outcomes. The wage regression of an individual $i$ of gender type j is given by:$\ln W_{ji} = X_{1ji}\Gamma_{1j} + X_{2ji}\Gamma_{2j} + \beta_j \ln G_{ji} + U_{ji}, j = \text{male, female}$here $\ln W$ is the log of weekly wages for males and females working fulltime,(35 hours or more per week) $X_1$ is the matrix of Mincerian human capital determinants like age, marital status,$X_2$ represents the matrix of controls for location,industry occupation. G represents the time spent on personal grooming.In general represents the time spent by workers on washing, dressing.$\beta$, represents the marginal returns in weekly wages to time spent grooming.By

introducing grooming in its log form the model allows for diminishing returns. It is expected $\beta > 0$and the time allocated to grooming is endogenous, grooming habits are determined in the culture. And $\beta$ will be biased upward if higher wages lead to more grooming, and biased towards zero if increase wages cause less grooming. Second equation is therefore grooming equation$\ln G_{ji} = I_{ji}\Gamma_{aj} + \alpha_j \ln W_{ji} + E_{ji,v}] = male, female$I represents matrix of exogenous variables that determine the time spent on grooming (personal traits), and wages in log.Two types of factors are considered (1)household characteristics(2)other activities with ones social life. In tables 4 & 5[58] results are obtained by 2SLS and generalized method of momentsand (GMM).In table 4, 3068 observations version of first (i) using log of grooming as an explanatory variable (ii) adding a dummy interaction to account for possible racial disparities regarding the returns to grooming, in table 5 there are 2837 observations, and in the two tables standard theoretical predictions are confirmed. The returns to age,which proxy labour experience are positive statistically significant in the early years, but negative in later years negative sign on $AGE^2/100$.Whites earn more than their minority counterparts, education contributes positively to earnings. Marriage has positive effect on men's wages but has no significant effect on those of women. Extra time spent on grooming has positive significant effect for men that earn 5% higher wages; this coefficient is positive but insignificant for women's earnings. There is also week evidence than the returns to grooming by race for males and females. One problem with this analysis is the weak instruments and the second is the validity of instruments, IVs must not be correlated with wages. To test validity of the IVs it is used Hansen J (distributed $\chi^2$) and heteroscedasticity problem which should be corrected in the first stage by OLS to use the 2SLS if not GMM should be used.Also, coefficient on grooming may be biased because grooming and beauty may be correlated.

3. **What are the four puzzles which Bowles et al. (2001) identify in the empirical literature on the determinants of earnings? In what sense are they "puzzles"?**

First, apparently similar individuals receive quite different earnings. The puzzle is to understand how in the standard earning equation for the individuals of the same race ,sex, between 2/3 and 4/5 of the variance of natural logarithm of hourly wages of individuals is explained by a person's age ,year of schooling ,occupation, and income. Second puzzle is to understand, what is that successful parent's pass on to their children that gives them labour market advantages beyond the superior schooling, or cognitive scores measured in available studies. Third puzzle is to explain why apparently irrelevant personal traits (beauty, height, and obesity)are often robust predictors of earnings.Fourth puzzle is to explain why the apparent impact of school resources on earnings might be so different from their apparent effects on subsequent earnings. On survey of 3,000 employers the most important was the "attitude" and "communication skills" compared with the "years of schooling" and "academic performance". The

[58] See Appendix 2

second example in a Survey 1,693 British employers identify "poor attitude, motivation or personality" as recruitment problem in 62% of the cases, while "lack of technical skills" in 43% .The third empirical example is from a series of studies on the labour market impact of the GED, a diploma gained by a test of cognitive skills taken by a large fraction of dropouts from US high schools. Heckman and his co-authors reason that GED is mixed signal indicating to the employers that the individual had cognitive skill to complete high school but lacked the motivational or behavioural requisites. These examples illustrate a possible bias, "skill shortages" when there is difficulty in recruiting suitable employees. And second bias is the presumption that anything rewarded in a competitive labour market must be a skill.Model in which trait that is not skill may be rewarded in a competitive labour market. If disequilibrium rents arising from technological shocks are persistent and if labour services are not subject to costless enforceable contracts,individual behavioural traits unrelated to productive capacities may bear a positive price.

4. **Interpretation of the meaning of Bowles et al.'s term "incentive enhancing preferences" .And to what extent, the behavioural model can resolve the puzzles identified in Question 3.**

Coasean traits are defined as "*incentive enhancing preferences*" including such personality traits as a sense of efficacy avoiding disruptive behaviour,as determinants of earnings. They do not contribute directly to the production and they are in the Coasean model of earnings, determination which has been explored by sociologists that frequently stress the non-skilled related determinants of earnings and of the contribution of schooling to the economy. Increase in" incentive enhancing preferences "will lead an employee to work harder. Examples of "*incentive enhancing preferences* "are: individual's evaluations, of the prospect of retaining the job in the future, efficacy as opposite of fatalism (*incentive depressing trait*), and third example is desirability of holding the job.In table 2[59]are presented results from: (NLSYW) National Longitudinal Survey of Young Women and National Child Development Study(NCDS) both data sets are presented in two columns one for the extended human capital model; and another one for behavioural model .In column A the estimated signs of the variables (years of education, IQ score, Years of work experience, Parental SES) are positive consistent with the literature, number of children variable is with negative sign. In column B are presented results from the behavioural model which includes exogenous instrument for personality. Roter score has negative sign so that the belief that outcomes are the results of fate or luck has negative influence on earnings. Other variables have same signs as in model of Column A with a slight decrease in the size and they are statistically significant except Parental SES which is insignificant. This model is applied on 915 observations. In columns C and D coefficients on personality variables are significant and suggest that 1% deviation change in *aggression* is associated with almost 8% decrease in wages, and 1% decrease in *withdrawal* is associated with over 3% decrease in wages. The increase in variance from including personality is larger than the mean increase in explained variance from including cognitive scores to wage

[59] See Appendix 3

determination.This model has1123observations. Results in table 3 [60]show that,in high status column one standard deviation increase in aggression of women decrease women's earnings by more than 7%, while the same change is associated with an average increase in men's earnings by almost 15%. One standard deviation increase in withdrawal is associated with a decrease in men's wages by 17% and 15% for high and low status occupations, respectively. For, women changes in withdrawal are associated with a 6% increase in wages for high status women and 6% decrease in wages for women in low status occupations.The model provides following solution to the puzzles identified in question 3. First the unexplained variance in the standard earnings function is due in part to individual differences in behavioural traits that are rewarded on labour markets. Second, the contribution of schooling and parental socioeconomic status to earnings is in part explained by earnings-enhancing behaviours learned or genetically transmitted from parents,or by additional years of schooling. Third, the apparent labour market returns to such traits as good housekeeping and slim figures reflect the co variation of these traits with behaviours sought by employers. Finally contradictory evidence on the effectiveness of school resources may not be puzzle at all. If incentive – enhancing preferences and other behavioural traits are important determinants of earnings, and some of these are fostered by higher quality schooling, enhanced school resources may have important effects on subsequent earnings without having large significant effects on cognitive achievement.

## 5. Summary

Personnel economics has been widely defined as an application of mathematical approaches, econometric statistical methods to the questions of human resource management, Lazear (2008). This essay reviewed some of the theoretical and empirical literature on the subject of training earnings and grooming as well as mincerian related variables to wages. Finally, the main founds are : as, post productivity returns to training are higher than wage returns, firms find profitable to pay for the general training,the returns to age, which proxy labour experience are positive statistically significant in the early years, but negative in later years negative sign on $AGE^2/100$. Whites earn more than their minority counterparts, education contributes positively to earnings. Marriage has positive effect on men's wages but has no significant effect on those of women. Extra time spent on grooming has positive significant effect for men that earn 5% higher wages; this coefficient is positive but insignificant for women's earnings.If disequilibrium rents arising from technological shocks are persistent and if labour services are not subject to costless enforceable contracts, individual behavioural traits unrelated to productive capacities may bear a positive price.If incentive – enhancing preferences and other behavioural traits are important determinants of earnings, and some of these are fostered by higher quality schooling, enhanced school resources may have important effects on subsequent earnings without having large significant effects on cognitive achievement.

[60] See Appendix 3

## Appendix 1

**Table 1.1Some predictions of human capital theory**

| Row No. | Model | who pays | Divergence between wages (w) and Net marginal Productivity at Training firm | Transferability of Training |
|---|---|---|---|---|
| [1] | Perfect competition, general training | Worker | None | Fully transferable |
| [2] | As above but with credit Constraints | Sharing | w>MP during training and w<MP after training | Transferable but wage returns elsewhere Greater than returns at firm providing training |
| [3] | Perfect competition Specific training | Sharing | w>MP during training W<MP after training | Non-transferable |
| [4] | Perfect competition, Mix of general and Specific training | Sharing | w>MP during training W<MP after training | Partially transferable; wage returns elsewhere less than returns at firm |
| [5] | Oligopolistic labour Market, general Training | Firm | W<MP during and after training implying rents for the firm | Fully transferable wage returns elsewhere greater than returns at firm |

## Appendix 2

Table 4 : **Male Wage regressions (n=3068)**

| **Method:** | **2SLS** | **2SLS** |
|---|---|---|
| **Variables** | **CoeffCoeff** | |
| | **(Std.Error)** | **(Std Error)** |
| LnGROOMING | 0.047* | 0.188* |
| (0.023) | (0.082) | |
| LnGROOMING*WHITE | - -0.161 | |
| (0.085) | | |
| AGE | 0.065** 0.066** | |
| (0.007) | (0.007) | |
| $AGE^2/100$ | -0.067** | -0.067** |
| (0.008) (0.007) | | |
| WHITE | 0.140** | 0.603** |
| (0.033) | (0.260) | |
| NOHIGH | -0.304** -0.320** | |
| (0.035) | (0.036) | |
| SOMECOLL | 0.097** | |
| | 0.078** | |
| (0.025) | (0.028) | |
| COLLEGE | 0.399** | |
| | 0.384** | |
| | (0.031) | |
| | (0.031) | |
| MARRIED | 0.150** | |
| | 0.146** | |
| | (0.020) | |

| | | | | |
|---|---|---|---|---|
| | | | | (0.021) |
| Pagan-Hall's | $\chi^2(32)$ | 30.845 | 49.961 | |
| Centered $R^2$ | | 0.3915 | | 0.3796 |

These * and ** represent statistical significance at the 0.05 and 0.01 levels.

**Table 5: Female Wage regressions (n=2837)**

| **Method:** | **GMM** | **GMM** |
|---|---|---|
| **Variables** | **Coeff** | **Coeff** |
| | **(Std.Error)** | **(Std Error)** |
| LnGROOMING | 0.023 | 0.066 |
| | (0.027) | (0.070) |
| LnGROOMING*WHITE | - | -0.054 |
| | | (0.075) |
| AGE | 0.059** | 0.058** |
| | (0.006) | (0.006) |
| $AGE^2/100$ | -0.059** | -0.059** |
| (0.007) | (0.007) | |
| WHITE | 0.051** | 0.236** |
| | (0.024) | (0.256) |
| NOHIGH | -0.281** | -0.126** |
| | (0.045) | (0.046) |
| SOMECOLL | 0.128** | 0.126** |
| | (0.027) | (0.027) |
| COLLEGE | 0.477** | 0.476** |
| | (0.031) | (0.030) |
| MARRIED | -0.017 | -0.008 |
| | (0.019) | (0.019) |
| Pagan-Hall's $\chi^2(32)$ | 50.637** | 53.434** |
| Centered R2 | 0.3689 | 0.3649 |

## Appendix 3

Table 2 Conventional and Behavioural Wage Equations

| | NLYSW | | NCDS | |
|---|---|---|---|---|
| | extended human capital model A | behavioural model B | extended human capital model C | behavioural model D |
| Variable: | b(stat) b' | b(stat) b' | b(stat) b' | b (stat) b' |
| Years of education | 0.079(10.467)<br>0.196 | 0.071 (6.299)<br>0.179 | 0.108(9.638)<br>0.204 | 0.104(9.264)<br>0.197 |
| IQ Score | 0.066 (4.937)<br>0.081 | 0.063 (4.789)<br>0.077 | 0.006(2.996)<br>0.058 | 0.014 (2.626)<br>0.056 |
| "O" Exams completed* | | | 0.018(3.258)<br>0.071 | 0.0019 (0.861)<br>0.018 |
| Years of work experience | 0.0092<br>(2.399)<br>0.035 | 0.0083<br>(2.172)<br>0.032 | | |
| Parental SES | 0.0095<br>(1.476)<br>0.025 | 0.0087<br>(1.365)<br>0.023 | ** | ** |
| Number of children | - 0.073<br>(-6.278)<br>-0.096 | - 0.072<br>(-6.299)<br>-0.094 | | |
| Rotter score | | -0.028<br>(-4.481)<br>-0.067 | | |
| Aggression | | | | - 0.098<br>(-3.912)<br>- 0.076 |
| Withdrawal | | | | - 0.040<br>(-2.127)<br>- 0.033 |
| Adjusted $R^2$ | 0.327 | 0.341 | 0.245 | 0.259 |
| Observations | 915 | 915 | 1123 | 1123 |

Notes: All regressions include a constant and are white females actively employed in the year that wages are Measured (from Osborne 2000)

*"0" level exams indicate the number of completed Ordinary Level Exams to age 21.

** Socioeconomic status is also included in the model; however, it is not reported here because it is not statisticallysignificant,in either model.

Table 3 Returns to Distinct Personality Factors, Aggression and Withdrawal, By Sex and Predicted Occupational Status

| | High Status | | Low Status | |
|---|---|---|---|---|
| | Aggression b (t-stat) b' | Withdrawal b (t-stat) b' | Aggression b (t-stat) b' | Withdrawal b (t-stat) b' |
| | 0.199 | - 0.209 | - 0.079 | - 0.188 |
| | (5.199) | (-6.196) | (-4.599) | (-8.375) |
| Men | 0.145 | - 0167 | - 0.090 | -0.149 |
| | - 0.139 | 0.098 | - 0.057 | - 0.053 |
| | (-3.023) | (2.578) | (-1.216) | (-1.354) |
| Women | - 0.072 | 0.060 | - 0.052 | - 0.056 |

Notes: All regressions include a constant and are for white women actively employed in 1991 when wages are measured. The dependent variable is the natural log of self-disclosed hourly wages in in 1991, when respondents were 33 years of age. The coefficients b' represents the percentage change in wages from a one standard deviation change in the independent variable ($b'x=b_x\sigma_x$)

## References


1. Bassanini, A., Booth,A., Brunello,G.,PaolaDe,M., Leuven E.,(2005),***WorkplaceTraininginEurope*****,** IZA DP No. 1640,Discussion papers
2. Becker,S.G., (1993), ***Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education***. Chicago, University of Chicago Press
3. Bowles, S.,Herbert,G., Melissa,O.,(2001), ***The determinants of earnings: A behavioral approach,*** University of Massachusets Amherst college
4. Das,J., DeLoach, S.,B.,2008. "***Mirror, mirror on the wall: The effect of time spent grooming on wages***," Working Papers 2008-01, Elon University, Department of Economics.
5. Edward,L., 2008. "***Personnel economics***," *The New Palgrave Dictionary of Economics*, 2nd Edition, v. 6, p. 380 [pp. 380-84]