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UNIQUENESS AND INDETERMINACY OF EQUILIBRIA IN A MODEL WITH POLLUTING EMISSION

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Abstract. Is pollution a *dirty* word? To answer this question we develop an endogenous growth model *à la* Rebelo (1991) where *dirtiness* becomes a fundamental choice variable for the economy to grow. Conclusions to our analysis say that a positive sustainable economic growth is attainable only if polluting production activities are taken into account. Moreover, transitional dynamics points out that local stability and uniqueness of equilibria are also achieved.

JEL Classification: O41, Q01, Q32

Keywords: Environmental quality; Endogenous economic growth;
Pollution-augmenting technology

1. Introduction

Nowadays, pollution is still considered a *dirty* word. The basic question is whether or not a continued environmental degradation becomes necessary to the process of industrialization of an economy of our times. It is commonly accepted in the literature of this field that a clear connection between growth and environmental quality is so much complex, and not so easy to be found.¹ In fact, although concentration in the environment of some pollutants seem to benefit from growth (see, for example, coliforms in river basins); others irremediably worsen (as for CO_2 , SO_2); and still others do exhibit deterioration at a first stage followed by clear amelioration in a second phase of development.

Following Aghion and Howitt (1998), and Grimaud (1999), our scope is then to introduce environmental concerns as a fundamental choice variable for an economy to grow. To this end, the present paper is so aimed at describing how an economy – with depletion of environmental quality – performs by means of a Rebelo-type (1991) model. Why to choose this model? First, because it guarantees endogenous growth, although the simplicity of the structure, which is within the scope of our work. Second, because we do not need to endogenize the

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¹ For a complete survey of the literature concerning environmental economics, sustainable development and endogenous growth, see Pittel (2003).

technological sector which is simply maintained constant, thus simplifying the analysis (see, e.g., author, 2009, for a case with endogenous technical change). In other words, this version of the model considers a production function close to Rebelo (1991), and given by :

$$y = Akz$$

Where z represents a measure of dirtiness due to the existing production techniques (as pointed out by Aghion and Howitt, 1998),² while A is a constant which captures the level of technology.³ Besides, y stands for output, and k is a measure for aggregate capital, respectively. As we do not distinguish any kind of specialization among workers, from now on we will be dealing only with variables in per capita terms. Therefore, the level of new investments in physical capital can be expressed in the usual form

$$\dot{k} = y - c$$

We also borrow from Aghion and Howitt (1998) the assumption that pollution be a by-product of output. The flow of pollution loads P is then assumed to be proportional to the level of production, and to the use of cleaner technologies (which means low values of z) that reduce the pollution/output ratio

$$P = yz^\gamma \quad \gamma > 0$$

where γ is broadly referred to as a parameter indicating the degree of dirtiness reduction. To clarify the utility of using both variables, P and z , as two sides of the same coin – the damages to the environment, – let us make another example that can be drawn from current industrially advanced economies. Basically, oil combustion is being needed either to feed the engine of our cars or to stoke the furnaces of our firms, with CO_2 emissions being an unavoidable consequence. Referring to our model it would imply that only a fraction of the oil burnt (z) serves to produce final output (y), the rest being pushed into the atmosphere as a resulting emissions burden (P).

Following the existing literature of the field we also assume that the structure of preferences be given by the following CES utility function:

$$U(c, E) = \frac{(cE)^{1-\sigma} - 1}{1-\sigma}$$

² For example, focus on cheese manufacturing. Only a fraction of the raw milk processed gives rise to white cheese (or other dairy products), the remaining is called whey, a liquid by-product, only partially recyclable, which constitutes the greater part of the resulting pollution loads. In other words, we are assuming that production of output arises at the expenses of the environment, with some polluting emissions being necessarily needed.

³This production function exhibits constant returns to scale at a disaggregate level because each firm takes z as given. On the contrary, a social planner can internalize this kind of externality, due to pollution intensity, thus obtaining increasing returns (see, for example, Aghion and Howitt, 1998).

where c is per capita consumption, and E the usual environmental quality indicator (see, for example, Musu, 1995).⁴ Moreover, we define

$$\phi(c, E) = \frac{E \cdot U_E}{c \cdot U_c}$$

as the ratio of the values of environmental quality and consumption, both evaluated at their marginal utilities (see Le Kama and Schubert, 2004). That is, $\phi(\cdot)$ reflects the relative preference for the environment of the representative agent. Therefore, the utility function we adopted so far allows us to deal with the useful property of unitarian green preferences, that is $\phi = 1$.

On the other hand, environmental quality is supposed to evolve according to the law of motion

$$\dot{E} = \theta E - P$$

where θ represents the speed at which nature regenerates, and being now aware of the functional form assumed by the flow of pollution, when we substitute equation (1) into (2), such that $P = yz^\gamma = Akz^{1+\gamma}$. Finally, we focus on a centralized solution problem.⁵

2. Social planner analysis

The social planner maximizes the present discounted utility

$$\int_0^{\infty} \frac{(cE)^{1-\sigma} - 1}{1-\sigma} e^{-\rho t} dt$$

subject to the following constraints on per capita physical capital, and environmental quality:

$$\begin{aligned} \dot{k} &= Akz - c \\ \dot{E} &= \theta E - Akz^{1+\gamma} \end{aligned}$$

and given initial conditions on the state variables

$$k(0) = k_0 \quad E(0) = E_0$$

The current value Hamiltonian then looks like

⁴Both arguments c and E enter this utility function as two substitute goods. That is, as long as one increases, the second one must necessarily be reduced. Formally, this assumption requires $\frac{\partial^2 U}{\partial c \partial E} = \frac{1-\sigma}{(cE)^\sigma} < 0$ and consequently, $\sigma > 1$. Remember also that the higher

σ , the less willing are households to accept deviations from a uniform pattern of consumption over time (see Barro and Sala-i-Martin, 2004).

⁵ Appendix A provides a complete solution to the maximization problem which will be discussed in the next section.

$$H_c = \frac{(cE)^{1-\sigma} - 1}{1-\sigma} + \lambda[Akz - c] + \mu[\theta E - Akz^{1+\gamma}]$$

where λ , and μ represent the shadow prices of physical capital, and environmental quality, respectively.

First order condition for a maximum requires the discount Hamiltonian function to be maximized with respect to its control variables (c , and z)

$$\frac{\partial H_c}{\partial c} = 0 \Rightarrow \lambda = c^{-\sigma} E^{1-\sigma}$$

$$\frac{\partial H_c}{\partial z} = 0 \Rightarrow \lambda = \mu(1+\gamma)z^\gamma$$

though the canonical system provides also the law of motion of each costate variable,

$$\frac{\dot{\lambda}}{\lambda} = -\left(\frac{\gamma}{1+\gamma}\right)Az + \rho$$

$$\frac{\dot{\mu}}{\mu} = -\frac{c}{E}(1+\gamma)z^\gamma - \theta + \rho$$

this leading to a balanced growth rate given by

$$g = \frac{\varphi(1+\gamma)\tilde{z}^\gamma + \theta - \rho}{2\sigma - 1}$$

where φ represents the share of consumption to environmental quality, and \tilde{z} is a steady state solution for z , by log-differentiating (5), where we substitute (4), (6) and (7):

$$\gamma Az = \theta + \varphi(1+\gamma)^2 z^\gamma$$

whose explicit value is given in (P1).⁶

Evolution of the growth rate as a function of the parameter indicating the degree of dirtiness reduction, γ , roughly leads to a decreasing evolution of $g(\cdot)$, as in the following Fig. 1:

⁶Solution to this model requires consumption and environmental quality to grow in balanced growth at the same rate, that is $\frac{\dot{c}}{c} = \frac{\dot{E}}{E} = g$ thus being the share of consumption to

environmental quality constant along the BGP, $\frac{c}{E} = \varphi > 0$.

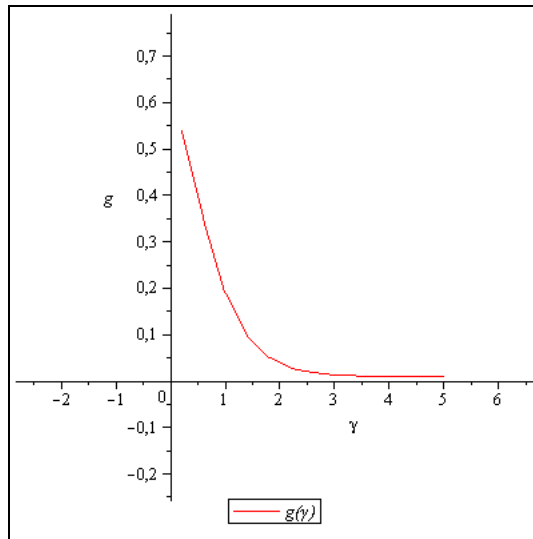


Fig. 1: Long run growth rate

This means that the growth rate of our economy is negatively influenced by any abatement process aimed to clean up the environment, but also lowers new production opportunities and future economic development.

To confirm the previous result, another comparative static exercise can be done, showing the dependence of the growth rate, g , on the level of dirty emissions, \tilde{z} . It follows from (7) that when \tilde{z} increases, g raises accordingly. Hence, polluting emissions seem necessary for the economy to grow in the long-run. Formally,

$$\frac{\partial g}{\partial \tilde{z}} = \frac{\varphi\gamma(1+\gamma)\tilde{z}^{\gamma-1}}{2\sigma-1} > 0$$

since we assumed $\sigma > 1$.

3. Local stability and uniqueness of equilibria

The next questions we need to answer regard which path will this economy follow while converging to the steady state? Is our system stable or unstable? If it is stable, do solutions describe uniqueness or multiplicity of equilibria, or might we face indeterminacy problems? To answer these questions, we ought to investigate the local stability properties of the BGP found in the previous section and describe the reasons for why an indeterminate equilibrium could possibly arise. To this end, we have to analyze the Jacobian matrix of the reduced system, and check for the sign of the associated eigenvalues.

First of all, to reduce the system, we introduce the following convenient variable substitution:

$$x = \frac{c}{E}$$

$$v = \frac{c}{k}$$

and make the weak sustainability condition, that is we assume the environmental quality to grow over time at a constant rate ($\frac{\dot{E}}{E} = \xi$);⁷ thus driving to a system of three equations in three unknowns

$$\begin{aligned}\frac{\dot{x}}{x} &= \left[\left(\frac{1-2\sigma}{\sigma} \right) \xi - \frac{\rho}{\sigma} \right] + \left(\frac{\gamma}{1+\gamma} \right) \frac{A}{\sigma} z \\ \frac{\dot{v}}{v} &= \left[\left(\frac{1-\sigma}{\sigma} \right) \xi - \frac{\rho}{\sigma} \right] + \left[\frac{\gamma - \sigma(1+\gamma)}{1+\gamma} \right] \frac{A}{\sigma} z + v \\ \frac{\dot{z}}{z} &= \frac{\theta}{\gamma} + \left(\frac{1+\gamma}{\gamma} \right) x z^\gamma - \frac{A}{1+\gamma} z\end{aligned}$$

with the following steady state values

$$\begin{aligned}\tilde{x} &= \left(\frac{\gamma}{1+\gamma} \right) \frac{1}{\tilde{z}^\gamma} \left[\frac{A\tilde{z}}{1+\gamma} - \frac{\theta}{\gamma} \right] \\ \tilde{v} &= A\tilde{z} - \xi \\ \tilde{z} &= \left(\frac{\Theta + \sigma\xi}{A\gamma} \right) (1+\gamma)\end{aligned}$$

where $\Theta = \rho - (1-\sigma)\xi > 0$.

The Jacobian matrix, evaluated at the steady state, then becomes

$$J^* = J_{(\tilde{x}, \tilde{v}, \tilde{z})} = \begin{bmatrix} 0 & 0 & \left(\frac{\gamma}{1+\gamma} \right) \frac{A}{\sigma} \\ 0 & \frac{\theta}{\sigma} - \left[\frac{\gamma - \sigma(1+\gamma)}{1+\gamma} \right] \frac{A}{\sigma} \tilde{z} & \left[\frac{\gamma - \sigma(1+\gamma)}{1+\gamma} \right] \frac{A}{\sigma} \tilde{v} \\ \left(\frac{1+\gamma}{\gamma} \right) \tilde{z}^{1+\gamma} & 0 & -\frac{A\tilde{z}}{1+\gamma} \end{bmatrix}$$

with the following associated signs⁸

$$J^* = \begin{bmatrix} 0 & 0 & + \\ 0 & + & - \\ + & 0 & - \end{bmatrix}$$

⁷ Remember that under the *weak sustainability* version, environmental quality is not constrained to be constant over time ($\dot{E} = 0$), thanks to technological progress which permits to substitute natural capital with physical capital continuously.

⁸ Since both parameters γ and σ are constrained to be greater than unity ($\gamma > 1$, $\sigma > 1$).

Proposition 1. *Let assume the following parameters' restrictions: $\gamma > 1$, $\sigma > 1$, $\xi > 0$, and $\rho > \theta$; then the equilibrium is locally unique: J^* has one negative eigenvalue and two eigenvalues with positive real parts.*

Proof. For completeness, see also the Appendix B.

Briefly, we are able to derive the characteristic equation of the system, defined as

$$-\kappa^3 + trJ^* \kappa^2 - BJ^* \kappa + DetJ^* = 0$$

being κ the auxiliary variable (the eigenvalue of the system). Provided that $trJ^* > 0$, $BJ^* < 0$, and $DetJ^* < 0$, we can thus check for local stability of the system around the steady state by means of the neat Routh-Hurwitz theorem, which can be summarized as

The number of roots of the characteristic polynomial with positive real parts is equal to the number of variations of sign in the scheme

$$-1 \quad trJ^* \quad -BJ^* \quad + \frac{DetJ^*}{trJ^*} \quad DetJ^*$$

that we can briefly synthesize for our model as :

$$- \quad + \quad + \quad -$$

that is, we have two changes of sign, hence J^* has one negative eigenvalue and two eigenvalues with positive real parts. As a consequence, the equilibrium is *locally unique*.

Trying to simulate the system numerically, we can solve for it by substituting out some reasonable parameter values that can be found across the literature on the field (See, for example, Stokey, 1998).⁹ Therefore, the

⁹With the following parameters' scheme:

γ	σ	A	ξ	ρ
2	1.5	1	0.03	0.02

the Jacobian matrix now becomes:

$$J^* = \begin{bmatrix} 0 & 0 & 0.44 \\ 0 & 0.15 & 0.09 \\ 0.01 & 0 & -0.06 \end{bmatrix}$$

since we assume that the level of technology (A) is normalized to one, for simplicity, while γ and σ are strictly greater than one. Moreover, natural capital is assumed to grow at a 3% annual rate ($\frac{\dot{E}}{E} = \xi = 0.03$). Finally, we assume a small, but still positive, level of the social discount rate, $\rho = 0.02$.

characteristic equation of the system now becomes :

$$f(\kappa) = -\kappa^3 + 0.09\kappa^2 + 0.013\kappa - 0.0007$$

which can be solved through Cardano's formula, and represented as follows in Fig. 2:

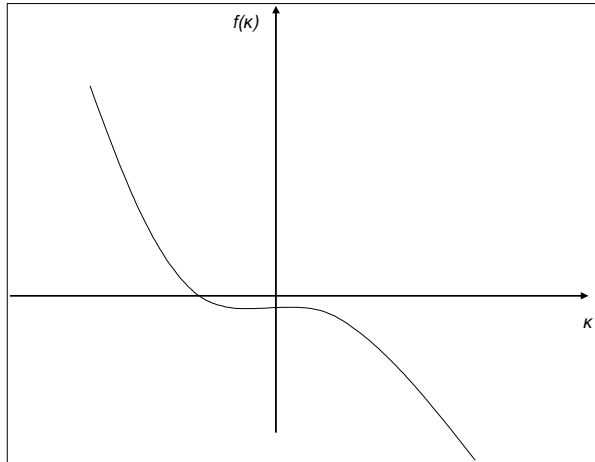


Fig. 2: Characteristic Function

that is to say, there is a double change of sign, and there are one negative eigenvalue and two complex conjugate eigenvalues with positive real part.¹⁰ With a three-dimensional phase space, motion close to an equilibrium can be studied on the basis of local linearized equations. In our case, graphic representation of the solution might be depicted as in Fig. 3:

¹⁰Cardano's formula to solve cubic equations in basic form: $x^3 + ax^2 + bx + c = 0$ can be obtained through the convenient substitution $y = x + a/3$, that leads to the reduced form: $y^3 + py + q = 0$ with $p = \frac{3b-a^2}{3}$ and $q = c + \frac{2a^3}{27} - \frac{ab}{3}$, thus deriving the following associated roots:

$$x_1 = -\frac{a}{3} + u + v$$

$$x_{2,3} = -\frac{a}{3} - \frac{u+v}{2} \pm \sqrt{3} \frac{u-v}{2} i$$

where $i = \sqrt{-1}$ is the imaginary root, $u = \sqrt[3]{-\frac{q}{2} + \sqrt{D}}$ and $v = \sqrt[3]{-\frac{q}{2} - \sqrt{D}}$, whereas

$$D = \left(\frac{p}{3}\right)^3 + \left(\frac{q}{2}\right)^2$$
 is the discriminant.

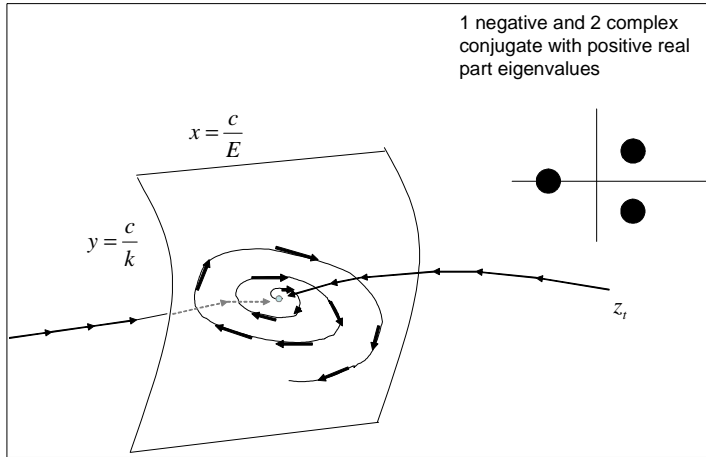


Fig. 3: Liapunov's Saddle

As pointed out in the Argand diagram above the picture, we can think of it as a so-called Liapunov's saddle of index 2, where the index stands for the number of positive eigenvalues. Hence, for any starting value of our *state-like* variables – capital (k) and environmental quality (E) – the corresponding initial values of our *control-like* variables – consumption (c) and the level of dirtiness (z) – must be those which lay along the stable manifold that drives the system towards the stable equilibrium point. The general idea is that, for any positive initial level of physical and natural capital, k_0 and E_0 , there is a unique initial level of consumption and dirtiness, c_0 and z_0 , that is consistent with households' intertemporal optimization. Obviously, if the economy does not start with these initial values, that is we are off the stable manifold, we will never reach the equilibrium, thus being balanced growth amongst variables irremediably compromised.

4. Evolution of $z(t)$

It can be useful to separately analyze the evolution of the level of dirtiness, z , along the transition path towards the steady state. By means of the equation of motion for z_t derived in (P),

$$\frac{\dot{z}}{z} = \frac{\theta}{\gamma} + \left(\frac{1+\gamma}{\gamma} \right) x z^\gamma - \frac{A}{1+\gamma} z$$

we might deeply investigate the properties of this nonlinear first-order differential equation. And since z is raised to the power of γ , we are thus facing a parametric problem, that can be quite difficult to deal with. To ease the analysis, let us firstly fix x at the steady-state

value (\tilde{x}), for we can imagine z to move along the stable plane x - y . Moreover, if we simply consider the case when $\gamma = 1$, we are able to derive, with a little bit of mathematical manipulation, the following simpler differential equation

$$\dot{z} - \theta z = bz^2$$

where $b = [2\tilde{x} - \frac{A}{2}]$

This equation is commonly referred to as a *Bernoulli equation*, which can be easily reduced to a linear differential equation and solved as such, providing the following solution for z :

$$z(t) = \frac{e^{\theta t}}{B + ce^{\theta t}}$$

where, B is a positive constant, and $c = -\frac{b}{\theta}$. And since we constrained $z \in [0, 1]$, we assume therefore that $b < 0$, and consequently $c > 0$. Graphic representation of Eq. 10 is given in Fig. 4:

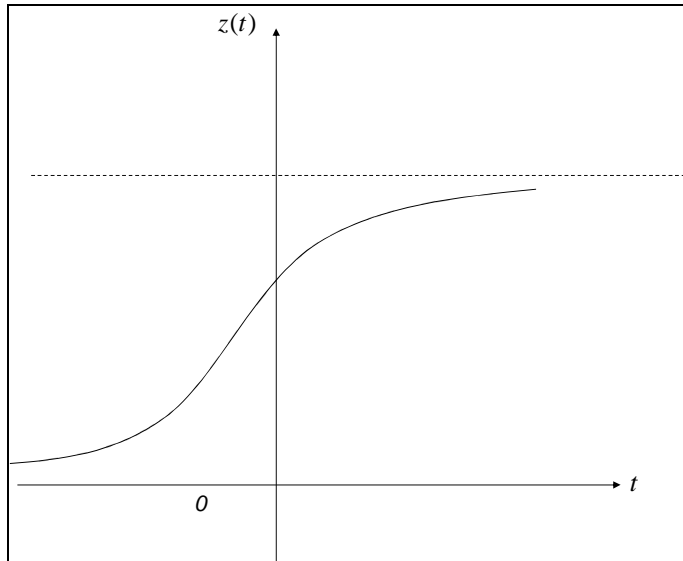


Fig. 4: Evolution of dirtiness

However, since our analysis is of economic sense only in the positive quadrant, we may note that z evolves less than proportionally as time goes by, which is also consistent from an empirical point of view. In this light, it is worth noting that the current debate among environmental economists is mainly concerned with the robustness of the so-called Environmental Kuznets Curve hypothesis (*EKC*), for some indicators of environmental degradation are supposed to rise at an early stage of development, and then to necessarily fall with increasing per capita income. Moreover, recent evidence points out that even if emissions of many pollutants have undoubtedly declined over time due to increasingly stringent environmental regulations, it is also true that a new variety of pollutants have

entered the *environmental scenario* (e.g., carbon dioxide, sulfur and nitrogen oxides, municipal waste), so making the aggregate damaging effect of an upward sloping drift (see, for example, Stern 2004). The dynamic depicted in Fig. 4 does clearly fit the first case, with dirtiness being rising at an early phase of development, until an upper-bound is finally reached whenever societies demand that more attention be paid to environmental concerns, and economies hopefully move towards a sustainable path.

5. Concluding Remarks

Although some attempts have been made to extend traditional endogenous growth models, they mostly lead to indeterminacy, that is multiple equilibria might arise.¹¹ Traditional explanations of indeterminacy arising in endogenous growth models is explained through two identical economies with identical initial conditions that might consume, produce new goods though polluting the environment, and exploit natural resources at completely different rates. Only in the long run are these economies supposed to converge to the same growth rate, but not to the same level of output, consumption, and human and physical capital.¹² Conclusions to our analysis say that we might face determinacy instead, and transitional dynamics confirms that when environmental issues are introduced into a Rebelo (1991) type model a unique stable equilibrium can be reached (that is, BGP is determinate), depending on the initial values the economy starts up with.

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¹¹ For example, Benhabib and Perli (1994) study the dynamics of endogenous growth in a generalized version of Lucas (1988) that incorporates a labour-leisure choice; while Scholz and Ziemes (1999) try to explain exhaustible resource use by means of a Romer (1990) type model. They both conclude that equilibrium trajectories are indeterminate, and a continuum of equilibria is very likely to happen.

¹² It is usually assumed the presence of cultural and non-economic factors affecting fundamentals like technology or preferences to greenery, as a possible explanation for equilibria to differ along the transition paths.

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Appendix A

The Social Planner Maximization Problem

The current value Hamiltonian for the maximization problem is given by

$$H_c = \frac{(cE)^{1-\sigma} - 1}{1-\sigma} + \lambda[Akz - c] + \mu[\theta E - Akz^{1+\gamma}] \quad (A.1)$$

where λ and μ denote the costate variables associated with the accumulation of physical and natural capital, respectively.

First order conditions can be written as:

$$\frac{\partial H_c}{\partial c} = c^{-\sigma} E^{1-\sigma} - \lambda = 0 \Rightarrow c^{-\sigma} E^{1-\sigma} = \lambda \quad (A.2)$$

$$\frac{\partial H_c}{\partial z} = \lambda Ak - \mu(1+\gamma)Akz^\gamma = 0 \quad (A.3)$$

$$\text{that is simply}^{13} \lambda = \mu(1+\gamma)z^\gamma \quad (A.4)$$

Equation of motion for each costate variable is given by

$$\dot{\lambda} = -\frac{\partial H_c}{\partial k} + \lambda\rho \quad (A.5)$$

$$\dot{\mu} = -\frac{\partial H_c}{\partial E} + \mu\rho \quad (A.6)$$

and we can simply derive, by means of the conditions obtained above:

¹³ Necessary condition for a maximum can be checked by studying the sign of all principal minors of the Hessian matrix for the control variables of the problem, whose determinant is formed by the following signs: $|H| = \begin{vmatrix} - & 0 \\ 0 & - \end{vmatrix}$ thus obtaining, $|H_1| < 0$, $|H_2| = |H| > 0$, that is to say, the system is maximized.

$$\frac{\dot{\lambda}}{\lambda} = -\left(\frac{\gamma}{1+\gamma}\right)Az + \rho \quad (\text{A.7})$$

$$\frac{\dot{\mu}}{\mu} = -\frac{c}{E}(1+\gamma)z^\gamma - \theta + \rho$$

whereas, taking logs in (A.1) and differentiating, we have

$$\frac{\dot{\lambda}}{\lambda} = -\sigma \frac{\dot{c}}{c} + (1-\sigma) \frac{\dot{E}}{E} \quad (\text{A.8})$$

since we assume that, in balanced growth, c and E must grow at the same rate, g , it is indeed true that

$$\frac{\dot{\lambda}}{\lambda} = (1-2\sigma)g \quad (\text{A.9})$$

Moreover, the law of motion of the shadow price of the environment, the costate variable μ , is

$$\dot{\mu} = -c^{1-\sigma}E^{-\sigma} - \mu\theta + \mu\rho \quad (\text{A.10})$$

or, alternatively,

$$\frac{\dot{\mu}}{\mu} = -\frac{U_E}{\mu} - \theta + \rho \quad (\text{A.11})$$

given that $\frac{\partial U(c)}{\partial E} = c^{1-\sigma}E^{-\sigma} = U_E$. But substituting out μ in the RHS, by means of equation (A.4), we obtain

$$\frac{\dot{\mu}}{\mu} = -\frac{U_E}{\lambda}(1+\gamma)z^\gamma - \theta + \rho \quad (\text{A.12})$$

Since $\lambda = U_c$, from FOC, and given constancy of z in balanced growth at some value \tilde{z} , we have

$$\frac{\dot{\mu}}{\mu} = -\frac{U_E}{U_c}(1+\gamma)\tilde{z}^\gamma - \theta + \rho \quad (\text{A.13})$$

and finally, since equilibrium requires that $\frac{U_E}{U_c} = \frac{c}{E} = \varphi$, it follows

$$\frac{\dot{\mu}}{\mu} = -\varphi(1+\gamma)\tilde{z}^\gamma - \theta + \rho \quad (\text{A.14})$$

Equation (A.4) says that

$$\lambda = \mu(1+\gamma)z^\gamma \quad (\text{A.15})$$

but we are assuming that, for balanced growth to be achieved, z must be held constant at some value called \tilde{z} . In fact, from equation (1) we can derive

$$\frac{\dot{y}}{y} = \frac{\dot{k}}{k} + \frac{\dot{z}}{z}$$

but since balanced growth requires both output, y , and physical capital, k , to grow at the same rate, it follows consequently that z must be held constant at some value called \tilde{z} . Hence, λ and μ must be equal, so it is their growth rate:

$$\frac{\dot{\lambda}}{\lambda} = \frac{\dot{\mu}}{\mu} \quad (\text{A.16})$$

On the other hand, from (A.16), by means of (A.9), follows that

$$\lambda_t = \mu_t = \tilde{\lambda} e^{(1-2\sigma)gt} \quad (\text{A.17})$$

where $(1-2\sigma)g < 0$, since we assumed that $\sigma > 1$.

It is easy to note that as long as $t \rightarrow \infty$ all Lagrange multipliers converge to zero (with $\tilde{\lambda}$ being a constant value assumed by both shadow prices in BGP).

Transversality conditions for a free terminal state hold for all shadow prices, and are given by

$$\begin{aligned} \lim_{t \rightarrow \infty} \lambda k e^{-\rho t} &= \tilde{\lambda} e^{(1-2\sigma)gt} \tilde{k} e^{gt} e^{-\rho t} = \tilde{\lambda} \tilde{k} e^{-(2\sigma g + \rho)t} = 0 \\ \lim_{t \rightarrow \infty} \mu E e^{-\rho t} &= \tilde{\mu} e^{(1-2\sigma)gt} \tilde{E} e^{gt} e^{-\rho t} = \tilde{\mu} \tilde{E} e^{-(2\sigma g + \rho)t} = 0 \end{aligned} \quad (\text{A.18})$$

where $\tilde{\lambda}$, $\tilde{\mu}$, and \tilde{k} , \tilde{E} , are the shadow prices and the state-values on the balanced growth path, respectively. Moreover, for free time t , we need to show that $\lim_{t \rightarrow \infty} H = 0$, which is always verified due to convergence towards zero of both the discounted utility function, $\lim_{t \rightarrow \infty} U(\cdot) e^{-\rho t} = 0$, and all the multipliers, as proved above.

Appendix B

Dynamics of a Rebelo-type model with dirtiness

Transitional dynamics of the problem can be derived through the law of motion of the state variables:

$$\begin{aligned} \dot{k} &= Akz - c \\ \dot{E} &= \theta E - Akz^{1+\gamma} \end{aligned} \quad (\text{B.1})$$

with the stated equations for the multipliers:

$$\begin{aligned}\frac{\dot{\lambda}}{\lambda} &= -\left(\frac{\gamma}{1+\gamma}\right)Az + \rho \\ \frac{\dot{\mu}}{\mu} &= -\frac{c}{E}(1+\gamma)\tilde{z}^\gamma - \theta + \rho\end{aligned}\tag{B.2}$$

and being aware that the law of motion for z can be derived from first order condition (5), by taking logs to both sides, and then substituting out the law of motion of each multiplier, as defined in (6).

To make things simpler, we adopt the following convenient substitutions:

$$\begin{aligned}\frac{c}{E} &= x \\ \frac{c}{k} &= v\end{aligned}\tag{B.3}$$

and derive the system of autonomous equations:

$$\begin{aligned}\frac{\dot{x}}{x} &= \left[\left(\frac{1-2\sigma}{\sigma}\right)\xi - \frac{\rho}{\sigma}\right] + \left(\frac{\gamma}{1+\gamma}\right)\frac{A}{\sigma}z \\ \frac{\dot{v}}{v} &= \left[\left(\frac{1-\sigma}{\sigma}\right)\xi - \frac{\rho}{\sigma}\right] + \left[\frac{\gamma-\sigma(1+\gamma)}{1+\gamma}\right]\frac{A}{\sigma}z + v \\ \frac{\dot{z}}{z} &= \frac{\theta}{\gamma} + \left(\frac{1+\gamma}{\gamma}\right)xz^\gamma - \frac{A}{1+\gamma}z\end{aligned}\tag{B.4}$$

with the following steady-states equilibria:

$$\begin{aligned}\tilde{x} &= \left(\frac{\gamma}{1+\gamma}\right)\frac{1}{\tilde{z}^\gamma} \left[\frac{A\tilde{z}}{1+\gamma} - \frac{\theta}{\gamma}\right] \\ \tilde{v} &= A\tilde{z} - \xi \\ \tilde{z} &= \left(\frac{\Theta + \sigma\xi}{A\gamma}\right)(1+\gamma)\end{aligned}\tag{B.5}$$

where $\Theta = \rho - (1-2\sigma)\xi > 0$.

Stability analysis can be checked through the signs of the Jacobian matrix of the system

$$J_{(\tilde{x}, \tilde{v}, \tilde{z})}^* = \begin{bmatrix} J_{11}^* & J_{12}^* & J_{13}^* \\ J_{21}^* & J_{22}^* & J_{23}^* \\ J_{31}^* & J_{32}^* & J_{33}^* \end{bmatrix}$$

evaluated at the steady state $(\tilde{x}, \tilde{v}, \tilde{z})$, thus obtaining,

$$J_{(\tilde{x}, \tilde{v}, \tilde{z})}^* = \begin{bmatrix} 0 & 0 & \left(\frac{\gamma}{1+\gamma}\right)\frac{A}{\sigma} \\ 0 & \frac{\Theta}{\sigma} - \left[\frac{\gamma-\sigma(1+\gamma)}{1+\gamma}\right]\frac{A}{\sigma}\tilde{z} & \left[\frac{\gamma-\sigma(1+\gamma)}{1+\gamma}\right]\frac{A}{\sigma}\tilde{v} \\ \left(\frac{1+\gamma}{\gamma}\right)\tilde{z}^{1+\gamma} & 0 & -\frac{A\tilde{z}}{1+\gamma} \end{bmatrix} \quad (\text{B.6})$$

where we assume $\frac{\dot{E}}{E} = \xi > 0$, and $\sigma > 1$.

The associated determinant then becomes

$$\text{Det}J^* = \begin{vmatrix} 0 & 0 & \left(\frac{\gamma}{1+\gamma}\right)\frac{A}{\sigma} \\ 0 & \frac{\Theta}{\sigma} - \left[\frac{\gamma-\sigma(1+\gamma)}{1+\gamma}\right]\frac{A}{\sigma}\tilde{z} & \left[\frac{\gamma-\sigma(1+\gamma)}{1+\gamma}\right]\frac{A}{\sigma}\tilde{v} \\ \left(\frac{1+\gamma}{\gamma}\right)\tilde{z}^{1+\gamma} & 0 & -\frac{A\tilde{z}}{1+\gamma} \end{vmatrix} \quad (\text{B.7})$$

that can be reduced to

$$\text{Det}J^* = -\frac{A}{\sigma}\tilde{z}^{1+\gamma} \left\{ \frac{\Theta}{\sigma} - \left[\frac{\gamma-\sigma(1+\gamma)}{1+\gamma}\right]\frac{A}{\sigma}\tilde{z} \right\} \quad (\text{B.8})$$

which is always negative ($\text{Det}J^* < 0$), as long as all parameters are constrained to be positive and, particularly, either $\gamma > 1$ or $\sigma > 1$, thus determining the following sign sequence for each matrix element:

$$J^* = \begin{bmatrix} 0 & 0 & + \\ 0 & + & - \\ + & 0 & - \end{bmatrix} \quad (\text{B.9})$$

Following Benhabib and Perli (1994), we need to check for the sign of the real part of the roots (the eigenvalues of the Jacobian matrix), and study the stability of the system by means of the Routh-Hurwitz criterion. To this end, we derive the characteristic equation of the Jacobian matrix:

$$-\kappa^3 + \text{tr}J^*\kappa^2 - BJ^*\kappa + \text{Det}J^* = 0$$

and examine the variation of signs in the following sequence:

$$-1 \quad \text{tr}J^* \quad -BJ^* + \frac{\text{Det}J^*}{\text{tr}J^*} \quad \text{Det}J^*$$

where the trace of the determinant is given by

$$\text{tr}J^* = J_{11}^* + J_{22}^* + J_{33}^*$$

that is explicitly

$$\text{tr}J^* = \frac{\Theta}{\sigma} - \left(\frac{\gamma}{1+\gamma}\right)\frac{(1-\sigma)A\tilde{z}}{\sigma} \quad (\text{B.10})$$

which is clearly positive ($\text{tr}J^* > 0$), since $\sigma > 1$.

Furthermore, the cross determinant of the minors, is given by

$$BJ = \begin{vmatrix} J_{11}^* & J_{12}^* \\ J_{21}^* & J_{22}^* \end{vmatrix} + \begin{vmatrix} J_{22}^* & J_{23}^* \\ J_{32}^* & J_{33}^* \end{vmatrix} + \begin{vmatrix} J_{11}^* & J_{13}^* \\ J_{31}^* & J_{33}^* \end{vmatrix}$$

or, explicitly,

$$BJ^* = -\frac{A}{\sigma} \tilde{z} \left\{ \frac{\Theta}{\sigma} - \left[\frac{\gamma - \sigma(1 + \gamma)}{1 + \gamma} \right] \frac{A}{\sigma} \tilde{z} \right\} - \frac{A}{\sigma} \tilde{z}^{1+\gamma} \quad (\text{B.11})$$

which is clearly always strictly negative, $BJ < 0$.

And since,

$$\begin{aligned} -BJ^* + \frac{DetJ^*}{trJ^*} &= \frac{A}{\sigma} \tilde{z} \left\{ \frac{\Theta}{\sigma} - \left[\frac{\gamma - \sigma(1 + \gamma)}{1 + \gamma} \right] \frac{A}{\sigma} \tilde{z} \right\} + \\ &+ \frac{A}{\sigma} \tilde{z}^{1+\gamma} - \frac{\frac{A}{\sigma} \tilde{z}^{1+\gamma} \left\{ \frac{\Theta}{\sigma} - \left[\frac{\gamma - \sigma(1 + \gamma)}{1 + \gamma} \right] \frac{A}{\sigma} \tilde{z} \right\}}{\frac{\Theta}{\sigma} - \left(\frac{\gamma}{1 + \gamma} \right) \frac{(1 - \sigma)A\tilde{z}}{\sigma}} > 0 \end{aligned} \quad (\text{B.12})$$

it is indeed true that the necessary condition

$$-BJ^* + \frac{DetJ^*}{trJ^*} > 0$$

always holds. It can be so proved that there are two change of sign in the characteristic roots, with one negative eigenvalue and two eigenvalues with positive real part. That is, there is always a continuum of equilibria.

ON THE MACROECONOMIC IMPACT OF REMITTANCES IN ROMANIA

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Abstract. This note looks at remittances' aggregate impact on the private consumption and investment in Romania for the period 2000 to the second quarter of the year 2008. We estimate two separate equations, one for the private consumption and one for the investment, using an ARDL (Auto Regressive Distributed Lag) model for each equation. We try to account for the time series properties of the variables. The study provides evidence against the worst hypothesis regarding the impact of remittances, which would be that in Romania remittances positively influence the consumption and negatively the investment. In the final part we provide a discussion of the results and lines for future developments.

JEL Classification: C22, E21, E22, E29

Keywords: consumption; investment; remittances; macroeconomic impact; time series analysis; ARDL.

1. Introduction

The role played by the financial transfers of the workers abroad in the development and economic growth of the origin country is of maximum interest for the research institutions and for the policy making organizations (national and international).

Chami et al. (2003) starts a list of recent papers at the International Monetary Fund (IMF) on the issue of migrants' remittances. In a simple model they provide a link between the motivation of the remittances and their effects on the economic activity in the migrants' origin country. One of the starting points is the assumption that the relationship between the migrant and her family is based on altruism. Therefore, the utility of the migrant depends on the utility of her family members at home. This implies that remittances will be sent in order to help the family to avoid the shortfalls created by idiosyncratic or aggregate negative economic shocks. Thus, the model predicts that transfers have a compensatory role and fluctuate countercyclically.

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Another important feature of the model of Chami et al. (2003) is that the family members who do not migrate participate in the domestic labor market. The realization of wages and output in the origin country responds to the aggregate behavior of its workers, which is influenced by the financial transfers from abroad. Therefore, the receipt of remittances has an effect on overall output, which in turn affects the likelihood of needing remittance transfers. Under these circumstances, a moral hazard problem can emerge between the remitters and the recipients. Its effect is to induce the recipients to act in ways that tend to decrease expected output (e.g. the recipients may decrease their labor force participation, limit their job searches, invest in riskier projects, etc.). The authors empirically analyze the two testable implications of their model on a panel that include up to 113 countries, over (up to) 29 years. Data confirms the countercyclical nature of remittances and that they are negatively associated with economic growth.

Using a vector error correction (VEC) model for Sri Lanka, Lueth and Ruiz-Arranz (2007) call into question the universality of the assumption that the transfers are motivated by altruism. Under altruism remittances should be negatively correlated with the income in the home country. Alternatively, remittances could be motivated by portfolio considerations, in which case they should be aligned with the business cycle in the home country and respond to interest rate differentials. Under either hypothesis, other macroeconomic variables are likely to have an impact on the amount of money sent home: exchange rate, price level in the origin country, business cycle in the host country, etc.

The authors estimate the VEC model on quarterly data from 1996 to 2004. They find that remittances behave strongly procyclical, are positively correlated with the oil price (which can be a good proxy for the economic activity in migrants' host countries), and decline when the Sri Lankan currency weakens. The authors conclude that the case of Sri Lanka shows that remittances can sometimes be less of a hedge against the negative shocks in migrants' origin country than commonly believed. From an econometric point of view, the study of Lueth and Ruiz-Arranz (2007) tries to overcome the weaknesses of earlier studies that seek to establish a relationship between workers remittances and a set of macroeconomic variables (most of the earlier studies ignore the time series properties of the variables, or issues of endogeneity and reverse causality, etc.).

Giuliano and Ruiz-Arranz (2005) try to give an answer to the following three questions: what is the macroeconomic effect of remittances, how does financial development influence the growth effect of remittances, respectively, are remittances important for productive investment? From a theoretical point of view, the relationship between remittances, financial development and growth is a priori ambiguous. However, using pooled cross-section data on remittance flows which cover 70 developing countries, Giuliano and Ruiz-Arranz (2005) show that this type of transfers can promote growth in less financially developed countries. Consequently, their study provides evidence that remittances can substitute for a lack of financial development and promote growth through the investment channel. As for the econometric analysis, the authors control for the endogeneity of remittances and financial development using a Generalized Methods of Moments (GMM) approach.

The motivation, the macroeconomic impact and the cyclical properties of the remittances gain increasing interest from the organizations of the European Union (EU) as well. As Schiopu and Siegfried (2006) notice, at the level of EU, the

Council invited the Commission in May 2003 to investigate the possibilities for reducing the cost and increasing the reliability of remittances from workers living in the EU. Moreover, it is exactly the existence of such studies like the one of Schiopu and Siegfried [8] that reveals an increasing interest at the level of European Central Bank (ECB) for issues related to remittances. Their work addresses the key question whether remittances behave like capital flows or like altruistic transfers. Using a dataset containing information on bilateral remittance flows from 21 European countries to 7 European neighboring countries, they find that the difference in GDP between the host and home countries increases average remittances and that the effect of the interest rate differentials is not significant. These results are interpreted as an indication that altruism is important for remitting, while the investment motive is weak.

The present note contributes to the strand of the literature on remittances that tries to establish correlations with macroeconomic variables for a single recipient country, which in this case is Romania. With respect to much of the above mentioned literature (for instance Schiopu and Siegfried, 2006), we are more interested in the effects of these transfers rather than their determinants. Between 2000 and 2008 the trend of the remittances' ratio from GDP grew from less than 2% to more than 5% (see Appendix B). Although such a figure does not place Romania in the first fifteen countries with the highest remittances received as a percentage of the GDP (by IMF, 2003 classification, Balance of Payments Statistics Yearbook 2002 (Washington, DC, IMF Publications Services)), it shows the country is closed to enter this top. Realizing the level and importance of these transfers, in our opinion, studies on the macroeconomic impact of the remittances subscribe to the main objective of a central bank, which is price stability. To better understand this last statement, suppose for instance that remittances are used by the migrants' families only to supplement private consumption. (This is the conclusion of the majority of the empirical studies regarding the destination of the remittances, as Taylor et al. (1996) notice in a detailed review of the literature in this field.) Under these circumstances, an increase in the remittances would generate an increase of the aggregate demand mainly through consumption. If additionally, the problem of moral hazard (as indicated by Chami et al., 2003) is present, then an increase in the remittances would definitely have a negative impact on the price stability. That is, the clearing between the increasing aggregate demand and the aggregate supply of goods would only be possible against a background of inflationary pressures or/and higher imports. Alternatively, if remittances also have as destination productive and entrepreneurial activities, then the impact of their growth can be very different, as noticed by Leon-Ledesma and Piracha (2004). That is, the clearing between the increasing aggregate demand and supply would base itself also on increased production capacities and thus, it would less reflect into inflationary pressures.

This note is limited to a brief inspection of remittances' impact on the private consumption and investment. To our knowledge, it is the first attempt to establish an econometric relationship between remittances and these two macroeconomic variables in the case of Romania, using time series specific techniques. The period considered in the study is 2000Q1-2008Q2. The reason is that viable data for remittances are not available before 2000, respectively after 2008Q2 the financial-economic crisis starts in Romania, a period of huge negative shocks that cannot be relevantly integrated in an econometric analysis with the rest

of the data. We estimate two separate equations, one for the private consumption and one for the investment, using an ARDL (Auto Regressive Distributed Lag) model for each equation. We try to account for the time series properties of the variables. Even after not considering in our analysis the period corresponding to the financial-economic crisis, there are special circumstances under which the estimation of the two equations is conducted. Specifically, Romania joined the EU on 1st of January 2007, and due to this fact the country experienced before and after “very high” growth rates for investment, consumption, remittances, etc., even if expressed as GDP ratios. Therefore, most of the variables in our analysis depict trend.

The results of the ADF (Augmented Dickey-Fuller) and KPSS (Kwiatkowski, Phillips, Schimdt and Shin) unit root tests are in many cases contradictory, and moreover, they are very volatile to small modifications of the sample and the size of the tests.¹ Therefore, we analyze the equations for two scenarios: the stationarity of the time series involved in the estimations, respectively the non-stationarity of some of these series. The study may suffer from a number of possible drawbacks that are discussed at the end of the paper. However, in our view, the study provides evidence against the worst hypothesis regarding the impact of remittances, i.e. that in Romania remittances positively influence the consumption and negatively the investment. On the contrary, in an optimistic interpretation of our results, remittances have a positive influence on investment and a negative impact on the private consumption.

The note is organized as follows. Section II presents the data and the analytical form of the two equations. Section III presents the results and in section IV we discuss these results, draw some conclusions and establish lines for the future investigation of the issue.

2. Data and econometric models

2.1. Data

The data used in the econometric analysis range from the first quarter of the year 2000 till the second quarter of the year 2008. Sources for the data are the National Institute of Statistics, respectively the Statistics Department of the National Bank of Romania. The data include quarterly time series for GDP, private consumption, investment, remittances, foreign direct investment, real interest rates on loans and deposits and a productivity indicator for the whole economy. (The calculation of the real interest rates for both deposits and loans is based on nominal annual rates which are calculated as weighted averages of short-term (i.e. maturity up to one year) interest rates with different maturities. For instance, for the deposits, the weights show the incidence of a given maturity in the total amount of deposits). We skip the main descriptive statistics of the time series that we use. However, files with data and calculations are available upon request (Excel, Matlab, Eviews files). Moreover, Appendix B presents graphs with the time series involved in our analysis. Table 1 of the Appendix A presents the notation that we associate to each variable, respectively the terms they are being expressed in.

¹ The fact that the two tests may give different results should not be surprising, since their null hypotheses are different and the tests have different power properties for small number of observations.

2.2. Private consumption and investment equations

The general forms that we use for the consumption and investment equations are the following:

$$Z_t = \delta_0 + \sum_{i=1}^{N_Z} \phi_i \cdot Z_{t-i} + \sum_{j=1}^3 \sum_{i=1}^{N_{W_j}} \vartheta_{ji} \cdot W_{j,t-i} + v_t ; \quad (1)$$

$$Y_t = \alpha_0 + \sum_{i=1}^{N_Y} \phi_i \cdot Y_{t-i} + \sum_{j=1}^3 \sum_{i=1}^{N_{X_j}} \beta_{ji} \cdot X_{j,t-i} + u_t . \quad (2)$$

The stochastic process v_t is white noise and is uncorrelated with the past values of the dependent variable $Z = \frac{ch}{y}$, but also with the past and current values of the regressors $\{W_j\}_{j=1,\dots,N_W}$. The stochastic process u_t is white noise and is uncorrelated with the past values of the dependent variable $Y = \frac{gk}{y}$, but also with the past and current values of the regressors $\{X_j\}_{j=1,\dots,N_X}$. In the current specification $N_W = N_X = 3$, and the regressors in (1) are $W_1 = \frac{rem}{y}$, $W_2 = \frac{rrd}{100}$, and $W_3 = prod$, respectively the regressors in (2) are $X_1 = \frac{rem}{y}$, $X_2 = \frac{rrl}{100}$, $X_3 = \frac{fdi}{y}$.²

From the economic theory point of view, such a specification can be seen as coming from an appropriate formulation of the maximization problem of the representative consumer. In its investment decision, the representative consumer takes into account the market real interest rates, the financial transfers from abroad represented by the remittances, and the foreign direct investments. In its consumption decision, the representative consumer takes into account the market real interest rates, the financial transfers from abroad represented by the

² There are other determinants of investment (exchange rate differentials, inflation, etc.) and consumption (unemployment, expected inflation, etc.) besides the ones we mentioned. Of course, because of data scarcity, we had to make a compromise regarding the omitted variables bias, so the regression could not contain too many explanatory variables. The determinant factors we introduced in the regression are well documented by the economic theory.

remittances, and the changes in its productivity.³ Notice that the investment and the consumption decisions may be part of the same decision within a representative consumer framework. Therefore, in order to motivate the independent estimation of the two equations, we consider that deciding upon consumption does not biunivoquely determine the investment, so we may have different determinants for these macroeconomic variables.⁴

Within a representative agent framework, in a comparative statics analysis, different monotonicity that consumption and investment may have with respect to changes in the remittances, may be obtained from the values taken by some fundamentals like time preference discount rate, limitations regarding managerial and entrepreneurial abilities, risk aversion, habit permanent parameters, etc. However, a comprehensive theory would be based on a detailed account of the macroeconomic structure of the consumption and production sectors and the linkages between them. A model of representative agent within these lines is subject to future development.

In the specification of equation (2) we use real interest rate on loans since its trend captures the development and the increasing competition in the area of the investment credit. Regarding the foreign direct investments, these can be seen in two different ways. First, they are financial flows into the country, and second, they can be seen as introducing changes within the economic environment which can be translated into an increase of the managerial and entrepreneurial abilities of the representative agent.⁵ For both equations, the autoregressive part of the dependent variable is meant to capture habit or inertia aspects. Moreover, it is considered that the independent regressors can influence the investment and the consumption with certain lags.

Finally, note that from a theoretical point of view, the variables involved in each of the two equations should be stationary (we use ratios with respect to the output and real rates). However, a simple graphical inspection reveals that most of these variables are integrated of order higher than zero. The next section discusses more in detail the results of unit root tests and the estimation of the two equations.

3. Results

3.1. Short analysis of the private consumption equation

The analysis of this equation is done for the whole period of available data, that is 2000Q1-2008Q2.

³ Notice that the changes in the real wage may be a relevant factor of influence over the consumption. However, we analyzed on our available data on wages and productivity the correlation between the two variables (this analysis is available upon request). The statistical analysis of the data confirms that the changes in the productivity are highly correlated with the changes in the real wage. Therefore, for the purpose of this note, we only use the productivity as a regressor (by doing so, we do not put too much burden on the regression data, and in the same time we insure against omitted variables bias).

⁴ Endogeneity and simultaneity issues are not completely discarded; they are discussed later in this study and are subject to future research.

⁵ For instance, the privatization into the hands of foreign owners means much more than a simple lump-sum transfer to the authorities. It means another organizational culture, restructuring, modernization, etc.

Unit root tests

The ADF test for the variable $W_2 = \frac{rrd}{100}$ rejects the null hypothesis of a unit root at

1% significance level (and implicitly at 5% and 10%), while the KPSS test fails to reject the null hypothesis of stationarity at 10% (and implicitly at 5% and 1%). (The unit root test ADF is conducted following the algorithm presented in Enders[2].) A similar result is obtained for $W_3 = prod$, with the exception that, in this case, we talk about trend-stationarity. These results are robust to small modifications of the

sample size. Regarding the variables $Z = \frac{ch}{y}$ și $W_1 = \frac{rem}{y}$, the results of the ADF

and KPSS tests are somehow contradictory. Following the algorithm of Enders[2], for the variable Z the ADF test fails to reject the null hypothesis of a unit root (at 10% significance level), however, when reducing only with two observations the sample to 2000Q1-2007Q4, the ADF test rejects the null hypothesis of a unit root (at 5% significance level). KPSS test fails to reject the null hypothesis of trend-stationarity at 1% significance level, but there is rejection at 5%. A similar result is obtained for W1, with the exception that ADF test concludes that there is no unit root on the sample 2000Q1-2008Q2, respectively it fails to reject the null hypothesis of a unit root when restricting to the period 2000Q1-2007Q4.

Estimation and inference

We first run a regression in levels for the equation (1) and the results are presented in Table 2.1. If we consider that all the variables are trend-stationary (stationary in the case of W2), then the estimation and inference can be done on the detrended series using standard asymptotic theory, including for the long-run properties of the model (see Wickens and Breusch, 1988 and Pesaran and Shin, 1999). Since the inference results in Table 2.1 are susceptible to spurious elements, Table 2.2 presents the estimation and inference results when we work with (linear) detrended versions of the variables. The results are very much the same as the ones in Table 2.1 (including the number of considered lags).⁶ In both estimations, the significant coefficients of the variables W2 and W3 have the expected signs from economic theory point of view, and moreover, the long-run coefficients also have the expected signs (the long-run coefficient of the variable

W_j is given by the formula $\frac{\sum_{i=1}^{N_{W_j}} \vartheta_{ji}}{N_Z \sum_{i=1} \varphi_i}$) regarding the remittances, they have, ceteris

paribus, a negative significant influence at the first lag and the long-run coefficient is negative.

However, for both estimations, applying delta method to the long-run coefficient of the remittances shows that this is not significant at standard significance levels

⁶ Both regressions are robust to modifications of the sample and introduction of dummies for outlier observations of different variables.

(see Table 2.3). Therefore, there is no strong evidence for the negative impact of the remittances on the private consumption, *ceteris paribus*.⁷ If we work under the scenario of the non-stationarity of the variables Z and W1, the inference regarding the long-run properties of the model should be based on t-statistics that are adjusted according to the methodology of Pesaran and Shin (1999) (these adjusted statistics have asymptotic standard normal distribution). The inference based on the methodology of Pesaran and Shin (1999) for ARDL models with difference-stationary variables shows that the long-run coefficient of the remittances is significant at 10%, as one can see in Table 2.3.

3.2. Short analysis of the investment equation

Any attempt to run a regression in levels that include the observations for the years 2007 and 2008 of the variable $Y = \frac{gk}{y}$ failed. The autoregressive part of the dependent variable is an explosive process when taking into account the observations of the years mentioned above. When running the regression in levels, we restrict our analysis to the period 2000Q1-2006Q2, which is the largest period on which the autoregressive part of the dependent variable is not explosive.

Unit root tests

On the period 2000Q1-2006Q2, the variables $X_2 = \frac{rrl}{100}$ and $X_3 = \frac{fdi}{y}$ are

found to be trend-stationary using the ADF and KPSS tests. (Using Enders[2] procedure, the ADF test rejects the null hypothesis of a unit root using a significance level of 5%, while KPSS fails to reject the null hypothesis of trend-stationarity at all standard significance levels.) As for Y and X1, an analogous discussion as in the case of the variables Z and W1 = X1 can be done, within the corresponding period. (KPSS test rejects the null hypothesis of trend-stationarity at 5%, while ADF test concludes there is no unit root, but it is sensitive to small modifications of the sample.) As for the period 2000Q1-2008Q2, it is enough to mention that testing for the unit root of the variable Y reveals that it may be integrated of an order higher than one.

Estimation and inference

First we run a regression in levels for the period 2000Q1-2006Q2. The results are presented in Table 3.1. Although there is heavy burden on the data (i.e. few observations and many regressors), the regression is robust to modifications of the sample and introduction of dummies for outlier observations (of course, only within the period 2000Q1-2006Q2). Since the inference results in Table 2.1 are susceptible to spurious elements, we also run the regression with detrended time series, for the same period 2000Q1-2006Q2. The signs of the coefficients remain the same, but most of them become insignificant. We do not report here the results

⁷ Wickens and Breusch (1988) propose different methods for the estimation and inference that regard the long-run properties of an ARDL model, which may have better finite sample properties than the standard delta method; applying such methods is subject to our future investigation.

of this estimation, instead we report and explain later the results of a regression in detrended variables for the whole period of available data. We pursue for the moment by considering the variables Y and X1 as difference-stationary and we apply the analysis proposed by Pesaran and Shin (1999).

The problem in the estimation of an ARDL with difference-stationary variables is the inference and not the consistency of the estimators. We report in Table 3.3 the inference regarding the long-run coefficients of the model, based on t-statistics that are adjusted according to the methodology of Pesaran and Shin (1999). The remittances are found to have a positive long-run coefficient and significant at 1%. In the long-run, the variables X2 and X3 have expected signs and are significant as well.

In the end we report in Table 3.2 the results of a regression in detrended variables. The time series of Y was detrended using a linear trend with a change in the slope, or by HP filter. The time series of X3 was detrended using linear trend with a break point.⁸ The period of estimation is 2000Q1-2007Q4, which is equivalent to introduce some dummies for the outlier observations of X3 for the last two periods. The results resemble the ones obtained in Table 3.1. However, the estimation is very volatile to modifications of the sample, not necessarily regarding the signs of the short-run and long-run coefficients, but their significance. This fact is also reflected by the very poor results of the Wald test applied to establish the significance of the long-run coefficients, as shown in Table 3.3.

4. Discussion and further developments

In this brief note we estimate two separate equations, one for the private consumption and one for investments, using an ARDL model for each equation. The study provides evidence against the worst case scenario regarding the impact of remittances, which is that in Romania remittances positively influence the consumption and negatively the investment. In the most optimistic interpretation of our results, the analysis provides evidence that, *ceteris paribus*, the remittances have a positive influence on the investment and a negative impact on the private consumption.

There are several issues that one can argue they represent severe drawbacks of the present study. First, from theoretical point of view, how to reconcile the results of a negative impact of remittances on consumption and positive on investment? However, there is theory to explain such result. One way is to accept the hypothesis that the financial transfers 'activate' entrepreneurial appetite and abilities of migrant's family at home, which are ready to sacrifice from their own consumption in order to sustain the portfolio action initiated from abroad (for instance, migrants' families can cover the costs to set-up business, or they participate with their own money, restricting in the same time their consumption, to the construction of new houses, which generates investment from the firms in this sector, etc.). Notice that such theories also rely on the assumption that for the Romanians at home the remittances are not simple lump-sum transfers, but they are perceived more as permanent expected sources of income. A way to test this

⁸ The break points are econometrically estimated. (For the stationary variable, the break point is graphically identified and then a standard Chow test is applied; for the trend variable, the ZA procedure is applied in order to determine the most probable break point (see Zivot and Andrews(1992) for methodological issues)).

hypothesis can be seen as a first step of ensuring our results. Of course, a consistent model that integrates all the above ideas should be provided, and it is subject to future research.

An interesting problem of selectivity-bias can be raised at this point of the discussion. The series of remittances includes an estimation of the transfers that are not made through formal channels (e.g. bank transfers), but informally (e.g. money carried in the bag). The estimation mechanism of this part of the remittance financial flows is not yet known to us. Assuming that obtaining the whole series of remittances is based too much on the countable 'formal' remittances, then there is a simple explanation of the result of negative impact on consumption and positive on investment. That is, the statistical analysis would suffer from a selectivity-bias problem. In real life, a phenomenon that can occur is that the money for investments are sent in higher quantity, probably with lower frequency, and mostly through formal channels for risk considerents, while the money for supplementing the consumption of the family at home are sent through informal channels, in lower quantity and higher frequency for cost considerents. If all the above ideas are true, then there should be no surprise that the statistical analysis suggests a negative impact of remittances on consumption and positive on investment. Moreover, in our opinion, such arguments, if found to be relevant, would raise the biggest question mark on the validity of our results.

Second, there are obvious endogeneity issues related to the analytical form of our equations. Forming consumption and investment may not be independent phenomena, or, as shown by Chami et al. (1), the output of a country, and implicitly changes in the state of its consumption and investment components, can motivate changes in the remittance flows. These problems should be addressed in the future by appropriate econometric methods of estimation or different econometric formulation of the model to be estimated (see for instance Glytsos (2005) for an estimation of remittances' impact within a macroeconomic model with simultaneous equations).

Third, it is hard to motivate different treatments for the variables in both equations (i.e. trend-stationarity versus non-stationarity, since the unit root tests are not very helpful in some cases). Moreover, the asymptotic tests for the long-run coefficient of the remittance variable (but also for the rest of variables) in the detrended equations do not provide strong evidence for a significant impact, negative in the case of consumption and positive for investment. In spite of all its possible drawbacks, we consider that the present study provides enough evidence that in the case of Romania, before the start of the financial-economic crisis, the remittances did not have a negative impact from macroeconomic point of view, in the sense of creating the self-sufficiency that different studies suggest for other regions or countries.

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A Appendix

Table 1: The notation used for the variables

Notation	Variables
y+	GDP
ch+	Private consumption
gk+	Investment
rem++	Remittances
fdi++	Foreign direct investment
rrl+++	Real interest rate on loans
rrd+++	Real interest rate on deposits
Prod	Productivity

+ Expressed in real terms and seasonally adjusted. ++ Transformed in national currency, deflated with an approximation of the GDP deflator in order to be expressed in real terms, and seasonally adjusted. +++ Obtained from the nominal interest rates, subtracting the quarter on quarter inflation, expressed in annual terms.⁹

⁹ Productivity is calculated as real GDP divided to the number of employees and self-employed individuals in the economy.

Table 2.1: ARDL estimation of the private consumption equation in levels (classical finite/asymptotic inference, susceptible to spurious elements)

<i>Z</i> – dependent variable		
Regressors	Coefficients	t-stat
constant*/*	0.060	1.848
Z(-1)***/**	0.761	7.828
W1	0.362	1.065
W1(-1)**/**	-0.796	-2.437
W2**/**	-0.092	-1.971
W2(-1)	-0.043	-0.939
W3	-0.043	-1.548
W3(-1)**/**	0.074	2.683
No.obs.=33	Sample (adj.)=2000Q2- 2008Q2 AIC=-6.17	R2(adj.)=0.98 SIC=-5.81

Remark: *** -significant at 1%, ** -significant at 5%, * -significant at 10%. / separates the significance results using t-distribution, respectively normal distribution. The number of lags are chosen based on 'Akaike Information Criterion'(AIC) or 'Schwarz Information Criterion'(SIC).

Table 2.2: ARDL estimation of the private consumption equation with detrended variables (classical finite/asymptotic inference)

<i>Z_d</i> – dependent variable		
Regressors	Coefficients	t-stat
Constant	0.003	1.532
Z _d (-1)***/**	0.862	7.614
W1 _d	0.440	1.166
W1 _d (-1)*/**	-0.684	-1.952
W2**/**	-0.107	-1.975
W2(-1)	-0.067	-1.343
W3 _d	-0.038	-1.142
W3 _d (-1)**/**	0.077	2.218
No.obs.=33	Sample (adj.)=2000Q2- 2008Q2 AIC=-6.01	R2(adj.)=0.82 SIC=-5.64

Remark: X_d represents the detrended form of variable X. *** -significant at 1%, ** -significant at 5%, * -significant at 10%. / separates the significance results using t-distribution, respectively normal distribution. The number of lags are chosen based on AIC or SIC.

Table 2.3: Private consumption equation: the long-run coefficients and their significance under different scenarios

Variable – long-run coefficients	The estimation in detrended variables (classical asymptotic inference)	The estimation in levels (classical asymptotic inference, susceptible to spurious elements)	Non-stationarity scenario (inference based on Pesaran and Shin (1999) methodology)
	Wald χ^2 -statistic	Wald χ^2 -statistic	Adj. t-statistic
W1	-1.768 (0.306)	-1.816 (1.151)	-1.816* (-1.650)
W2	-1.268 (1.158)	-0.569* (3.009)	-0.569*** (-3.362)
W3	0.281 (0.573)	0.132*** (33.629)	0.132*** (8.622)

Remark: *** -significant at 1%, ** -significant at 5%, * -significant at 10%, based on χ^2 distribution, respectively normal distribution.

Table 3.1: ARDL estimation of the investment equation in levels (classical finite/asymptotic inference, susceptible to spurious elements), period 2000Q1-2006Q2

<i>Y – dependent variable</i>		
Regressors	Coefficients	t-stat
constant**/**	0.087	2.410
Y(-1)**/**	0.512	2.926
X1**/**	0.911	2.966
X1(-1)	0.243	0.932
X1(-2)	-0.027	-0.108
X1(-3)	-0.614	-1.826
X2	-0.003	-0.902
X2(-1)	-0.012	-0.414
X2(-2)**/**	-0.060	-2.103
X2(-3)	0.044	1.386
X3***/**	-0.274	-4.004
X3(-1)	-0.025	-0.399
X3(-2)**/**	0.137	2.128
X3(-3)**/**	0.301	4.282
No.obs.=23	Sample (adj.)=2000Q4-2006Q2	R2(adj.)=0.94
	AIC=-8.06	SIC=-7.37

Remark: *** -significant at 1%, ** -significant at 5%, * -significant at 10%. / separates the significance results using t-distribution, respectively normal distribution. The number of lags are chosen based on AIC or SIC.

Table 3.2: ARDL estimation of the investment equation with detrended variables (classical finite/asymptotic inference).

Y_d – dependent variable		
Regressors	Coefficients	t-stat
Constant	-0.000	-0.373
$Y_d(-1)$	0.373	1.444
$X1_d^{**/**}$	0.546	2.682
$X1_d(-1)$	-0.263	-0.989
$X1_d(-2)$	0.036	0.130
$X1_d(-3)$	-0.240	-0.821
$X2_d$	-0.035	-0.815
$X2_d(-1)$	0.023	0.705
$X2_d(-2)$	-0.044	-1.349
$X2_d(-3)$	0.042	1.157
$X3_d^{**/**}$	-0.192	-2.861
$X3_d(-1)$	-0.012	-0.126
$X3_d(-2)$	0.098	0.992
$X3_d(-3)^{**/**}$	0.182	2.334
No.obs.=29	Sample (adj.)=2000Q4-2007Q4	R2(adj.)=0.33
	AIC=-7.42	SIC=-6.76

Remark: *** -significant at 1%, ** -significant at 5%, * -significant at 10%. / separates the significance results using t-distribution, respectively normal distribution. The number of lags are chosen based on AIC or SIC.

Table 3.3: Investment equation: the long-run coefficients and their significance under different scenarios

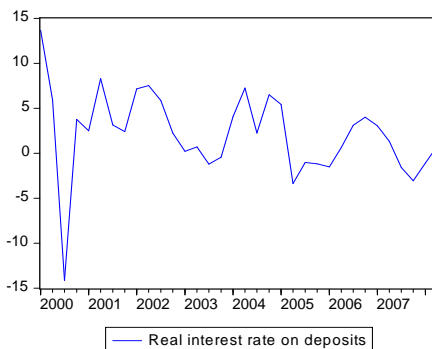
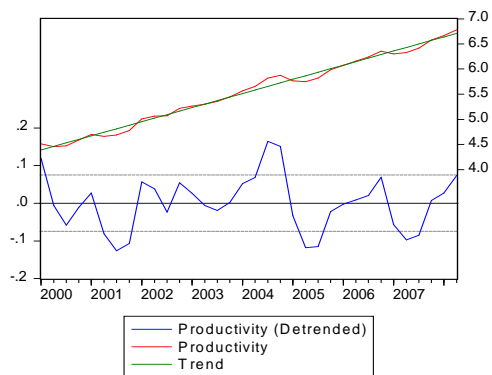
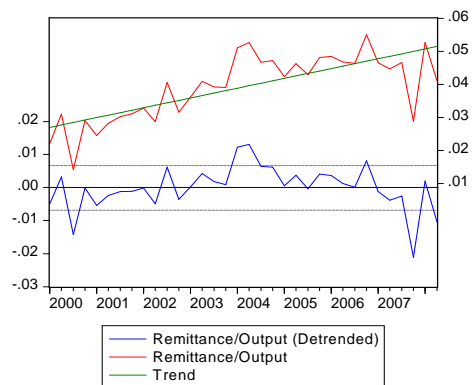
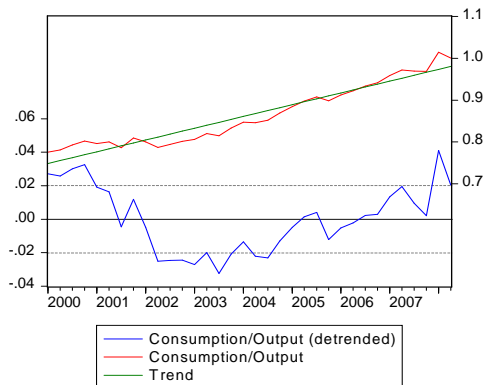
Variable – long-run coefficients	The estimation in detrended variables (classical asymptotic inference)	The estimation in levels (classical asymptotic inference, susceptible to spurious elements)	Non-stationarity scenario (inference based on Pesaran and Shin (1999) methodology)
	Wald χ^2 -statistic	Wald χ^2 -statistic	Adj. t-statistic
X1	0.125 (0.049)	1.052*(3.303)	1.052***(3.838)
X2	-0.022 (0.042)	-0.127 (1.929)	-0.127***(-3.689)
X3	0.121 (0.071)	0.286 (1.583)	0.285***(50.805)

Remark: *** -significant at 1%, ** -significant at 5%, * -significant at 10%, based on χ distribution, respectively normal distribution.

B Appendix

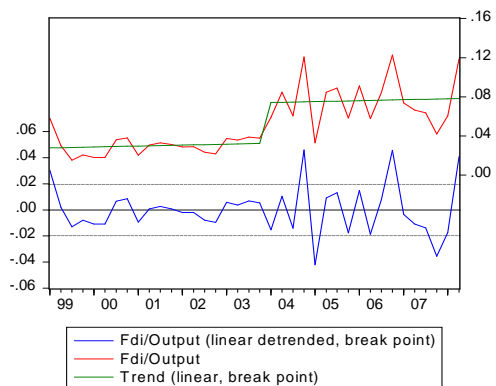
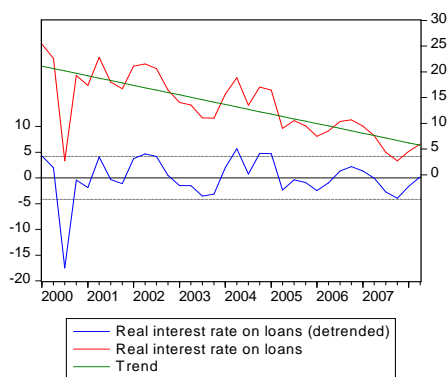
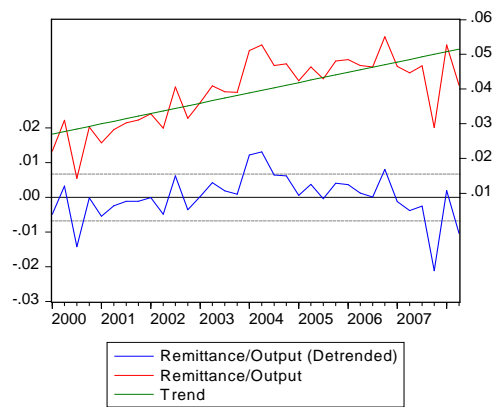
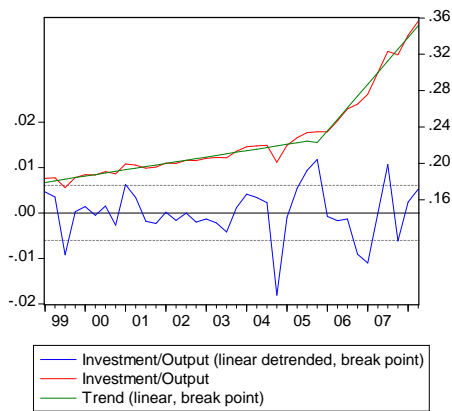
Graphs of the variables used in the consumption equation:

- The detrended series is plotted in the bottom of each graph (if plotted);
- The level series is plotted in the top of each graph.



Graphs of the variables used in the investment equation:

- The detrended series is plotted in the bottom of each graph;
- The level series is plotted in the top of each graph.



Acknowledgements

This research has been conducted within the period spent by the author at the National Bank of Romania. I would like to thank Cezar Boțel, Dorina Antohi, Anca Gălățescu, Cornel Todirică, Mihai Copaciu, Iulian Ciobăcă, Bogdan Rădulescu and one anonymous referee for helpful comments.

FDI IMPACT ON ECONOMIC GROWTH IN CENTRAL AND EASTERN EUROPEAN COUNTRIES. A CONDITIONAL APPROACH

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Abstract. The purpose of this paper based on a quantitative analyze, is to demonstrate that the positive FDI impact on host country's economic growth is not an automatic process which follows unconditionally an active policy of FDI promotion. The effects have to be assessed cautiously. The theoretical and empirical contributions in this field are numerous (Leahy and Neary, 2004; Konings, 1999 etc.). Our empirical analyze, realized on a sample of 19 CEEC, observed between 1994 and 2004, estimates a model inspired by Barro and Sala-i-Martin, according to panel econometrics. The results confirm that the catalytic role of FDI is conditioned by an adequate economical environment (qualified workers, developed financial institutions, political stability and commercial openness).

JEL Classification: F21, F23, F43, C33

Keywords: FDI, economic growth, emergent economies, panel

1. Introduction

Historically speaking, the 1960s and the 1970s were mostly characterized by a negative perception upon the foreign direct investments (FDI) role that had changed in a positive one in the 1980s and the 1990s. It was the era of the structural changes and orientation to global economy through trade and FDI liberalization. Acting in the global economy, the multinationals and their investments became more and more attractive for at least two reasons: (i) the access to other financial sources (official or private) was restrictive, and (ii) the multinationals could enhance the technology and know-how transfer. To this respect, the economic growth could be the result of a significant materials stock accumulation, and mostly the result of qualifications, knowledge and technology transferred by foreign firms in the domestic production process.

In the 1990s, brought up under a centralized economy and being aware of the difficulties to come from the transition, the Central and Eastern European Countries (CEEC) followed a policy more or less inspired of economic growth

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resumption. The transition imposed stimulation of the savings and investments and consequently the attraction of the FDI where internal accumulation proved to be insufficient. However, the usage of FDI flows to finance the current account deficit, in the first phases of transition limited their role in the promotion of the economic growth. But once the deficit ceased being dangerous, external flows of capital proved their catalyst role for the progress of the transition economies.

In the last few decades we noticed an increasing euphoria about the FDI attraction, all over the world and especially in CEEC, where the need to accelerate the economic growth required the identification of new investment sources. In this area, FDI are preferred for multiple reasons, and especially for their debt free character. Despite their assumed positive effects upon the host country economy, a question persists about their real contribution to economic growth. The 2000 years reality underlines fatal influences of the foreign presence in the host country economy, respectively the positive externalities absence, gross repatriated profits, and recently and most important, the frequent delocalization towards other countries becoming more attractive. In that way, the FDI unstable character becomes more and more obvious nowadays.

In addition, we wonder if the FDI catalytic impact is an automatic process or if it is conditioned by certain factors tied to domestic economy performances. And if the economic growth was based essentially on foreign capital inflows, we wonder what would happen if the global context discouraged global investment? In fact, this is the reality that confronts nowadays the majority of CEEC because of the international crises.

The advantages and shortcomings of flows (FDI) as capital sources in the emergent countries are more and more discussed in the 21st century. This is a sensitive and also controversial subject, determining a real dispute between theoreticians, statisticians and public authorities.

Intuitively, the contribution of the FDI to the economic growth is possible in four distinct ways: (1) capital accumulation to replace the obsolete capital inherited from the past centralized economy; (2) technology transfer in high value-added sectors; (3) easily access to the worldwide market and (4) job creation in the new firms.

And yet, the catalyst role of the FDI is not unanimously accepted. If profitability and the market shares held by the national investors diminish because of the foreign competition, they will suffer at the productivity level. The only factors which will be able to transform the FDI into economic growth factor are due to the characteristics of the host country and are gathered under the "absorption capacity" (Deepak, 2001, Nunnenkamp and Spatz, 2003): the qualified labor, the adequate infrastructure, the sufficient equipment which allows the national investors to assimilate the technology and the relatively high national revenue.

Firstly, the bigger the human capital endowment and the GDP per capita, the bigger the capacity of benefiting from technology transfer initiated by foreign subsidiaries in favor of national firms. Secondly, the more opened the host economies are to the international trade, the less restrictive is the intermediary goods import indispensable for the investors. Thirdly, the institutional development level (the legal framework, the corruption amplexness, the public management quality, the ownership protection, and the government discretionary interference) condition the technology and know-how transfer to the subsidiaries. Finally, the under-developed capital markets keep the host country from largely benefiting from

foreign presence (Alfaro et al., 2002). In order to take advantage of externalities, the national firms need financial resources for internal structure reorganization, for equipment purchase, and for the employment of qualified managers and workers. The absence of financial funds or their expensiveness in the context of an insufficiently developed national capital market, restrict the national firm's development that cannot meet the international competition or benefit from the foreign presence. It is not only the loan availability that counts, but also the good functioning of the stock market which, in fact, is the place where the link between the national and foreign investor is established.

There is a consistent theoretical framework which sustains the existence of a positive relation between FDI and economic growth. The models of endogenous economic growth that belong to Romer (Romer, 1986, 1990, 1993) and Barro and Sala-i-Martin (Borensztein et al., 1998) are relevant for their theoretical role. Among the empirical studies that confirm this hypothesis we present those of Krkoska (2001), Borensztein et al. (1998), Damijan (2003). The majority of these studies identify the technology transfer through FDI as the main growth vector.

On the other hand, there also were set off and empirically verified those theoretical fundamentals behind the hypothesis of the correlation absence or even of the negative correlation (Solow - 1956, Karl Marx, Aitken and Harrison - 1999, Carkovic and Levine - 2002, Lyroudi - 2004).

The hypothesis under which, the existence of a sufficiently developed economic environment conditions the FDI contribution to economic growth, has an important theoretical and empirical support. We can mention here the contributions of Leahy and Neary (2004), Wang (2003), Bengoa and Sanchez (2003), Nunnenkamp and Spatz (2003), Sinani and Meyer (2004).

Economical literature developed in the FDI area is divided in three categories: (i) the studies that identify FDI among growth determinants; (ii) the FDI determinants literature; (iii) the studies on causal relationship between FDI and growth. This study takes part of the first category and verifies the hypothesis of conditioned FDI catalytic role in CEECs.

The paper is structured as follows: section 2 presents a brief literature review, while section 3 is dedicated to descriptive analyses. An empirical approach of the problem is presented in section 4. Finally, in the last section we conclude and establish further research directions.

2. Literature review

The hypothesis under which, the existence of a sufficiently developed economic environment conditions the FDI contribution to economic growth, has an important theoretical support.

We can mention here the contributions of Brecher and Diaz-Alejandro - 1977, Brecher - 1983, Boyd and Smith - 1999 (Carkovic and Levine, 2002), but more important, the theoretical model of endogenous growth. It presents the technological progress as having the engine function for the economic growth. That means to condition the growth by the availability of the qualified labor force which would allow the internalization of the technological transfer initiated by foreign investors.

In this field, of the endogenous growth theory, we mention the Barro&Sala-i-Martin model (Borensztein et al., 1998) that assumes the existence of an economy where the technological progress results from the capital goods

diversification. The production is limited to a single consumption good, as in the following technology $Y_t = AH_t^\alpha K_t^{1-\alpha}$, where \mathbf{A} represents the economic environment quality (exogenous variables on control and politics, influencing the productivity), \mathbf{H} is the human capital and \mathbf{K} the physical capital. In contrast to the human capital which is given, the physical capital accumulates by diversification.

The national capital stock is given by $K = \left\{ \int_0^N x(j)^{1-\alpha} dj \right\}^{\frac{1}{1-\alpha}}$, where capital goods

types are $\mathbf{x}(j)$. From \mathbf{N} capital goods, \mathbf{n} are produced by the national firms and \mathbf{n}^* by the foreign investment firms. It was assumed that the technological adaptation process required by the new capital goods creation is costly; it demands a fixed cost F prior to new capital good production. F negatively depends on the foreign firms weight in the host economy (\mathbf{n}^*/\mathbf{N}), and positively on the national capital goods weight in those produced in the developed countries (\mathbf{N}/\mathbf{N}^*). In fact, the foreign firms bring to developing countries the necessary knowledge for new capital goods production. On the other hand, the existence of a technological gap augments the imitation possibilities and the new technology become cheaper; it's cheaper to imitate already existing products than to create new ones. The author's subsequent demarche (maximizing the profits and utility function) conduct to the following expression for the growth rate: $g = \frac{1}{\sigma} [A^{1/\alpha} \phi F (\mathbf{n}^*/\mathbf{N}, \mathbf{N}/\mathbf{N}^*)^{-1} H - \rho]$,

where $\phi = \alpha(1-\alpha)^{(2-\alpha)/\alpha}$. The FDI impact on growth becomes transparent in this expression. FDI, measured by \mathbf{n}^*/\mathbf{N} , reduces the new capital goods cost, so that the new technology become less expensive, being encouraged. Moreover, the FDI effect on growth is positively correlated with human capital level.

As we have seen, the endogenous growth theoretical model accentuates the technological progress as growth enhancing. That allows identifying a causal FDI-growth relationship depending on qualified labor force availability; the human capital has an important technological transfer internalization role.

De Mello (1999) is the economist to whom we own the dual approach of FDI contribution to economic growth, bounding FDI transferring supplementary capital from FDI transferring know-how. The FDI from the first category can lead to capital and new technology accumulation in the host country, without a long-run impact on growth. The effect is present only under the FDI-domestic investments complementarily hypothesis. On the contrary, those FDI that involve knowledge transfer lead to knowledge stock increase in the host country and enhance the long-run economic growth. The multiplication of competencies and qualifications associated to FDI may act in the same way. Indeed, the superior knowledge accumulation reduces the innovation cost and the technological progress produces more rapidly. From this perspective, the local competencies are important to allow the FDI associated knowledge internalization.

Human capital influences physical capital profitability and, implicitly, international capital mobility. On the other hand, technology transfer through imitation from FDI enhances research and development (R&D) activity and growth. A similar reasoning sustain that transferred technology could be beneficial only

when the labor force is qualified, technical assistance is appropriate, complementary equipment is adequate, and other innovations are available.

Ever since economists like Nelson or Arrow, the difficulty in information rapprochement is well-known, while more recent contributions show that in order to internalize the results of one R&D activity a certain effort of the receiver company is necessary. R&D externalities are perceived as being endogenous depending on firm investments in its "absorption capacity".

Schumpeter underlined, almost one century ago (1911), the developed financial sector role for technological innovation, capital accumulation and growth in the host country. The good functioning of the financial market reduces transaction costs allowing capital allocation in more profitable projects and that lead to economic growth (Khan, 2007).

An important and recent contribution at theoretical level belongs to Leahy and Neary (2004), inspired by the numerous empirical studies that considerably supported the idea that (R&D) improves the absorption capacity of a company (ability to internalize the externalities derived from other companies) and directly contributes to raising its performances. Leahy and Neary develop a theoretical model for the absorption capacity which is defined as the ratio between its disposable knowledge, deriving from opponent companies, and the actual knowledge level in economy. The absorption capacity is formalized as it follows:

$y = y(x, X, \delta)$, where x are the knowledge resulting from the own R&D activity, and δ are the difficulties in the knowledge internalization process ($\delta = 0$ if $y = X$ maximum absorption capacity, and $\delta = 1$ if $y = 0$ minimum absorption capacity). The marginal production cost of the firm negatively depends on own knowledge (resulted from own R&D activity) (x) and available knowledge from the competing firms (y): $c = c(x, y)$. Combining the absorption capacity equation with the marginal cost equation, the own knowledge impact on costs is obtained, as well as the effective externalities' measure. The authors show a decrease of effective externalities coefficient as a result of important difficulties in knowledge absorption from competitors.

In the light of those contributions, FDI are presented as always generating the productivity increase of the foreign investment firms, while the host country productivity is conditioned by a high externalization degree. The externalization, or better, the internalization of knowledge in the host country, is easier in the R&D intensive sectors or in the firms disposing of a sufficient stock of knowledge to start.

An important set of empirical contributions on FDI-economic growth relationship identify some conditions representative for "social capacity" which have to be fulfilled in order for the host country to benefit from FDI in terms of economic growth. Those conditions concern an adequate human capital level (Borensztein et al., (1998), Wang (2003), Konings (1999), Sinani and Meyer (2004)), economical and political stability, market liberalization and competitiveness (Balasubramanyam et al., (1996), Bengoa and Sanchez (2003), Buckley et al., (2002)), a sufficient infrastructure endowment, a minimum level of national revenues per capita (Nunnenkamp and Spatz (2003)), developed financial institutions (Alfaro et al., (2002), Khan (2007)).

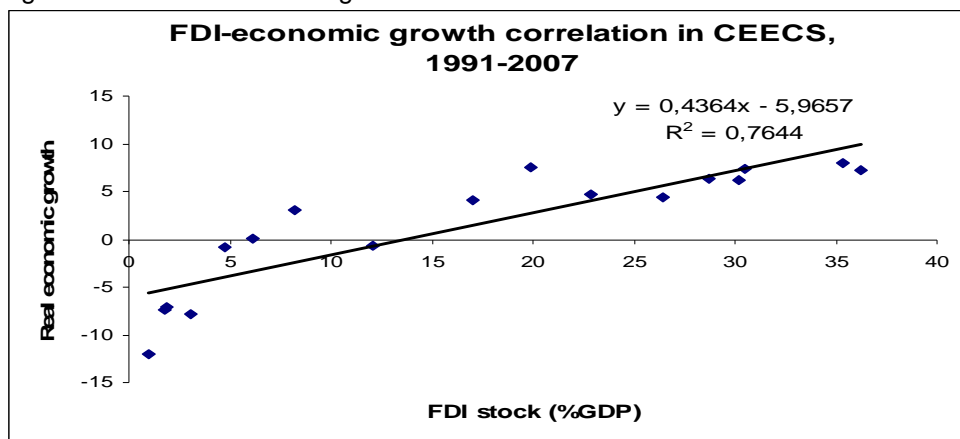
Those studies constitute the empirical support for the idea according to which the host countries have to improve their business environment and attain a minimum economic level before attracting FDI enhancing growth.

3. Descriptive analyses

In what follows we made a descriptive analyses of the “FDI - economic growth” relation in the CEEC². For this purpose, we use the following indicators: the FDI stocks and the economic growth in real terms per capita. The FDI stocks are preferred versus the FDI flows to avoid the endogenous problems; on one hand, the FDI has an impact on the economic growth and on the other hand, FDI is under the influence of the host country’s performance in economic growth terms. As FDI stocks are less influenced by host country growth than FDI flows, we analyze the stocks. In the first stage, we analyze the region’s FDI stocks and the medium economic growth of the region (see Figure1).

If we refer to the whole of the CEEC when we try to identify the relation between the FDI stocks and the regional economic growth, we record certain stability. By carrying a first analysis, we can assert, with a high rate of certainty ($R^2=0.76$) that a supplement of 1% of the GDP for the FDI stocks of the area, normally generates a supplement of the growth rate of 0.4%. If in general, the situation is optimistic, analyzed separately, those countries have evolved differently from the beginning of the transition until nowadays. Even if the FDI stocks of the area would explain the regional economic growth, after 2000, the connection seems extremely weak if we consider the differences between countries. The empiric results of our study will clarify the correlation between the FDI stocks and the economic growth. This correlation should be conditioned by certain factors.

Figure 1: The FDI-economic growth correlation in the CEECs



Source: based on the UNCTAD Database, National Accounts Main Aggregates Database, Statistics Division, UNECE (United Nations Economic Commission for Europe)

² The CEEC countries we refer to are: Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Former Yugoslav Republic of Macedonia, Moldova, Poland, Romania, Russia, Serbia Montenegro, Slovakia, Slovenia, Ukraine

According to both, theoretical and empirical contributions, in order to explain growth rate in CEEC, the interaction of FDI with labor force qualification, capital market development, political stability and commercial flows liberalization have to be studied as well (see appendix, Figures 2-5).

Firstly, one observes two effects by analyzing the interaction between FDI and the capital market development (Figure 2)³. (1) For the same development level of financial sector, a supplement of FDI accelerates the economic growth. However, the effect is less visible for a less developed financial economy (G1 and G2), but it is obvious for financially developed countries (G3 and G4) (FDI effect). (2) Countries with similar performances in terms of FDI inflows (G1 and G2) register different growths paths; those countries which have a developed financial sector (G3, respectively G4) are favored (the effect of the financial performances).

Secondly, as it results from Figure 3⁴, for a certain level of human capital qualification, the growth of the FDI led to the acceleration of the economic growth; the effect is more visible for the economies with a high level of education (G3 and G4). In other words, a certain level of qualification in the host country is necessary in order to obtain the positive effect of FDI.

Similarly, the analysis of the interaction of FDI with political stability allows observing two effects (Figure 4)⁵. (1) For the politically stable countries (G2 and G3), an increase of FDI inflows leads to the acceleration of the economic growth; but for the politically unstable countries, the attraction is difficult even for some FDI flows (FDI effect). (2) Countries with similar performances in FDI area (G1 and G2) record different economic growths, more significant in the politically stable countries (G2) (the political stability effect).

³ Source: authors calculations after the World Bank Financial Structure Database. The countries' groups are : (G1) - Albania, Belarus, Macedonia, Russia and Ukraine, (G2) – Bulgaria, Hungary, Moldova, (G3) - Poland, Romania, Slovakia and Slovenia, (G4) –Baltic States, Croatia, Czech Republic.

The variables: FDI (%GDP) annual average weight of the FDI flow in the current GDP; Economic growth rate - growth rate of the real GDP per capita; commercial banks assets - weight of the commercial banks claims in the total banking claims on the real non-financial sector.

⁴ Source: authors calculations after the CHELEM; UNCTAD; National Accounts Main Aggregates Database, Statistics Division, UNECE; International Labour Office
The countries' groups are : (G1) - Slovakia, Slovenia, Albania, Poland et Romania, (G2) - Croatia, Hungary, Latvia and the Czech Republic, (G3) – Russia and Ukraine, (G4) – Bulgaria, Estonia and Lithuania

The variables: FDI (%GDP) annual average weight of the FDI flow in the current GDP; Economic growth rate - growth rate of the real GDP per capita; Qualification: the weight of the recipients of tertiary education.

⁵ Source: authors calculations after World Bank, Indicators of the Governance
The groups of countries are: (G1) Ukraine, Serbia, Montenegro, Russia, Albania, Bosnia-Herzegovina, Macedonia; (G2) Poland, Romania, Slovakia, Slovenia, Belarus; (G3) Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania, Czech Republic, Moldova.
The variables are: FDI (%GDP) – annual average weight of the FDI flow in the current GDP; Economic growth rate - growth rate of the real GDP per capita ; political stability – stable countries (0, +1.34), unstable countries (-1.68, 0)

The identification of an interaction between FDI and the commercial openness, in order to explain the economic growth in the CEEC, proves to be more difficult (Figure 5)⁶. For a certain degree of foreign trade liberalization, a supplement of FDI led to the acceleration of the economic growth. But, contrary to expectations, the effect is more obvious in the case of countries having an indicator of the commercial opening below 150% (G1 and G2), than for the other countries (G3 and G4).

We thus expect that the results of the empirical analysis show us a powerful interaction between FDI and financial performances, political stability and labor force qualification, but less significant between FDI and foreign trade liberalization.

4. Macroeconomic empirical analysis

4.1. Data and methodology

Our empirical analysis, based on a macroeconomic data panel (evolution of the variables since 1994 until 2004, in the 19 CEEC), follows several stages: (1) the study of the FDI effect on the economic growth via technology transfers; (2) the analyze of the interaction between the FDI and the human capital, the financial performances, the political stability or the liberalization of the international business, in order to explain economic progress. The variables of the model and the data sources are presented in Table 1.

The estimates were carried out after the panel techniques, by using the WinRATS software. The estimate method is the GLS, in a model with random individual effects. We prefer random effects panel techniques for at least three reasons: (1) the panel is preferred compared to the „cross-country race” analysis when having a small sample (19 countries); it brings more robustness to the results because it also exploits the temporal dimension of the data; (2) it is appreciated that there exist consistent and specific individual effects that are not observed, which influence the endogenous variable beyond the selected exogenous variables (the individual effects are preferred to the pool); (3) it is supposed that the individual effects are random (the random effects are preferred to the fixed effects). In fact, the estimation under fixed effects hypothesis is not possible because of a constant exogenous variable (GDP0) during the analyzed period, which makes it difficult to operate the centering on the average at the time of estimating the coefficients.

⁶ *Source : authors calculations after UNECE, Statistic Division, National Accounts Main Aggregates Database*

The groups of countries are: (G1) Belarus, Bosnia-Herzegovina, Macedonia, Romania, Serbia and Montenegro, Ukraine, Poland, Slovakia; (G2) Croatia, Bulgaria, Latvia, Lithuania; (G3) Russia, Slovenia; (G4) Estonia, Hungary, Moldova and Czech Republic.

The variables are: FDI (%GDP) – annual average weight of the FDI flow in the current GDP; Economic growth rate - growth rate of the real GDP per capita ; Commercial openness - the sum of exports and imports, divided by GDP

We dispose of 209 observations (the 19 CEEC observed through the 11 year period).

Table 1 : The variables of the model

Variables	Description	Data source
GRGDP	Per capita real growth rate	UNECE (Statistics Division), National Accounts Main Aggregates Database
FDIsk	FDI stock weight in constant GDP	UNCTAD and IMF (IFS)
logGDP0	Initial level of GDP per capita (1993 level in constant prices 1990)	UNECE (Statistics Division), National Accounts Main Aggregates Database
EDU	Weight of five level qualification owners (university degree) ⁷	LABORSTA, International Labour Office
logGFCF	Gross fixed capital formation (mil USD constant prices 1990)	UNECE (Statistics Division), National Accounts Main Aggregates Database
ASSETS	Deposit money bank vs. central bank assets ⁸	World Bank Financial Structure Database
SKMK_LQ	Stock market total value traded to GDP (stock market liquidity) ⁹	World Bank Financial Structure Database
POL_STAB	Political stability level (from -2.5 to +2.5)	World Bank, Governance Indicators
OPEN	The foreign trade openness (sum of imports and exports, to constant GDP)	UNECE (Statistics Division), National Accounts Main Aggregates Database

The specific characteristics of every country from the sample justify the integration of a heterogeneous dimension within the model, respectively the individual effects materialized into own specific constants for each individual of the panel. A model with individual effects is represented as follows:

$$y_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it}, i \in [1, N], t \in [1, T], N \text{ individuals}, T \text{ periods}$$

The equal coefficient β hypothesis $\beta_i = \beta, i \in [1, N]$ is accepted, but the common constant α hypothesis is rejected for all individuals. In a random effect model, the residuals' structure is the following: $\varepsilon_{it} = \alpha_i + \lambda_t + v_{it}$, where α_i stands for the random individual effects (the structural or out of time specificities for each individual), λ_t stands for the temporal effects (factors that

⁷ The variable is calculated as the weight of five level qualification owners in 2000; according to ISCED-97 (International Standard Classification of Education), five level qualifications concern the first level of tertiary education, the university degree). Only for 2000 year we dispose the data for all countries in the sample; our option to limit the observations on this variable to the 2000 year is in line with Wang (2003) and Borensztein (1998) papers.

⁸ This represents the ratio of deposit money bank claims on domestic non financial real sector to the sum of deposit money bank and Central Bank claims on domestic non financial real sector. It is an indicator of relative size of commercial banks comparative to central bank.

⁹ It represents total shares traded on the stock market exchange to GDP.

identically influence the individuals' sample, but the factors vary with time), and v_{it} stands for the factors that influence the endogenous variable differently with time and from one individual to another. ε_{it} are independent and identically-distributed. The BLUE estimator is the GLS estimator. Furthermore, we may say that the random effect model is an intermediary specification between the no individual effect model and the fixed effect model. The hypothesis for a common distribution of the individual effects permits considering a structure that is neither totally homogenous, nor totally heterogeneous (see also Sevestre, 2002).

4.2. Results

There are two possible ways for FDI to generate economic growth: by contributing to capital accumulation and by contributing to knowledge accumulation through technologic transfers. While the first one is often verified (empirically validated), the second is less obvious. Consequently, here we focus on the second topic, studying the CEEC sample between 1994 and 2004. The introduction of the gross fixed capital formation variable into the model, allows the control of FDI contribution to the economic growth beyond the impact on capital accumulation.

The first estimates where we regress the growth rate of the real GDP per capita to the weight of FDI flow to actual GDP, lead to a not very significant result, that of the negative influence of the FDI on the economic growth. We thus think to the endogenous character of the FDI variable, which could have affected the quality of the results. Often present in the empirical studies, the endogenous character of the FDI is discussed and solved in various ways. The avoidance of the problem of the endogenous character of FDI variable is possible by using instrumental variables.

In our regression, the replacement of the FDI flow with the past value of this one does not make any improvement to the quality of the results. On the contrary, by modeling the economic growth with the FDI stock (calculated as percentage of constant GDP), we obtain robust results which confirms expectations. The empirical specification, according to the model of Barro and Sala-i-Martin, takes the following form:

$$GRGDP_{it} = c_0 + c_1 FDI_{it} k_{it} + c_2 \log GDP_{it} + c_3 EDU_{it} + c_4 \log GFCF_{it} + c_5 ASSETS_{it} + c_6 SKMK_LQ_{it} + c_7 POL_STAB_{it} + c_8 OPEN_{it} + e_{it}$$

We choose to insert the ratio of FDI to GDP and not simply the stock, in order to better accentuate the factor n^*/N from the theoretical model. The initial level of GDP accentuates the catch-up effect, being a proxy for N/N^* . The quality of economical and political environment (A from Barro's model) is represented here by variables as ASSETS, SKMK_LQ, POL_STAB or OPEN.

Table 2: The FDI stocks and economic growth – panel of 19 CEEC (1994-2004)

Independent Variable GRGDP	(1)	(2)	(3)	(4)	(5)
Constant	11.30	12.5*	12.46	52.52*	64.6
FDIsk	0.03**		-0.02	-0.08**	-0.08*
EDU	-0.04	-0.11*	-0.13*	-0.24	-0.56
LogGDP0	0.01	0.01	-0.03	-5.04	-5.72
LogGFCF	-0.93	-0.94*	-0.81	-1.86	-2.76
FDIsk*EDU		0.002***	0.002**	0.004***	0.004**
ASSETS				5.75	6.19
SKMK_LQ				16.26**	16.11**
POL_STAB				4.05**	4.52**
OPEN				0.01*	0.02*
LogGFCF*EDU					0.03
<i>Obs</i>	149	149	149	117	117
<i>R2</i>	0.16	0.17	0.18	0.37	0.37

Note: *** marks the significant coefficients at 1% level, ** significant at 5% level and * significant at 10% level

Positive and significant at 5% in the first regression, the coefficient of the variable on FDI stocks becomes negative and significant with the introduction of the interactive variable $FDIsk*EDU$, because part of the FDI effect on growth is taken by the interactive variable. The FDI has an impact on the growth by itself, but also by the interaction with the human capital. There are thus strong complementary effects of FDI and human capital, on the growth rate of the income (the result proves to be robust as long as the significance degree does not change with the addition of other determinants). Consequently, the advanced technology brought by the foreign investors contributes to the economic growth of the host country only by interaction with the absorption capacity of this country. As the results show it, the interaction of the FDI with the human capital is of such nature that for the countries having slightly qualified labor force, the FDI direct effect is negative. The threshold of the education level beyond the FDI starts to have positive effects on growth tends to increase as new variables are added to the basic regressions, up to 20% in the regression (4). This threshold is reached by only five countries within our sample (Bulgaria, Estonia, Lithuania, Russia and Ukraine).

The negative influence of the FDI stock has multiple interpretations in the literature: the elimination of the national investors from the market, the repatriated profits higher than the new entries of FDI (Nunnenkamp and Spatz, 2003), the linearization of the nonlinear interaction between FDI and human capital (Borensztein, 1998).

The investigation of the interaction between the aggregate investment (GFCF) and the labor force qualification confirms our intuition. This interaction is a particular characteristic of the FDI (regression 5). Out of these one can draw the conclusions on the technological differences implied by the overseas investment and the national one. The FDI is directed especially towards the sectors where a technological innovation process is present, and thus the interaction with the human capital is a crucial factor in the explanation of the FDI effects on the economic growth. On the other hand, the domestic investment targets mainly the

more traditional activities, so that the interaction between the aggregate investment and the human capital is not sufficiently important for being detected in the regressions.

In addition, we study the FDI impact upon the economic growth, through financial markets (for a graphical representation see appendix – Figure 6). We create an interactive variable, resulted from FDI and financial markets interaction, and we use it in testing the significance of the financial environment in stimulating the positive externalities associated to FDI flows. As the financial market variables are expressed in terms of flows, the association with FDI stocks would be inappropriate. For that reason, we test the interaction between financial markets and FDI flows in our previous specification.

The results of the regression differ from one estimate to another, as we change the variable on the financial performance (see Table 3).

Table 3: Economic growth and FDI: The financial markets role

Independent variable	(6) DEBTS	(7) ASSETS	(8) LOANS_ BK	(9) LOANS	(10) CAPITALIZ ATION	(11) SKMK_ LQ
Constant	32.87	115.7	-2.62	-2.62	125.12	65.50
FDI	-1.58***	-17.81**	-0.04	-0.04	-1.01***	-0.28
EDU	0.01	-0.31*	0.09	0.09	-0.32***	-0.18
LogGDP0	-3.27	-10.72	0.17	0.17	-18.63	-9.35
GFCF	0.47***	0.18	-0.05	-0.05	0.15	0.13
Financial mk	-79.58***	-38.61	-26.84**	-26.84**	-47.52**	-9.77
FDI*Fin Mk	2.90***	17.40**	-0.74	-0.74	5.45**	0.05
POL_STAB	5.97**	13.89*	-4.77	-4.77	10.73***	8.90***
OPEN	0.11***	0.05**	0.13***	0.13***	0.15***	0.04*
Obs	24	25	23	23	26	26
R2	0.91	0.86	0.88	0.88	0.85	0.76

Note: 1) *** marks the significant coefficients at 1% level, ** significant at 5% level and * significant at 10% level. 2) FDI and GFCF are the weights of the FDI flow and the GFCF in the current GDP. DEBTS indicate liquid engagements in the financial system (%GDP) by giving the overall dimension of the financial sector. LOANS take into account all the private loans, granted by the banks (LOANS_BK) and by other financial institutions (LOANS). CAPITALIZATION represents the stock market capitalization, the medium value of the listed shares of the companies (%GDP).

To have an estimate of the importance of the financial sector in the drive of FDI effects on growth, we calculate the FDI net effect resulted from the addition from the FDI individual effect with the interactive variable effect. During the 1994-2004 period, the FDI contributed to the economic growth in that CEEC where the dimension of the financial sector was of minimum 54% of the GDP¹⁰, the activity of credit was completely decentralized¹¹, and the market capitalization had exceeded the threshold of 18% of the GDP¹². As a whole, an extremely large number of the CEEC were confronted with negative effects on growth because of the interaction of the FDI with their financial environment. Our results confirm the assumption

¹⁰ From $(-1.58+2.90 \cdot P > 0)$ results $P > 0.54$

¹¹ From $(-17.81+17.40 \cdot P > 0)$ results $P > 1.02$

¹² From $(-1.01+5.45 \cdot P > 0)$ results $P > 0.18$

according to which the insufficiently developed financial institutions cancel the positive effects of the FDI.

In the following, we check the existence of a conditioning of the relation “FDI - economic growth” by the degree of political stability and of commercial flows liberalization in the CEEC during the time 1994-2004 (see also appendix-Figure 7).

With a relatively high degree of significance in the previous specifications, the variables on political stability and commercial flows liberalization become less significant in the last specifications where interactive variables are added. The interactive variables capture a significant part of the effect of the independently seen variables.

Table 4: Economic growth and FDI: The role of the political stability and the commercial flows’ liberalization

Independent variable GRGDP	(12)	(13)
Constant	43.72	33.84
FDI	-1.45 ***	-1.95***
EDU	-0.14	-0.01
LogGDP0	-5.11	-3.81
GFCF	0.12	0.14
DEBTS	-31.83 ***	-25.51 **
POL_STAB	2.44	3.51
OPEN	0.10 ***	0.05
FDI*POL_STAB	1.20 **	-
FDI*OPEN	-	0.01 **
Obs	24	24
R2	0.83	0.83

Note: *** marks the significant coefficients at 1% level, ** significant at 5% level and * significant at 10% level

The interactive variables’ coefficients are positive and significant at 5% in the regressions 12 and 13, which confirm that the generalization of the benefit brought by the FDI to the host country is conditioned by the existence of a political stability and by the promotion of trade flows liberalization policy. In order for the FDI attracted in the CEEC during the 1994-2004 period to be beneficial in terms of economic progress, a degree of political stability of minimum 1.2¹³, respectively a commercial openness of at least 195% of the GDP¹⁴ were necessary. None of the observed countries satisfied these criteria for the entire period.

5. Concluding remarks

Summarizing, the theory of economic growth based on FDI advanced from Solow’s neoclassical model in 1950-1960, to dependency theory in 1970, than to endogenous growth theory in 1980-1990, to Aitken and Harrison’s model during the second half of 20th century and finally to Leahy and Neary’s contribution in 2004. Simultaneously, the perception on FDI role in development process

¹³ From $(-1.45+1.2 \cdot P > 0)$ results $P > 1.2$

¹⁴ From $(-1.95+0.01 \cdot P > 0)$ results $P > 195$

changed, proceeding alternatively from an optimist approach to a pessimist one, and arriving recently to a more nuanced understanding of FDI impact.

Moreover the empirical contributions results are split, varying with the analyzed countries or periods, and the used methodologies. To keep in mind is the fact that studies realized on CEECs samples find, at their best, a FDI contribution through capital accumulation. More frequently, the results show the absence of complementarity between foreign investments and domestic ones, identifying even negative externalities for local firms that reduce its production. Technological transfer through FDI does not constitute a valid channel for economic growth in the host country, as long as the firms that benefit from this transfer are at most those with foreign participation. Such results determined, especially after 2000, a more nuanced approach explaining the technological transfers' absence through the extremely reduced absorption capacity in the domestic firms and in the whole economy. This hypothesis was verified successively for samples from developing countries, Asiatic countries, Latin America, China, Pakistan, but less for transition countries.

Our study realized on CEEC countries constitutes, as we believe, a significant contribution to this literature set, underling pessimist results on technological transfers from FDI. Nevertheless, our conclusions sustain the nuanced approach on FDI role, conditioned by a sufficient absorption capacity in the host country.

Out of the two methods of growth promoted via FDI inflows, the contribution to the gross fixed capital accumulation is more obvious than the technology transfers caused by the FDI. From the point of view of the technology transfers, the FDI produce positive effects on growth only in the countries where one reaches a minimal threshold of qualified human capital. The fact that the interaction with the human capital is a crucial factor in the explanation of the FDI effects on the economic growth is an unquestionable index that the FDI are directed firstly towards the sectors where a technological innovation process is present. On the other hand, the national investment targets mainly the more traditional activities, so that the interaction between the aggregate investment and the human capital is not so important. Our results confirm the assumption according to which the insufficiently developed financial institutions counteract the FDI positive effects. Moreover, the internalization of the benefit brought by the FDI to the host country is conditioned by the existence of an adequate degree of political stability and by the promotion of trade flows' liberalization policy.

We consider that it is out-of-date to regard the IDE as promoters of the economic growth under any conditions. Nevertheless, we do not exclude the possibility that the relation FDI – economic growth is very powerful at certain times and for the particular case of certain countries. We appreciate that the euphoria created around the FDI attraction is partially justified. There are no good reasons to support the governments' growth policy which artificially created an attractive environment for the foreign investors (offering tax incentives or subsidies). The concerns of economic policy should revolve around the creation of an adequate commercial, educational, financial and institutional context.

As we believe, the guarantee for a FDI positive impact in economy is obtained only if the absorption capacity is improved. The efforts should orientate in such direction, before looking to attract foreign capital volatile flows at any cost. Certainly, neither of the politics independent of external capital flows does

represent a solution, but the openness should be rational and completed by adequate politics for the internal development.

A new research direction is outlined if we consider the following reasoning. The positive FDI-economic growth relationship, where it is identified through panel analyses, does not necessarily indicate a causal relation between the two. There exists the possibility that FDI flows and economic growth are both under other factors' incidence that determine their evolution in the same direction (economic integration for example - Gao, 2005). According to others opinion, the correlation between the FDI and the economic growth explains mainly an economic cycle, and less the long term effect of the FDI. Consequently, a causal relationship has to be investigated between FDI and economic growth.

Our first results on testing the causality relation between the FDI and the economic growth in Romania show that the FDI has a short term impact over the Romanian economic growth (Pop Silaghi and Masca, 2008). The further studies should bring details to this subject.

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- *** ILO, LABORSTA Database
- *** IMF Database IFS
- *** UNCTAD Database
- *** UNECE, National Accounts Main Aggregates Database
- *** WORLD BANK Financial Structure and Governance Indicators

APPENDIX

Figure 2: FDI, commercial banks assets and the economic growth in the CEECs

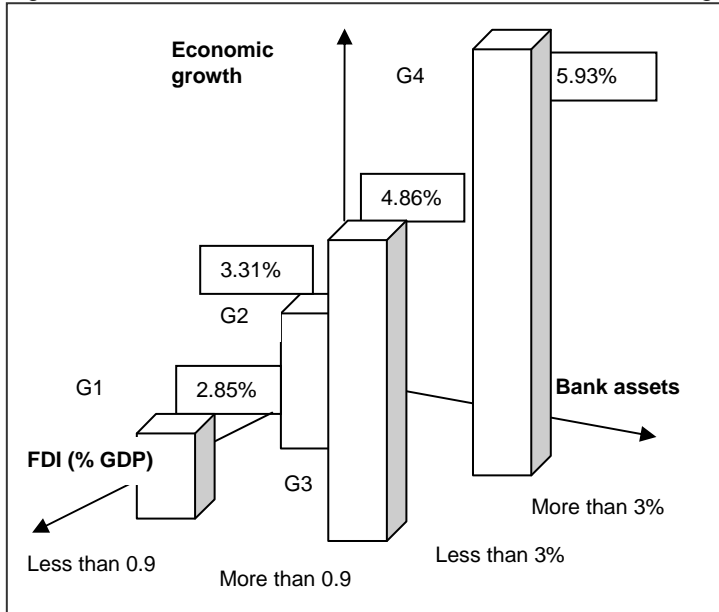


Figure 3: FDI, Education and the economic growth in the CEECs

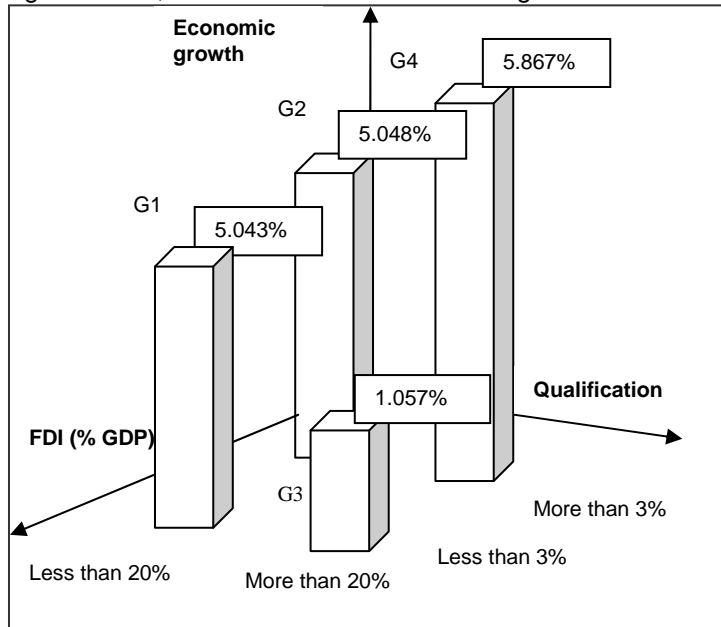


Figure 4: FDI, Political stability and economic growth in the CEECs

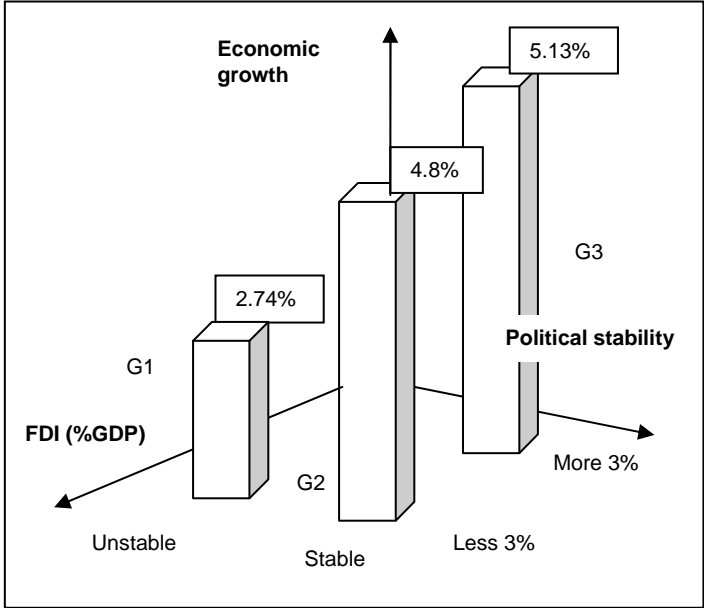


Figure 5: FDI, Openness and economic growth in the CEECs

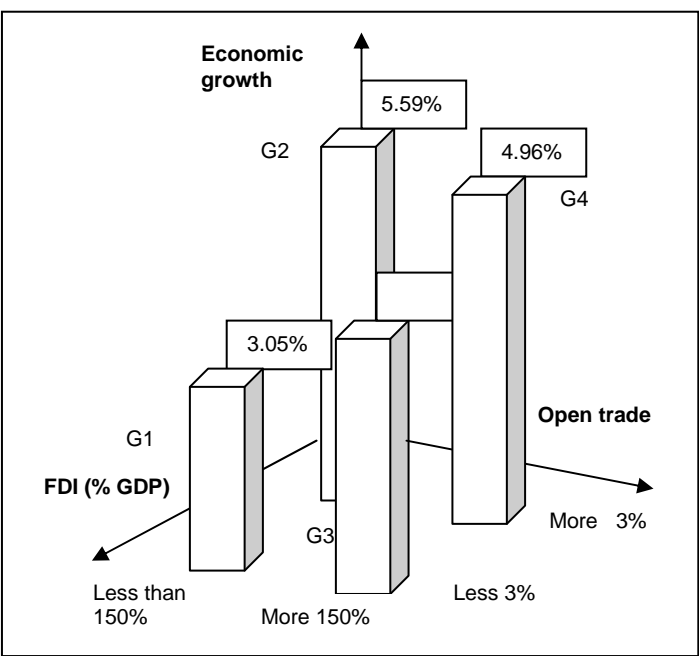
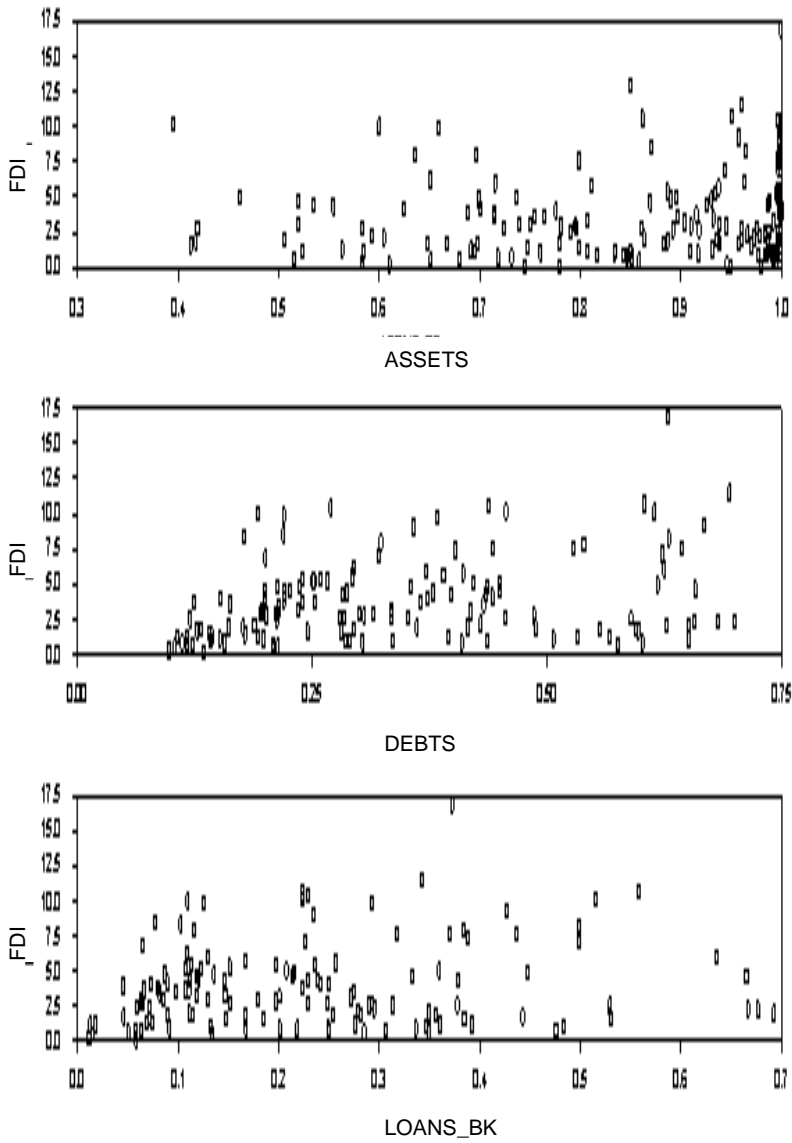


Figure 6: The FDI and the financial market (1994-2004)



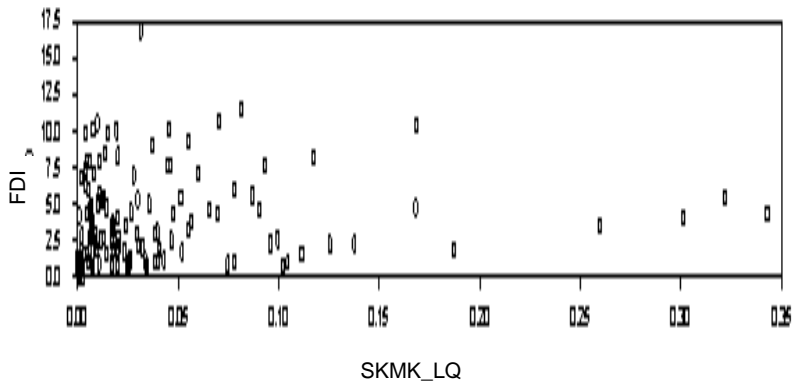
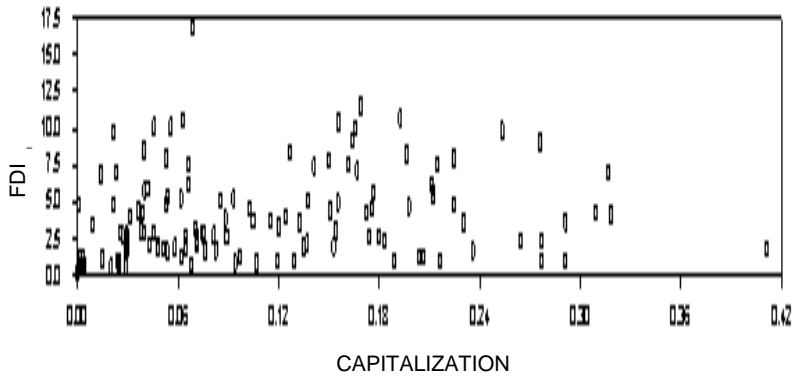
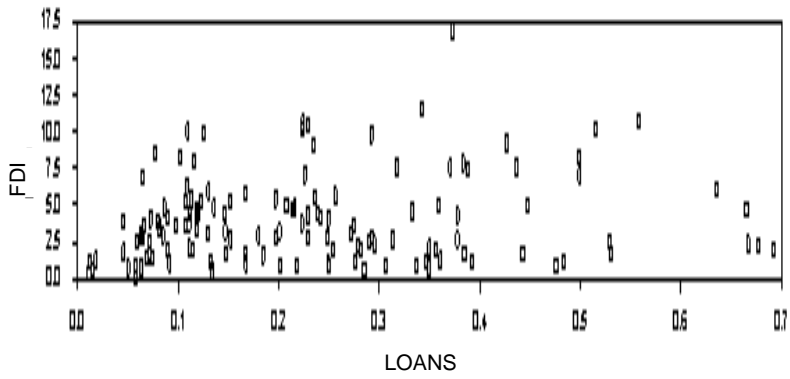
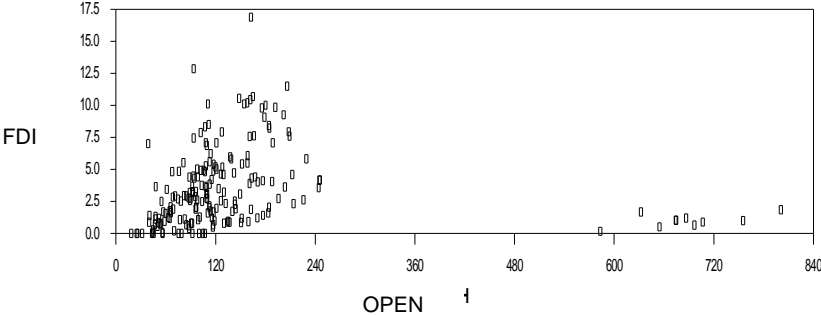
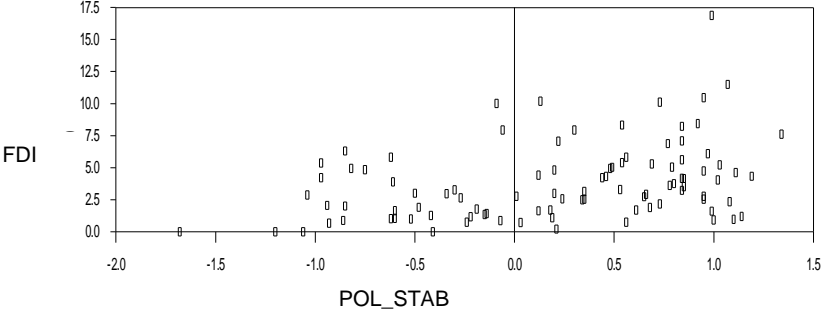


Figure 7: The FDI and the political stability, respectively the openness for international trade



EFFECT OF TRADE LIBERALIZATION: THE EXPERIENCE OF INDONESIAN COFFEE AND RUBBER INDUSTRIES

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Abstract. The study revealed that Indonesian coffee and rubber industries benefited from trade liberalization. Trade liberalization had a positive effect on the production, consumption, volume of export, net trade, CM and RCA of coffee and rubber. The price competitiveness analyses showed that coffee undergoing the wet process was more competitive than the dry processed one. This implied that higher quality coffee was more competitive in the export market. For rubber, SIR 20 was competitive. The relative export competitiveness of the commodities was not solely dependent on trade liberalization but also on other policies such as exchange rate. Productivity and quality should be prioritized in the development of coffee and rubber industries.

JEL Classification: C25, D43, L13

Keywords: Trade liberalization, Coconut industries

1. Introduction

In welcoming the era of globalization and trade liberalization, Indonesia started adjusting some of its trade policies. Prior to GATT-Uruguay Round agreement, the Indonesian government's commitment on agriculture encompasses four different types of obligations for agricultural reform including: improvement in market access, reduction in domestic support to agriculture, reduction in export subsidies, and *sanitary and phytosanitary* (SPS) measures (Nainggolan, 1996). In the context of the GATT/WTO and the growing blocks of free trade regions, ASEAN, where Indonesia is a member, set up economic cooperation among the members by establishing the *ASEAN Free Trade Area* (AFTA). Under AFTA, the *Common Effective Preferential Tariff* (CEPT) scheme was instituted to reduce tariff to a range of 0 – 5 % on all manufactured goods and agricultural products. Erwidodo (1999) stated that the CEPT includes the elimination of agricultural subsidies, tariff and non-tariff protections that used to be limited on imported agricultural commodities.

After independence in 1945, Indonesia adopted a protectionist stance for agriculture trade. High import tariffs and exchange rate incentives for exporters were the policies used to boost the export of agri-based products, such as coconut.

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The exporters of agri-based products enjoyed a preferential exchange rate that was 10 percent higher than official exchange rate. The period of 1970 to 1980s was characterized by policies aimed to develop domestic processing industries where the traditional exports was banned or taxed to pursue self-sufficiency in rice and used oil revenues to set up import substituting manufacturing industries (Nainggolan, 1996 and Fane, 1996). In 1969, the government subsidized the price of fertilizers to influence the rice farmers' usage while the tree crops enjoyed fertilizer subsidies only after 1973. In 1978, the agriculture sector also enjoyed the pesticide subsidies.

Since the early 1980s, Indonesia had undertaken a series of trade reforms that shifted Indonesia from having an inward-looking to an outward-looking development strategy (Kustiari *et al.*, 1998). The need to speed up trade and economic reforms is now a must, particularly in relation to Indonesia's commitment under the CEPT scheme of the AFTA, which is to be fully implemented by 2003. Accordingly, the government announced a major tariff reduction schedule in its deregulation package of May 1995. In the more recent deregulation packages of 1996 and 1997, the government consistently reduced import and export tariff rates on capital goods, eliminated export and import tariff surcharges for most products, simplified import regulations and facilitated exports.

In 1986, the government reduced the fertilizer and pesticide subsidies. The pesticide subsidy was abolished in 1990 but the fertilizer was eliminated in 1993. At the same time, the government re-opened the pesticide and fertilizer trade. The government maintained a tariff at 5% and a VAT at 10% for pesticide import but the fertilizer import imposed only a VAT at 10% in 1993.

The export duty of copra and coconut oil was 10 percent of fob price in 1976 and it was reduced at 5 percent of standard fob price in 1980. The standard fob price was determined by the Ministry of Industry and Trade. In 1981, the minimum standard fob price was US\$ 285/MT for copra and US\$ 438/MT for coconut oil but it was practically without export duty when the price fell below the standard fob price.

In the context of trade liberalization, a reduction of protection will reduce the trade barriers and thereafter, the volume of trade will increase. The increase in the volume of trade, however, does not mean that the participating countries will gain from trade. The benefits derived from the trade liberalization depend on the openness and the economic reforms of each country (Anderson and Tyers, 1990). Goldin and Knudsen (1990) stated that the developing countries will be among the most affected, either positively or negatively, by the outcome of the GATT negotiations on agricultural trade liberalization. The result in the Asia-Pacific region showed that the impact of trade liberalization on each participating country depends on at least four factors. The first is the scope of liberalization, whether this is multilateral, regional, or unilateral in nature. The second is the form of the commitment to conduct liberalization, whether this is based on a request-offer approach, involuntary, or voluntary commitments. The third is coverage of the liberalization scheme; for example, whether this involves removal of domestic distortions, elimination of non-tariff barriers, or merely reduction in border tariff; and finally, the speed with which the liberalization schemes proceed. The interaction among these factors will determine the changes in resource allocation and the amount of benefit or loss accrued by each country (Feridhanusetyawan, 1999). Matin *et al.* (1990) showed that the result of the trade liberalization in Uganda is not only dependent on the trade reforms but also on the appropriate

macroeconomic policies or indirect protection instruments, especially the exchange rate reform. The exchange rate reforms will directly or indirectly affect overvalued (or undervalued) currency and this could be traced through the nominal protection coefficient of the commodity (Goldin and Knudsen, 1990).

Agricultural importable, with some exceptions, are likely to benefit from liberalization. Surcharges maintain the levels of direct nominal protection for agricultural importable, which also benefit from lower negative protection as protection is reduced for the rest of the importable. The exceptions are products whose level of protection will be reduced, but these products have little weight among importable. In short, agricultural importable is likely to be more favored than exportable (Hachette, *et al.*, 1992).

On the demand side, trade liberalization affects the consumption through increasing exports and imports. The lowering of tradable prices through eliminating the trade barriers will raise the consumption.

The general objective of the study was to identify and describe the economic effects of trade liberalization on the Indonesian coffee and rubber industries. Specifically, the study aimed to: (1) assess the effects of trade liberalization on production, consumption and trade of coffee and rubber; (2) determine the export competitiveness of coffee and rubber; (3) determine the factors that influence the volume of export of green coffee and natural dry rubber; and (4) recommend trade policy reforms to address the problems and constraints affecting the coffee and rubber industries.

2. Methodology

This study analyzed the economic effects of pre- and post-trade liberalization on the coconut industries from 1969 to 1999. The periods, before and after trade liberalization, were from 1969-1985 and 1986-1999, respectively. These are the only data that can be used for this analysis.

Primary and secondary data were used in this study. Primary data were collected at the exporters' level to determine the marketing costs, identify and analyze the problems related to Sanitary Phytosanitary (SPS). Secondary data collected comprised of the time series data (1969-1999) on production and domestic wholesale prices of Indonesian coconut. The data were gathered from the Directorate General of Estate Crops of the Department of Agriculture and the Statistic Office in Indonesia.

The empirical analysis involved the measurement of degree of trade liberalization and export competitiveness. The policy effect was determined by regression analysis. The degree of trade liberalization was implicitly measured by the Nominal Protection Rate (NPR). The NPR was estimated with the following formula, where:

$$NPR = \frac{(P_d - P_w)}{P_w} \cdot 100\% \quad (1)$$

P_d = Domestic wholesale prices in domestic currency (Rp/kg). Rp means *Rupiah*, the Indonesia currency.

P_w = World prices in domestic currency (Rp/kg)

The NPR has three general interpretations:

1. $NPR < 0$ implies that the government gives penalty or provides no incentives to domestic producers,
2. $NPR = 0$ implies that there is no distortion; and
3. $NPR > 0$ implies that government provides protection or incentives to domestic producers

The export competitiveness was measured using three types of analyses: the competitiveness index, revealed comparative advantage index and export parity price index.

Athukorala (1998) proposed the competitiveness index to identify products that are substitutes or competitive to each other. In the export and import markets, the comparative advantage is measured by the formula (2).

$$CM_t = 100 \times \frac{\sum_{i=1}^n XP_{it}}{\sum_i \beta_i XW_{it}} \quad (2)$$

Where:

CM_t is the competitiveness index for each i -th principal commodity.

$CM_t = 0$ implies no competitive advantage

$CM_t > 0$ implies there is competitive advantage, and The larger the CM_t , the higher is the competitive advantage.

XP_{it} is the export earnings of the given country,

XW_{it} represents world export earnings, and β_i is the initial period's world market share (1961-1962 annual average).

In most literature, post-trade observations are often used in an attempt to approximate comparative advantage or the so-called *revealed comparative advantage* (RCA). Balassa's (1965) RCA index has already been used by Yanagida (1997), Wongsgulgeard (1998), and Chang and Hsu (1999) which is defined below:

$$RCA_i^k = \frac{X_i^k / X_i}{X_w^k / X_w} - \frac{M_i^k / M_i}{M_w^k / M_w} \quad (3)$$

where:

X is the value of exports;

M is the value of import and the superscript k denotes the commodity group; the two subscripts i and

w are, respectively, the exporting country and the world.

A value of RCA greater than unity indicates a stronger comparative advantage for the country in the export of a given commodity. Note that this index cannot capture the potential "future" comparative advantage. The RCA can be interpreted as follows:

1. $RCA \leq 0$ implies no competitive advantage,
2. $RCA > 0$ implies there is competitive advantage, and
3. The larger the RCA, the higher is the competitive advantage.

In the context of competitive analysis using primary data, export parity price are the measures of the level of competitiveness by comparing the domestic wholesale price and the world price (Gonzales in Lantican, 2000). The export parity price of coconut products using analysis of the ratio between the export parity (Pe) and the domestic wholesale price (Pd) has two general interpretations:

1. If $Pe/Pd > 1$, this implies that the agri-based products are competitive in the export market;
2. Conversely, if $Pe/Pd < 1$, this implies that the agri-based products are not competitive in the export market.

The effects of trade liberalization were determined using regression analysis. The volume of export function for coconut product was regressed following the same methodology adopted by Athukorala (1998) and Lantican (2000).

The multiple regression model of the volume of export expressed in linear form is as follow:

$$Y_t = c_0 + c_1 CM_t + c_2 RCA_t + c_3 RER_t + c_4 T + c_5 D_t + c_6 C_t + c_7 P_t + c_8 P^e_t + c_9 NPC_t + c_{10} Int_t \quad (4)$$

where:

- Y_t = Volume of export of coconut products at year t (million MT).
- CM_t = Competitive index of the coconut products at year t.
- RCA_t = Revealed comparative advantage of the coconut products at year t.
- RER_t = Real exchange rate at year t ($Rp/US\$$).
- T = Dummy variables with value of 0 (before trade liberalization) and 1 (after trade liberalization).
- D_t = Domestic production of the coconut products at year t (million MT).
- C_t = Domestic consumption of coconut products at year t (million MT).
- P_t = Real producer price of coconut products at year t (Rp/kg).
- P^e_t = Real export price of the coconut products at year t (Rp/kg).
- NPC_t = Nominal protection coefficient of the coconut products at year t.
- Int_t = Nominal interest rate at year t (%/year).

3. Results and Discussion

The economic effects of trade liberalization showed in Table 1-2. The average NPRs for coffee and rubber were both negative indicating that the government provided no protection for exporters of these agri-based products. The average NPR for coffee and rubber were -22.02% and -3.01% before trade liberalization, and -0.16% and -11.89% after trade liberalization, respectively. This indicated that after trade liberalization, trade restrictions for coffee and rubber were removed.

The average productivity of rubber increased from 0.57 ton/ha in 1969-1985 to 0.69 ton/ha in 1986-1999. This result conforms with the hypothesis that the average productivity would be higher after trade liberalization. On the other

hand, the average productivity of coffee declined from 0.57 ton/ha in 1969-1985 to 0.55 ton/ha after trade liberalization in 1986-1999. The decline in the productivity of coffee was primarily due to the ageing and unproductive plantations with no replanting program for the old and senile trees.

The per capita consumption of coffee and rubber increased after trade liberalization, from 0.38 kg/capita/year and 0.32 kg/capita/year in 1969-1985 to 0.41 kg/capita/year and 0.73 kg/capita/year in 1986-1999, respectively. The average export volume for coffee and rubber rose after trade liberalization, although that of coffee substitutes declined. This indicated that Indonesia's policy focused on the supply side and neglected the need for further processing on the demand side.

The net trade of coffee and rubber increased from US \$ 316.72 million and US\$ 579.15 million in 1969-1985 to US\$ 523.50 million and US\$ 1,133.10 million in 1986-1999, respectively.

The level of revealed comparative advantage (RCA) differed from the results of the CM for two reasons. First, the CM is weighted by the initial period's share. If the initial period's share is greater than the later period, this will result to a greater CM value. Trade liberalization resulted to increases in both exports and imports. The value of the CM will not be affected, but the RCA value will be lesser if the import share of the country increases. If the export share of the commodity in the world market increases, the CM will also increase but RCA will remain the same.

The results of the analysis indicated that the CM and RCA for all commodities increased after trade liberalization. The CM of coffee and rubber increased from 423.81 and 88.32 in 1969-1985 to 553.44 and 101.92 in 1986-1999, respectively. The average RCA of coffee increased from 9.65 in 1969-1985 to 9.83 in 1986-1999, but the average RCA of rubber declined from 45.20 in 1969-1985 to 31.45 in 1986-1999. However, the RCA of coffee substitutes and natural dry rubber declined after trade liberalization but it was not statistically significant. This evidence showed that after trade liberalization the increase in export was followed by a similar increase in import. This also suggested that if the government intends to improve the competitiveness of its agri-based products, it should examine its supply and demand side policies.

The export volume of coffee and rubber were mainly in raw material form indicating that processing for these products was still underdeveloped. This was evident particularly in the green coffee exports of 1993-2000, where the bulk consisted of 9% Arabica coffee, 88 % Robusta coffee and 3% in roasted, soluble and other forms. The lowest grade, such as the fourth grade of dry processed Robusta coffee (Robusta DP-4), contributed 50.3 % to the total export in terms of volume, followed by Robusta DP-6 and Robusta DP-5 with 10.5 % and 4.7 % contributions, respectively.

The same condition also showed in the export quality of natural rubber. The Standard Indonesian Rubber (SIR) scheme was first implemented in 1969 but their enforcement started only in 1989. SIR 50 and SIR 20, the lowest grades in the SIR scheme, comprised the bulk of Indonesia's natural rubber export volume in 1990-2000. SIR 50 contributed 47.9% to the total export while SIR 20 accounted for 43.0 % of total export.

The results of the price competitiveness analysis showed that the export price parity ratio of coffee ranged from 1.00 to 1.24 and the export price parity ratio

of SIR 20 rubber was 1.42. The sensitivity analysis of price competitiveness was done by appreciating and depreciating the value of the rupiah against the US dollar. Results indicated that the exchange rate has an important role in the competitiveness of coffee and rubber. (Table 3-5). The behavior patterns of the factors that influenced the export volume of coffee and rubber reflected the policies implemented by Indonesia. Not all variables were included in the analysis due to the multicollinearity problem (Table 6).

The effects of the degree of trade liberalization, as measured by the regression coefficient of NPC, showed that trade liberalization has a positive effect on green coffee. The regression coefficient of NPC for rubber has a negative effect but it was not statistically significant. This suggested that the effect of trade liberalization depends on the particular commodity.

The dummy for the differences in the export volume for green coffee and natural dry rubber during the pre- and post-trade liberalization were statistically significant at 5% and 1% probability levels, respectively. These implied that trade liberalization has a positive effect on the volume of exports.

The production of green coffee and natural dry rubber was not included in the model due to multicollinearity problem with the dummy. However, the production of green coffee and natural dry rubber have positive effects on the export volume.

The results of the regression on the consumption of green coffee supported the results for natural dry rubber, that consumption has a negative effect on the export volume. Results showed that an increase in the consumption of green coffee and natural dry rubber reduced their export volumes by 0.07 % and 0.01 %, respectively.

The competitiveness index (CM) had a positive effect on green coffee and natural dry rubber. The export volume for green coffee and natural dry rubber showed an average increased of 0.87 % and 0.99 %, respectively, due to an improvement of their competitiveness. The regression coefficients for competitiveness expressed in terms of the CM has a positive sign, indicating that an increase in the export volume was due to the increase in the competitiveness. This result is consistent with the supply-side policies that predominantly seem to be the main policies of Indonesia for the commodities included in this study. Production relatively contributed to the bulk of the increase in the export volume for green coffee and natural dry rubber resulting to the increase of their competitiveness.

The inverse effect of competitiveness, measured in terms of RCA, showed that competitiveness declined due to an increase in their import. The RCA was excluded from the model since it has multicollinearity problem

The export price has a positive effect on the export volume for all commodities but it was deleted from the model since export price has a strong correlation with the dummy.

There was also a positive effect on the producer price of natural dry rubber. The export volume of natural dry rubber was estimated to increase by 0.09 % due to a 1 percent rise in the domestic producer price. The effect on the producer price of green coffee was not included in the analysis since it was not statistically significant. This result manifested the role played by the domestic market for natural dry rubber vis-a-vis the world market compared to the domestic market of coffee. Indonesia is the second largest exporter of natural rubber after Thailand.

However, Indonesia primarily exports raw rubber. This indicated that Indonesia placed emphasis on the supply of raw rubber rather than on the demand for the processed form. Meanwhile, the world market for coffee is held by Brazil and Indonesia is only a price taker. This evidence suggested that maintaining domestic production is needed to reduce the risk from the volatility of the world price.

The exchange rate has a positive effect on the export volume for all commodities but it was deleted from the model for green coffee due to the multicollinearity problem. A depreciation of the rupiah relative to the US dollar increased the export volume of natural dry rubber by 0.25%, at 1 % significance level. This evidence indicated that the depreciation of the exchange rate was an important policy to encourage the export of Indonesian natural dry rubber.

The regression results on interest rate green coffee and natural dry rubber was deleted from the model since it was not statistically significant and had a multicollinearity problem. However, this variable has a negative effect on the export volume. This implied that the government should manage the domestic nominal interest rate carefully to create a favorable business environment as well as a favorable export-oriented environment.

4. Conclusions

The economic indicators (production, consumption, volume of trade, net trade, CM and RCA) indicated that the Indonesian coffee and rubber industries benefited from trade liberalization. However, the performance of coffee and rubber products was not solely dependent on the trade liberalization since the some indicators has adverse effect such as the NPR of coffee declined but the NPR of rubber increased which indicated that the removal of trade restriction dependent on the particular commodity and the productivity of coffee declined after trade liberalization. The competitiveness played a role in the success of export performance of these agri-based products.

The computation of price competitiveness showed that the higher the quality, the more the competitiveness of coffee products. There are many factors influenced the export volume for green coffee and natural dry rubber including exchange rate and producer price. These evidence implied that there are many factors influenced the performance of export volume for these agri-based products. Based on the findings of this study, the following recommendations are made for trade policy reforms to address the problems and constraints affecting the coffee and rubber industries.

First, there is an urgent need to improve the productivity of coffee and rubber industries, such that their productivity can be increased through in-service trainings and the introduction of improved management practices. The productivity of coffee should be given more attention by replanting old and senile trees with high yielding varieties. The world market should be considered due to the volatility of prices.

Second, improvement in the quality should be prioritized to increase the export competitiveness and revenue for the commodities in the study. The improvement in quality should be strengthened to produce better quality products in order to increase their value-added. The development of quality control standards and the management of the same from the farmers' to the exporters' levels is needed to identify channels to improve the quality of products.

Third, since the export performance of coffee and rubber was not solely dependent on trade liberalization, the government should consider others factors such as exchange rate and interest rate policies. The depreciation of the exchange rate and the low interest rate offers of the banks will increase the export volume for the commodities. Policies on these aspects should be strengthened to create a favorable export-oriented environment.

Further research and development must be done focusing on improved processing technologies and quality control to improve the quality and productivity of the coffee and rubber industries. The key research and development area should be a program to create alternative uses for these agri-based products to increase their value-added contributions.

Lastly, further study using more sophisticated models, such as computable general equilibrium model, is recommended to determine other dynamics in the economy.

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APPENDIX

Table 1. The different economic indicators of coffee products, Indonesia, 1969-1999.

INDICATORS	PRE- TRADE LIBERALIZATION (1969-1985)	POST- TRADE LIBERALIZATION (1986-1999)	T-VALUE
1. Nominal Protection Rate (%)	-22.02	-16.03	1.013 ^{ns}
2. Productivity (ton/ha) ^a	0.57	0.55	-2.145 ^{**}
3. Consumption (Kg/capita/year)	0.38	0.41	0.937 ^{ns}
4. Export Volume (MT/year)			6.521 ^{***}
Green Coffee	175.37	326.18	3.805 ^{***}
Coffee Extracts	0.11	1.79	1.281 ^{ns}
Coffee Husks and Skins	0	0.03	3.999 ^{***}
Roasted Coffee	0.003	0.40	-2.166 ^{**}
Coffee Substitutes	0.17	0.005	6.557 ^{***}
Total	175.65	328.40	
5. Net trade (US\$/year)			
Green Coffee	315.98	513.35	2.723 ^{**}
Coffee Extracts	0.71	8.75	3.507 ^{***}
Coffee Husks and Skins	0	0.02	1.996 [*]
Roasted Coffee	- 0.15	1.36	2.924 ^{***}
Coffee Substitutes	0.18	0.01	0.655 ^{ns}
Total	316.72	523.50	8.935 ^{***}
6. Competitiveness Index			
Green Coffee	491.44	712.79	3.914 ^{***}
Coffee Extracts	410.61	2,598.94	3.899 ^{***}
Coffee Husks and Skins	0	11.91	1.672 ^{ns}
Roasted Coffee	27.65	1,730.58	3.671 ^{***}
Coffee Substitutes	5.88	36.50	0.820 ^{ns}
Total	423.81	553.44	2.744 ^{**}
7. RCA			
Green Coffee	5.91	6.39	0.510 ^{ns}
Coffee Extracts	0.08	0.61	4.212 ^{***}
Coffee Husks and Skins	0	2.37	1.559 ^{ns}
Roasted Coffee	0.002	0.17	3.700 ^{***}
Coffee Substitutes	3.66	0.60	-0.803 ^{ns}
Total	9.65	9.83	0.039 ^{ns}

***, ** and * indicate significant relationship at 1%, 5% and 10% probability levels.
ns-not significant at 10% probability level.

Table 2. The different economic indicators of rubber products, Indonesia, 1969-1999

NO	INDICATORS	BEFORE TRADE LIBERALIZATION (1969-1985)	AFTER TRADE LIBERALIZATION (1986-1999)	T-VALUE
1.	Nominal Protection Rate (%)	-3.01	-11.89	-1.571*
2.	Productivity (ton/ha)	0.57	0.69	7.971***
3.	Consumption (Kg/capita/year)	0.32	0.73	3.218***
4.	Export Volume (MT/year)			
	Natural Rubber	10.21	34.29	4.318***
	Natural Dry Rubber	835.97	1,226.51	7.415***
	Total	846.18	1,260.80	8.061***
5.	Net trade (US\$/year)	2.33		
	Natural Rubber	576.82	7.13	1.283
	Natural Dry Rubber	579.15	1,125.97	4.500***
	Total		1,133.10	4.501***
6.	Competitiveness Index			
	Natural Rubber	35.69	53.40	-1.063ns
	Natural Dry Rubber	93.38	111.17	6.797***
	Total	88.32	101.92	4.315***
7.	RCA			
	Natural Rubber	5.19	11.00	2.252**
	Natural Dry Rubber	47.81	34.45	-1.141 ^{ns}
	Total	45.20	31.45	-1.266 ^{ns}

***, ** and * indicate significant relationship at 1%, 5% and 10% probability levels.
ns-not significant at 10% probability level.

Table 5. Export parity price of copra and coconut oil, Muara Sabak, Jambi Province, Indonesia, September 2001

PARTICULARS	EXCHANGE RATE, RP 9,635/US\$ ^a		EXCHANGE RATE, RP 11,562/US\$ ^b	
	Copra	Coconut Oil	Copra	Coconut Oil
FOB Price (US\$/kg)	0.162	0.275	0.162	0.275
Foreign Exchange Rate (Rp/US\$)	9,635.00	9,635.00	11,562.00	11,562.00
Export Price in Local Currency (Rp/kg)	1,560.87	2,649.63	1,863.00	3,162.50
Port Costs (Rp/kg)	15.00	15.00	15.00	15.00
Storage Costs (Rp/kg)	30.00	34.00	30.00	34.00
Transport Costs (Rp/kg)	17.92	16.00	17.92	16.00
Other Costs (Rp/kg)	10.00	15.00	10.00	15.00
Packaging Costs (Rp/kg)	12.00	15.00	12.00	15.00
Certificate of SPS (Rp/kg)	3.33	3.42	3.33	3.42
Certificate of Weight (Rp/kg)	3.90	1.50	3.90	1.50
Insurance (Rp/kg)	46.83	78.04	56.19	93.39
Export Parity Price (Rp/kg)	1,421.89	2,471.67	1,724.70	2,984.24
Domestic Wholesale Price (Rp/kg)	1,700.00	2,750.00	1,700.00	2,750.00
Export Parity Ratio	0.84	0.89	1.01	1.09

^a the actual exchange rate in September 2001

^b exchange rate is depreciated by 20 %

Source of Basic Data: Primary data from exporters, shipping line company and Quality Control Agency under the MOIT.

Table 3. Export parity price of coffee, Surabaya, East Java, Indonesia, September 2001.

DESCRIPTION	ROBUSTA							ARABICA
	DP-1	DP-2	DP-3	DP-4	WP-1	WP-2	WP-3	WP-1
FOB Price (US\$/Kg)	0.60	0.45	0.42	0.40	1.17	1.05	0.95	1.20
Foreign Exchange Rate (Rp/US\$)	9,475.00	9,475.00	9,475.00	9,475.00	9,475.00	9,475.00	9,475.00	9,475.00
Export Price in Local Currency (Rp/Kg)	5,685.00	4,263.75	3,979.50	3,790.00	10,422.50	9,475.00	7,580.00	11,370.00
Port Cost (Rp/Kg)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Storage Cost (Rp/Kg)	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Transport Cost (Rp/Kg)	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Fee for Indonesian Association of Coffee Exporters (Rp/Kg)	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Others Costs (Rp/Kg)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Packing (Rp/Kg)	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96
Fumigation	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
Certificate of SPS (Rp/Kg)	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Certificate of Weight (Rp/Kg)	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57
Insurance (Rp/Kg)	170.55	127.91	119.39	113.70	332.57	298.46	270.04	341.10
Export Parity Price	5,394.10	4,014.94	3,739.22	3,555.40	10,652.19	9,543.60	8,652.95	10,908.00
Domestic Wholesale Price	5,350.00	4,000.00	3,700.00	3,500.00	9,000.00	8,000.00	7,000.00	9,250.00
Export Parity Ratio	1.01	1.00	1.01	1.02	1.18	1.19	1.24	1.18

Source of Basic Data: Primary data from exporters, shipping line company and Qualities Control Agency under the MOIT.

Table 4. Export parity price of coffee at 5 % exchange rate appreciation, Surabaya, East Java, Indonesia.

DESCRIPTION	ROBUSTA							ARABICA
	DP-1	DP-2	DP-3	DP-4	WP-1	WP-2	WP-3	WP-1
FOB Price (US\$/Kg)	0.60	0.45	0.42	0.40	1.17	1.05	0.95	1.20
Exchange Rate (Rp/US\$)	9,001.25	9,001.25	9,001.25	9,001.25	9,001.25	9,001.25	9,001.25	9,001.25
Export Price in Local Currency (Rp/Kg)	5,400.75	4,050.56	3,780.53	3,600.50	10,531.46	9,451.31	8,551.19	10,801.50
Port Costs (Rp/Kg)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Storage Costs (Rp/Kg)	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Transport Cost (Rp/Kg)	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Fee for Indonesian Association of Coffee Exporters (Rp/Kg)	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Other Costs (Rp/Kg)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Packaging Cost (Rp/Kg)	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96
Fumigation	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
Certificate of SPS (Rp/Kg)	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Certificate of Weight (Rp/Kg)	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57
Insurance (Rp/Kg)	162.02	121.52	113.42	108.02	315.94	283.54	256.54	324.05
Export Parity Price	5,117.83	3,808.15	3,546.21	3,371.59	10,094.62	9,046.87	8,173.75	10,356.56
Domestic Wholesale Price	5,350.00	4,000.00	3,700.00	3,500.00	9,000.00	8,000.00	7,000.00	9,250.00
Export Parity Ratio	0.96	0.95	0.96	0.96	1.12	1.13	1.17	1.12

Source of Basic Data: Primary data from exporters, shipping line company and Quality Control Agency under the MOIT

Table 6. Results of the regression analysis on the export volumes of green coffee and natural dry rubber, Indonesia, 1969-1999.

ITEM	GREEN COFFEE		NATURAL DRY RUBBER	
	Model 1	Model 2	Model 1	Model 2
Constant	- 4.77*** (-3.02)	-3.24*** (-11.58)	-4.52*** (-6.13)	-7.22*** (-4.84)
NPC	0.22 ^{ns} (1.54)	0.230* (1.84)	0.10* (1.99)	-0.06 (-0.52)
Dummy	-0.06 ^{ns} (-0.41)	0.19** (2.06)	-0.05* (-1.79)	0.13*** (2.20)
Production	0.21 ^{ns} (0.47)	-	0.22** (2.09)	-
Consumption	-0.09*** (-3.38)	-0.07** (-2.09)	-0.007*** (-3.66)	-0.01** (-2.51)
CM	0.43** (2.07)	0.87*** (7.90)	0.50*** (3.99)	0.99*** (3.34)
RCA	0.18 ^{ns} (1.43)	-	0.006 ^{ns} (0.33)	-
Export price	-0.10 ^{ns} (-1.24)	-	0.143*** (6.05)	-
Producer price	0.14 ^{ns} (0.21)	-	-0.04** (-2.02)	0.09** (2.56)
Exchange Rate	0.36** (2.04)	-	0.16*** (5.94)	0.25*** (3.78)
Interest rate	-0.30 ^{ns} (-1.50)	-	0.08** (2.39)	-
R ²	0.96	0.89	0.99	0.91
Adjusted R ²	0.94	0.87	0.99	0.89
F-value	45.54***	50.95***	254.641***	42.15***
DW statistic	2.269	1.54	2.04	0.90

Note: Figures in parentheses are t-values

***, ** and * indicate significant relationship at 1%, 5% and 10% probability levels.

^{ns}-not significant at 10% probability level.

ROMANIA'S COMPETITIVE ADVANTAGE BEFORE ADMISSION TO THE EUROPEAN UNION

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Abstract. The purpose of this paper is to analyze the Romanian's competitiveness in the light of its external trade. There are a lot of quantitative measures that reveal different facets of the trade competitiveness, but we focused in this article on those regarding the geographical concentration of commercial flows, the intensity of intra-industry flows and the product specialization. All these measures were applied to the case of Romania, indentifying the most competitive traded goods of this country before its admission to the EU. We tried to demonstrate that the so called "low labor cost competitiveness" is a cliché and that this country hat much to offer as a new member of the European Union.

JEL Classification: C43, F14, F15

Keywords: comparative advantage, competitiveness, trade, specialization

1. Introduction

After the fall of the communist system, Romania had and still has a period of structural changes. In January 2007 she became a full member of the European Union. We consider that an analysis of the trade patterns in this context can reveal, on the one hand, these structural transformations and, on the other hand, the Romania's potential as a European Union country.

When speaking about trade patterns, the notions most linked are "specialization", "comparative advantage" and "competitive advantage". The reciprocal relation between specialization and competitive advantage is largely accepted: the existence of competitiveness and higher productivity presumes specialization and a higher competitive advantage leads to a higher specialization (Aiginger, 2001).

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On the contrary, there is much debate regarding the notions of “comparative advantage” and “competitiveness”. In the next lines we want to sustain the idea that when talking about trade the competitive advantages determine the specialization and not the comparative one.

For a long period of time it was considered that the comparative advantage explains the countries’ specialization in the traded goods. That is why, the most well-known indicator measuring specialization was the so-called revealed comparative advantage (RCA) developed by Bella Balassa (1965, 1977). In our opinion such an indicator reveals not the comparative advantages but the competitive one, since it is determined with the aid of exports’ and imports’ values of one country. Moreover, the performance of the external trade is due on the one hand to real factors but also to distortions generated by the imperfect competition (Siggel, 2006). One important presumption of the comparative advantage theory is the existence of a perfect competition. This theory postulates that a country is said to have a comparative advantage if it can produce a good at an opportunity cost lower than its trade partner (Popescu, 2001). From this definition, we consider that a more appropriate measurement of comparative advantage would be the average total cost and not an indicator based on exports’ and imports’ values like RCA. That is why we agree with the affirmation that the comparative advantages/disadvantages appear only in production, meanwhile the competitive advantages/disadvantages appear in the international trade (Popescu 2001).

Another very interesting point of view refers to the fact that from all the firms that operate in an industry which is characterized by the same comparative advantage or disadvantage, there are some of them which can reach competitive advantages (Abd-el-Rahman, 1991). These differentiations between the economic agents can be observed in productivity rates, profits rates, export performances, having an impact at the international level. The Abd-el-Rahman’s theory is that a firm can be uncompetitive in spite of a comparative advantage background and others can become competitive in spite of a comparative disadvantage of the field in which they operate. The possible gains are brought by the monopolistic competition of the markets. The first group of enterprises can compete on a national level, but the second group also at the international one.

We brought this explanation in order to explain, why we have used the indicators from the class of revealed comparative advantage to measure the competitive and not the comparative one.

The article is structured as follows: in the second part, we describe the most important indicators that reveal the concentration or the dispersion of the trade flows. In the third part we will focus more on those which measure the intra-industry trade. The theoretical approach will end with the large class of the “revealed comparative advantage” indicators that measure the product specialization of one country. For every group of measurements we show their advantages and disadvantages and suggest some improvements.

2. The indicators of trade flows geographical concentration

We want at the beginning of this approach to give some basic information regarding the Romanian trade values and to show how integrated / concentrated its commercial flows are.

OECD uses in this respect the Herfindal Index (HI). The presumption is that when a country j has a number of G trade partners, the more equal the ratio of national exports (or imports) to every country is, the higher the degree of integration of the origin country in that group of countries is. If we symbolize with X_{jk} the exports of country j to the country k and with $\sum_{k=1}^G X_{jk}$ the exports of country j to all the countries in the group, than the corresponding indicator for exports has the following expression:

$$HI_{X,j} = \sum_{k=1}^G \left(\frac{X_{jk}}{\sum_{k=1}^G X_{jk}} \right)^2.$$

If every trade partner is equally important, the indicator takes the value $1/G$, depending on how many economies are in that specific group. The higher the value of this index is, the higher the degree of geographical concentration of the flows is. In our opinion, this measurement is not very appropriate because it does not take into consideration how large the markets of some national economies are compared to the country of origin. That is why we consider that Trade Entropy Index is more suitable for our purpose.

The Trade Entropy Index (absolute and relative) is used to show the geographical spread of one country's commercial relations relative to a certain region. The entropy is determined like in the information theory, the field where it comes from. The main idea is that the entropy measures the error with which the information is transmitted. Given a random variable, the probability of every event out of n possible is equal to $1/n$. The uncertainty of n outcomes is defined as: $\log_b(n)$.

Using the above mentioned specifications, the entropy (u) has the form:

$$u_i = \log_b(n) = \log_b \left(\frac{1}{p(x_i)} \right) \text{ for } i = \overline{1, n}.$$

The entropy tends to infinity, if the probability of the event x_i is very small. On the contrary, if the probability of the event is high, than u tends to be zero. The average value of the entropy is:

$$\sum_{i=1}^n p(x_i) \cdot u_i = \sum_{i=1}^n p(x_i) \cdot \log_b \left[\frac{1}{p(x_i)} \right].$$

In our case, the imports and the exports are considered as information received and transmitted (Marwah and Klein, 1995). The expected value of this information reflects the degree of integration of the commercial flows. It may be calculated for imports and exports according to the following expressions (Laaser and Schrader, 2002):

$$TE_{M,j} = \sum_{k=1}^G a_{jk} \cdot \ln \left(\frac{1}{a_{jk}} \right), \text{ with } 0 < a_{jk} < 1 \text{ and } \sum_{k=1}^G a_{jk} = 1$$

$$TE_{X,j} = \sum_{k=1}^G b_{jk} \cdot \ln \left(\frac{1}{b_{jk}} \right), \text{ with } 0 < b_{jk} < 1 \text{ and } \sum_{k=1}^G b_{jk} = 1$$

where a_{jk} and b_{jk} are the imports' (exports') share of country j from (to) country k . The higher the index is, the more dispersed are the exports and the imports of a country. Its maximum value is reached when all the shares are all equal. This means that this maximum value differs proportionally with the numbers of the

countries in the group and it equals: $TE_M = TE_X = \ln G$, where G is the total number of commercial partners. That is why, more representative than the absolute value of the trade entropy index is its relative value obtained by dividing the absolute value to the maximum value. At the international level the higher the degree of dispersion is, the more integrate the country is considered to be.

3. Intra-industry specialization indicators

After a first analysis regarding the integration degree of the origin country in the world from the perspective of trade flows, we intend to deepen our research on aspects which reveal the nature of these flows. We want to see if Romania's trade is dominantly of inter- or intra-industry type.

In nowadays it is more and more obvious that along with inter-industry flows (between different industries), there is an increasing specialization toward intra-industry flows (trade with goods belonging to the same industry). There are a lot of explanations for this phenomenon starting from the level of aggregation of products and ending with imperfect competition, economies of scale, development of multinational corporations etc (Krugman, 1990).

In order to reveal the intensity of intra-industry, Grubel and Lloyd (1971) developed one measurement, starting from the assumption that the total trade is composed from inter- and intra-industry flows (Lafay, 1992). If the total trade is the sum of exports and imports of the country j for all goods i ($X_{ij} + M_{ij}$), the inter-industry trade will be the corresponding net export or the net import $|X_{ij} - M_{ij}|$. The intra-industry trade can be then determined as the difference between the two:

$$IIT_{ij} = (X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|$$

or as a percentage in the total trade:

$$\%IIT_{ij} = \frac{(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|}{(X_{ij} + M_{ij})} \cdot 100.$$

wherefrom the Grubel-Lloyd Index is derived:

$$GL_{ij} = 1 - \frac{|X_{ij} - M_{ij}|}{(X_{ij} + M_{ij})}.$$

One can observe that if $X_{ij} - M_{ij} > 0$, the index can be written as: $GL_{ij} = \frac{2 \cdot M_{ij}}{(X_{ij} + M_{ij})}$

and if $X_{ij} - M_{ij} < 0$, then $GL_{ij} = \frac{2 \cdot X_{ij}}{(X_{ij} + M_{ij})}$.

Generalizing, we reach to another intra-industry measurement developed by Finger (1975) called Trade Overlap Index:

$$TO_j = 2 \cdot \frac{\sum_{i=1}^N \min(X_{ij}, M_{ij})}{\sum_{i=1}^N (X_{ij} + M_{ij})} = 1 - \frac{\sum_{i=1}^N |X_{ij} - M_{ij}|}{\sum_{i=1}^N (X_{ij} + M_{ij})}, \text{ where } i = \overline{1, N}$$

i represents in this case (and for the rest of this paper) the group of commodity traded by the country j .

It was observed that the results of these indicators depend on how aggregated the exports' and imports' values are. Another improvement to this measure is to use the relative values for imports and exports of each good (as percentage in the total exported or imported value) instead of their absolute value, as follows (Aquino, 1981):

$$GL_{ij}^* = 1 - \frac{\sum_{i=1}^N \left| \frac{X_i}{\sum_{i=1}^N X_{ij}} - \frac{M_i}{\sum_{i=1}^N M_{ij}} \right|}{\sum_{i=1}^N \left(\frac{X_i}{\sum_{i=1}^N X_{ij}} + \frac{M_i}{\sum_{i=1}^N M_{ij}} \right)} = 1 - 0,5 \cdot \sum_{i=1}^N \left| \frac{X_i}{\sum_{i=1}^N X_{ij}} - \frac{M_i}{\sum_{i=1}^N M_{ij}} \right|$$

Both above mentioned measures of intra-industry trade can take values between 0 and 1. The larger their value is, the more intra-industry specialization exists.

4. Product specialization indicators

For the inter-industry specialization, the starting point is given by the Balassa Index, published in 1965 (for observations, see Yeats, 1985). He proposed an indicator of specialization, which “reflects relative costs as well as differences in non-price factors” (Balassa, 1965). Taking into consideration this affirmation, we think, as we said before, that all the indicators from the group “revealed comparative advantage” do not reflect comparative but competitive advantage because besides relative costs they cumulate all the factors that determine the competitive or not competitive position of a good. Because our analysis is done using the market prices of goods, it will offer information relative to competitiveness and not to comparative advantage. For the classical comparative advantage we would have needed data about unit labor cost, productivity and so on (see also Siggel, 2006).

Balassa, restricted the indicator to 74 manufactured goods and 11 main industrial countries. We will use it in an enlarged form, taking into consideration all traded goods (261 in SITC, rev. 3, at 3-digit-level) and all world countries. Because only the national and world exports are taken into consideration, this measure is called revealed export advantage (RXA) or comparative export performance index (CEP). Its corresponding expression is:

$$BRXA_{ij} = \frac{\frac{X_{ij}}{\sum_{i=1}^N X_{ij}}}{\frac{\sum_{j=1}^T X_{ij}}{\sum_{i=1}^N \sum_{j=1}^T X_{ij}}} \quad \text{or} \quad BRXA_{ij} = \frac{\frac{X_{ij}}{\sum_{j=1}^T X_{ij}}}{\frac{\sum_{i=1}^N X_{ij}}{\sum_{i=1}^N \sum_{j=1}^T X_{ij}}}$$

where X_{ij} is the export value of commodity i (with $i = \overline{1, N}$) by country j (with $j = \overline{1, T}$). In our case our reference export zone will be the world. We intend to find the specialization's patterns relative to all commercial partners in the world. The reason for not using also the imports resides in the fact that at the time it was proposed, the imports were affected by protectionist measures. Practically, the revealed comparative advantage compares the country's share of the industry with the national total share in the world export value. Or, in other words, it compares for each industry each product's share at the national and world level. Of course, a value for RCA greater than 1 reveals a comparative advantages in the commodity i of the country j and a value smaller than 1 reflects a comparative disadvantage.

In order to overcome the fact that BRXA was not calculated taking into consideration also the imports, Balassa proposed another measure. It compares the ratio of the exports for good i total exports to the corresponding ratio for imports. It can be written in or without logarithmic form:

$$BRCA_{ij} = \frac{\frac{X_{ij}}{\sum_{i=1}^N X_{ij}}}{\frac{M_{ij}}{\sum_{i=1}^N M_{ij}}}$$

Although this index takes into consideration also the imports, it has the disadvantage of not comparing the origin country's trade flows with those the national or international level. Moreover, this measurement cannot be determined for a good i characterized by complete specialization (it is just exported and not imported). In this case, M_{ij} is zero and the index is not determined.

After Balassa's contribution, there were many other attempts to offer a better indicator for the revealed comparative advantage. Vollrath (1991) offers a detailed analysis on some measures of RCA such as those of: Kunimoto, Donges and Riedel, Bowen, Ballance *et al.*

Michaely (1967) proposed another revealed comparative advantage indicator which can be determined also in a situation of total specialization, because it is not a ratio between the share of one good's exports in total exports and the share of one good's imports in total imports, but a difference between the two, as it can be observed:

$$MRCA_{ij} = \frac{X_{ij}}{\sum_{i=1}^N X_{ij}} - \frac{M_{ij}}{\sum_{i=1}^N M_{ij}}$$

Although it has the advantage of taking into consideration both sides of the trade exports and imports, like BRCA these values are just for the origin country without comparing them with the values at the world or at least at the regional level.

Also important for taking into account the intra-industry trade is the Lafay Index (1992). It is well known that the classical and neoclassical theories succeed to a certain extent to explain the inter-industry trade and the new theories of international trade intend to explain the phenomenon of intra-industry trade with a growing importance. Lafay Index takes into consideration the both types of trade. Another advantage is that Lafay index eliminates the influence of cyclical factors since it computes the difference between the each item's normalized trade balance and the overall normalized trade balance (Zaghini, 2003). That is why it is considered to be superior to Balassa's Index, but closely related to Michaely's Index.

Its formula is $LRCA_{ij} = y_{ij} - g_{ij} \cdot y_j$, where: $y_{ij} = \frac{X_{ij} - M_{ij}}{GDP_j}$ represents the trade balance of product i relative to GDP, $y_j = \frac{\sum_{i=1}^N X_{ij} - \sum_{i=1}^N M_{ij}}{GDP_j}$ – the trade balance for all the products relative to GDP and $g_{ij} = \frac{X_{ij} + M_{ij}}{\sum_{i=1}^N X_{ij} + \sum_{i=1}^N M_{ij}}$ is the relative trade importance of the product (or chain). It is built as follows: given the total trade deficit of a country, every product contributes more or less to this deficit. The positive difference between the real trade deficit of one product i (y_{ij}) and the theoretical one (which can be determined by multiplying

its importance in the national trade (g_{ij}) with the overall deficit of the country (y_j) represents its competitive advantage.

Developing the relation, the Lafay index becomes:

$$LRCA_{ij} = \frac{1000}{GDP_j} \cdot (X_{ij} + M_{ij}) \cdot \left(\frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} - \frac{\sum_{i=1}^N X_{ij} - \sum_{i=1}^N M_{ij}}{\sum_{i=1}^N X_{ij} + \sum_{i=1}^N M_{ij}} \right)$$

In order to avoid as much as possible the differences between indicators, we tried to use just the Comtrade database. That is why, we chose to express the weights of each product as share of i 's trade relative not to GDP, but to the total country's trade. So, the Lafay Index formula used in this paper is:

$$LRCA_{ij} = 1000 \cdot \left(\frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} - \frac{\sum_{i=1}^N X_{ij} - \sum_{i=1}^N M_{ij}}{\sum_{i=1}^N X_{ij} + \sum_{i=1}^N M_{ij}} \right) \cdot \frac{(X_{ij} + M_{ij})}{\sum_{i=1}^N (X_{ij} + M_{ij})}$$

where the used symbols are the same. The higher the positive values of LFI are, the higher the degree of specialization is. On the contrary, negative values of the index signify competitive disadvantages.

Vollrath (1991) proposes also three measures of competitive advantage:

- the relative trade advantage as difference between the revealed export advantage and the revealed import advantage, in a way which resemble with the Balassa's indicators: $RTA_{ij} = RXA_{ij} - RMA_{ij}$

$$VRTA_{ij} = \frac{\frac{X_{ij}}{\sum_{i=1}^N X_{ij} - X_{ij}}}{\frac{\sum_{j=1}^T X_{ij} - X_{ij}}{\sum_{i=1}^N \sum_{j=1}^T X_{ij} - \sum_{i=1}^N X_{ij}}} - \frac{\frac{M_{ij}}{\sum_{i=1}^N M_{ij} - M_{ij}}}{\frac{\sum_{j=1}^T M_{ij} - M_{ij}}{\sum_{i=1}^N \sum_{j=1}^T M_{ij} - \sum_{i=1}^N M_{ij}}}$$

- relative export advantage: $RXA_{ij} = \frac{\frac{X_{ij}}{\sum_{i=1}^N X_{ij} - X_{ij}}}{\frac{\sum_{j=1}^T X_{ij} - X_{ij}}{\sum_{i=1}^N \sum_{j=1}^T X_{ij} - \sum_{i=1}^N X_{ij}}}$

- revealed competitiveness:

$$RC_{ij} = \ln \left(\frac{\frac{X_{ij}}{\sum_{i=1}^N X_{ij} - X_{ij}}}{\frac{\sum_{j=1}^T X_{ij} - X_{ij}}{\sum_{i=1}^N \sum_{j=1}^T X_{ij} - \sum_{i=1}^N X_{ij}}} \right) - \ln \left(\frac{\frac{M_{ij}}{\sum_{i=1}^N M_{ij} - M_{ij}}}{\frac{\sum_{j=1}^T M_{ij} - M_{ij}}{\sum_{i=1}^N \sum_{j=1}^T M_{ij} - \sum_{i=1}^N M_{ij}}} \right)$$

The main difference between Balassa and Vollrath's RXA is the fact that in the case of the latter, double-counting in respect to country and commodity is prevented. However, in our case there is little difference between the two because Romania has not a large contribution to world trade.

On the other hand, RTA and RC present the advantage that they embody both the relative exports and imports, not only just one side of the trade flows. Because we use data for Romania's exports and imports at a level of disaggregation of 3 digits, there is the possibility to work with small values or to have no values for some commodities. Because the revealed competitiveness is more sensitive in this respect, we will apply the first Vollrath's Index. Vollrath says that a positive value of the VRTA reveals a competitive advantage and a negative one a competitive disadvantage. In our opinion the affirmation must be completed with two other conditions: on the one hand the first part of indicator (RXA) must be bigger than 1 and on the other hand the second part (RMA) must be smaller than 1. This, because we start from the assumption that a country will mainly export those products in which it has a competitive advantage and will import the products with a competitive disadvantage. In other words, not all the positive values reflect a real competitive value. We must pay attention to the individual values taken by the two components.

5. Empirical results

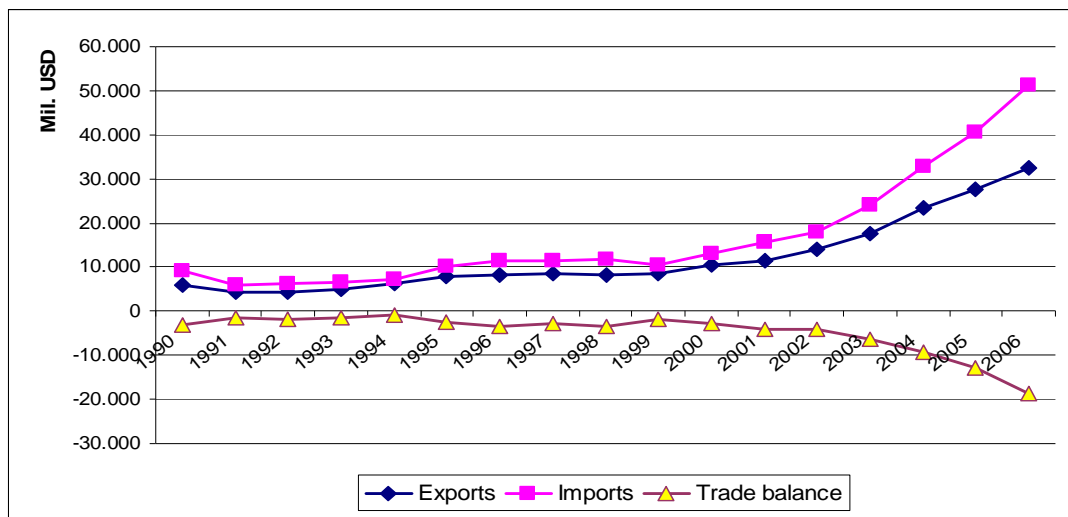
The period of time used in the present study is 1990-2006, the period of transition for Romania to a market economy. In January 2007, Romania was admitted to the European Union as an equal partner and one of the questions that one may put is what was happening in this period of 17 years. Of course that there were many changes in the meanwhile, but we try to focus here only on those concerning the commercial relations with the other countries inside and outside EU. On the other hand, we start from the assumption that the specialization pattern of Romania reflects the structural changes and the macroeconomic conditions.

The source for trade flows' values is the UN Statistical Division database, Comtrade. The analysis is done according to Standard International Trade Classification, rev. 3, at 3-digit level.

As we mentioned before, the measured indicators are: Trade Entropy Index (TE), Trade Overlap Index (TO), Grubel-Lloyd Index (GL), Revealed Comparative Advantage using Balassa's (BRXA, BRCA), Michaely's (MRCA), Lafay's (LRCA) and Vollrath (VRTA) formulas.

Firstly, as one can notice in the Graph 1, Romania has constantly faced a negative balance of trade, but its value became larger in the last years. Some of the causes are related to an increasing demand for foreign goods sustained also by the increasing purchasing power of the population, the easier access to credits, bad result in agriculture, and appreciation of national currency.

Graph 1: Romanian's values of exports, imports and trade balance, 1990-2006



Source: The Romanian National Institute of Statistics.

As shown in Graph 1, the highest trade deficit was in 2006. After our calculations in 2006, the imports represented 42% from GDP, the exports 26,7% and the trade deficit was around 15,3% from GDP. The main organizations which calculate the countries' competitiveness such as World Economic Forum and International Institute for Management Development take into consideration also the balance of trade (Lopez-Claros A. *et. al.* (2007), Garelli S. (2006)). From this point of view, the negative trade balance is always mentioned as a lack of in the Romanian's competitiveness.

Secondly, we calculated also the geographical spread or concentration of the Romanian's commercial flows. Analyzing Romania's trade entropy the results are those given in Table 1. Because we consider that the relative values are more representative, we were mainly interested in them. The absolute values are also given in brackets.

Table 1 shows that the value of trade entropy is slightly increasing and that the dispersion of imports is higher compared to exports. The smallest values were obtained when the region taken into consideration was the whole world (around 0,30-0,40) and the values are doubled in relation with Europe as a whole or with EU. That means that Romania is not a country enough integrated in the international trade flows. When we compare the concentration degree relative to the whole Europe and the EU-25 the results are to a certain extent surprising, because although the degree of dispersion is increasing, this is superior in relation to Europe than in relation to EU-25. That means that Romania has important trade partners outside the European Union, not only inside of it. For example, in 2006 the main destinations of Romanian's exports were: Italy (18,1%), Germany (15,7%), Turkey (7,7%), France (7,5%) respectively Hungary (4,9%). The main sources for our country's imports are: Germany (15,2%), Italy (14,6%), Russian Federation (7,9%), France (6,5%) and Turkey (5%).

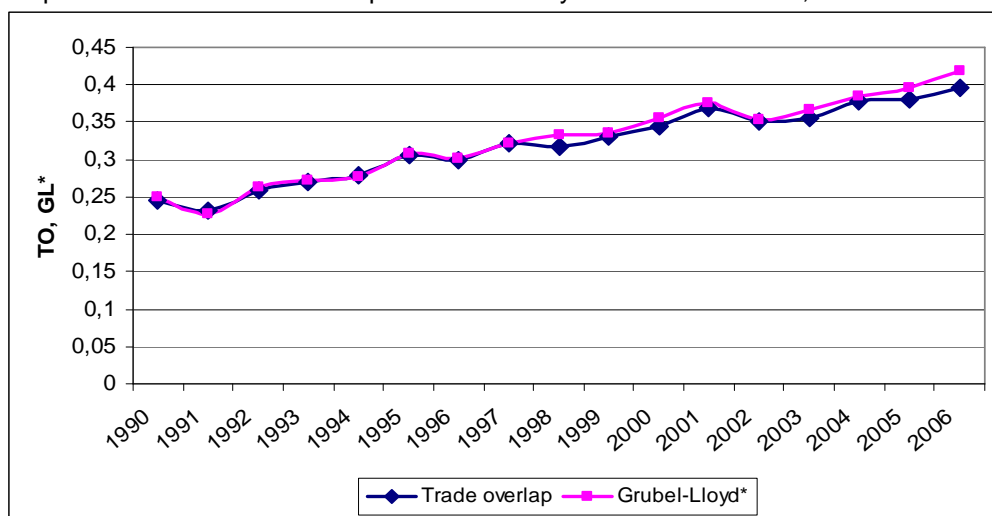
Table 1: Absolute and relative Trade Entropy Index for Romania, 1999-2005

Related to:	Imports' trade entropy			Exports' trade entropy		
	(a) World	(b) Europe	(c) EU-25	(a) World	(b) Europe	(c) EU-25
1999	0,36 (0,65)	0,72 (2,57)	0,69 (2,23)	0,35 (0,62)	0,69 (2,46)	0,65 (2,08)
2000	0,41 (0,73)	0,73 (2,63)	0,71 (2,27)	0,33 (0,58)	0,71 (2,56)	0,67 (2,14)
2001	0,39 (0,70)	0,73 (2,61)	0,70 (2,25)	0,33 (0,58)	0,70 (2,49)	0,66 (2,12)
2002	0,35 (0,62)	0,73 (2,60)	0,70 (2,24)	0,36 (0,65)	0,67 (2,41)	0,64 (2,07)
2003	0,32 (0,57)	0,74 (2,63)	0,71 (2,27)	0,31 (0,56)	0,69 (2,47)	0,66 (2,11)
2004	0,35 (0,62)	0,75 (2,69)	0,72 (2,32)	0,28 (0,50)	0,72 (2,59)	0,69 (2,23)
2005	0,37 (0,66)	0,76 (2,71)	0,73 (2,36)	0,32 (0,57)	0,74 (2,67)	0,70 (2,26)

Source: Own calculations based on data offered by The National Institute of Statistics, Romania.

Thirdly, we took also into consideration the importance of the intra-industry trade versus the inter-industry one. In this respect, we have determined the Trade Overlap and the Grubel-Lloyd Index according to the formulas already presented. The results are as shown in the Graph 2:

Graph 2: Values of Trade Overlap and Grubel-Lloyd Index for Romania, 1990-2006



Source: own calculations

Both indicators indicate an increasing share of the intra-industry trade, but the main part of it is still of inter-industry nature. That means that the main part of Romania's trade patterns can be described using the classical and neoclassical theories of trade and just partially using the new one, based on economies of scale and imperfect competition.

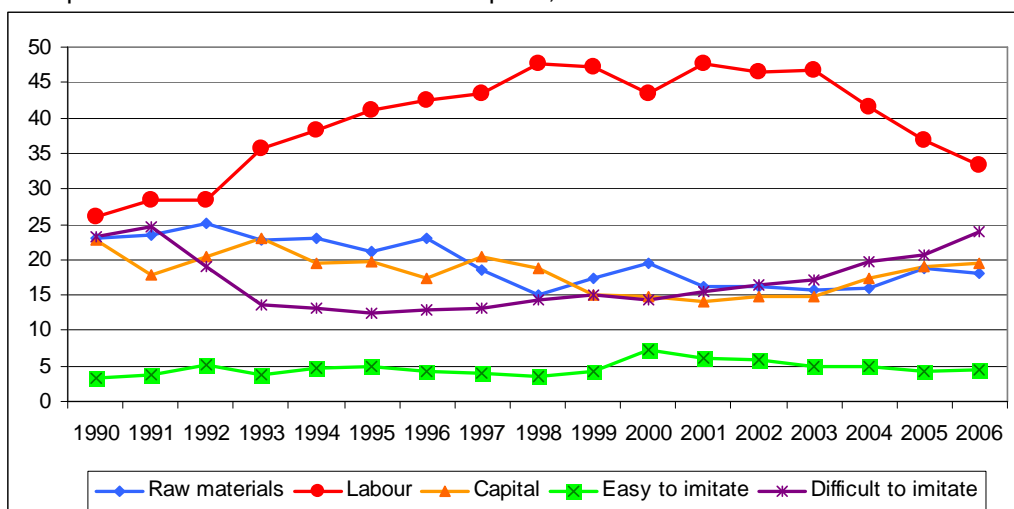
After this analysis at the macroeconomic level, we deepened our research at the microeconomic level – that of product specialization. As we mentioned in the introduction, we consider that our try to reveal the competitive advantages can also be done using different measures of revealed comparative advantage.

In order to have a more representative analysis, we divided the products in five categories according to their factor intensities (Yilmaz & Ergun, 2003):

- raw material intensive goods (SITC 0, 2, 3, 4, 56);
- labor intensive goods (SITC 26, 6 (excluding 62, 67,68), 8 (excluding 87, 88));
- capital intensive goods (SITC 1, 35, 53, 55, 62, 67, 68, 78);
- easy to imitate, research intensive goods (SITC 51, 52, 54, 58, 59, 75, 76);
- difficult to imitate, research intensive goods (SITC 57, 7, 87, 88).

In the Graph 3 we revealed the share of each group in the Romanian's exports. The main part is still taken by labor intensive goods and the smallest part by easy to imitate, technology intensive products. Between these limits, the shares of other three categories are mixed. In the last years, after a hard falling the catching-up group is, surprisingly the difficult to imitate, technology-intensive manufactures, followed by capital products and raw materials one.

Graph 3: The structure of Romania's exports, 1990-2006



Source: own calculations

It is also noticeable (see Graph 3) that beginning with 2001 the exported labor-intensive goods are constantly decreasing along with a constant increasing of capital and difficult to imitate technology group and an oscillatory evolution of raw-intensive goods. As we will show later, we founded that the best correlation of the external trade performances are beginning with 1999, 2000. Between 1990 and 2000, Romanian's economy needed a period of structural adjustments, but these changes can be seen as a pattern in the last 7 years.

After a first image of the exports' structure we wanted to determine exactly which products, belonging to each group are the most competitive. In this respect we calculated the so-called Revealed Comparative Advantage indicators. As general observations we can say the following about these indexes:

- From the obtained results we grouped the five RCA indicators into two classes: the first one is formed by Balassa RCA, Michaely and Lafay Index and the second by Balassa RXA and Vollrath RTA.

- The first group reveals, in our opinion, an internal competitive advantage, although the prices are formed at the international level. The explanation resides in the way in which these indicators are constructed. They compare in different ways the export and / or imports of one group of products to the total value of exports and / or imports of our country. Or, as in the case of Lafay Index, it compares the normalized trade balance of one product to the average normalized trade balance, but also relative only to the traded goods of the origin country and not taking into consideration also their importance compared to the international flows. Inside this group, we found a high correlation between Michaely and Lafay Index. It was very close to unity or even 1, which is why we treat them as one measurement. Every time a product revealed a comparative advantage according to Michaely and Lafay, they showed also a revealed comparative advantage according to Balassa RCA and vice versa. The latter was not definite in the case of those total specialized products, when the value of imports was zero, for example. In this case we draw a conclusion from the other two measures. In other words we can analyze from these entire indicators just one. We choose Lafay Index for the advantages that we have presented at the beginning of this paper.

- The second group of indicators formed by Balassa's RXA and Vollrath's RTA differs from the first one because along with values that reveal the performance of trade at the national level, there are taken into consideration also the corresponding values at the international level. Because Romania is a small country with a small share in the international trade (in 2006, the share was 0,28% for exports and 0,43% for imports), the values for Balassa's RXA were much closed to VRXA. So, there were situations when a product had a revealed export advantage and a revealed trade advantage too (in the sense that VRTA was positive), but it had an import disadvantage. In this case, the product was not considered as being a competitive one. In other words, in our opinion, Balassa's RXA is a necessary condition for revealing a competitive advantage, but not a sufficient one. The sufficiency condition is accomplished by analyzing also RMA, and comparing it to RXA, like Vollrath's RTA does.

- Comparing the two groups, the products that are competitive taking into consideration also the world exports and imports are fewer than those competitive when the world's flows were not considered. But we did not identify any product competitive at the international level and not competitive at the national one.

Putting all the values together we found difficult to reveal a pattern for the entire period. To facilitate our work we calculated the correlation coefficients for all five classes and for all the years. The values had differed very much, but we were interested to observe a period of time in which the correlation coefficient took high values. We considered a value above 0,8 as being enough high to reveal a strong linear correlation.

In the case of *raw materials* we could identify a pattern starting with 1999, 2000. The products that constantly revealed a competitive advantage in this category are shown in the Table 2. Among them, three show a significant increasing competitive advantage: 211 *Furskins, raw*; 222 *Oil seeds and oleaginous fruits of a kind used for the extraction of "soft" fixed vegetable oils*; 282 *Ferrous waste and scrap*. Relative constant values have the following products: 001 *Live animals*; 245

Fuel wood, wood charcoal; 248 Wood, simply worked; 288 Non-ferrous base metal waste and scrap and 421 Fixed vegetable fats and oils, “soft” crude refined or fractioned. The biggest fall is registered by 334 *Petroleum products* and 562 *Fertilizers*. Although the latter category had large fluctuations its average value for VRTA remained quite high (around a value of 5).

Table 2: The most competitive raw materials-intensive goods of Romania, 1990-2006

Year Code	'90	'91	'92	'93	'94	'95	'96	'97	'98
211	-5.0	-0.7	-0.9	-1.4	0.4	-0.6	-0.8	0.1	0.2
222	-3.7	-4.4	-1.9	-0.9	-0.8	-0.1	-0.9	0.1	0.8
282	0.0	0.0	1.9	0.2	0.1	0.1	0.3	2.1	7.3
001	-1.4	6.0	6.7	4.8	6.2	4.8	4.5	5.4	3.5
245	4.4	3.0	5.2	6.2	6.2	8.3	8.2	5.4	6.1
248	2.4	2.2	4.1	3.8	4.4	4.3	5.4	5.8	7.4
288	0.0	-0.1	0.1	2.2	1.9	0.2	0.0	0.4	2.7
421	-0.1	-0.3	-2.0	6.2	2.4	3.9	3.6	5.9	2.7
334	10.8	5.7	4.9	4.3	4.8	2.9	2.0	1.1	1.5
562	4.5	9.9	17.1	14.6	12.6	15.1	13.9	7.5	1.6
	'99	'00	'01	'02	'03	'04	'05	'06	
211	1.2	2.6	2.3	1.2	1.0	0.9	0.5	1.2	
222	4.8	1.1	0.9	0.1	1.4	1.2	1.3	3.0	
282	11.2	17.3	9.7	10.2	10.9	8.5	5.9	6.1	
001	6.1	5.6	3.5	3.6	5.9	5.4	4.2	4.1	
245	6.2	7.1	7.2	6.9	7.3	5.8	6.2	5.3	
248	8.9	9.0	7.6	7.2	7.2	6.4	5.7	5.5	
288	5.5	6.9	1.4	1.8	1.3	1.0	1.4	0.7	
421	2.9	0.9	1.3	-0.5	0.6	1.6	1.2	0.8	
334	1.2	1.9	1.3	2.7	2.0	1.9	2.8	2.4	
562	3.4	5.8	5.9	4.3	5.1	4.3	6.0	5.9	

Source: own calculations

In the case of the products that are labor-intensive we could remark a pattern starting with 1995. This is the most evident change in the Romania's economy, situation that was characterized by many politicians and economists like: "Romania, the country with a cheap labor advantage". As shown in the next table (3) the products with a high competitive advantage are those from the groups 83 *Travel goods, handbags* and 84 *Clothing and accessories*. More precisely, they are: 831 *Trunks, suitcases, bags*; 841 *Men's, boys' clothing not knitted or crocheted*; 842 *Women's, girls clothing not knitted or crocheted*; 843 *Men's, boys' clothing knitted or crocheted*; 844 *Women's, girls clothing knitted or crocheted*; 845 *Other textile apparel, nes*; 851 *Footwear*. There are other categories that had a lot of oscillations, but their competitive position in 2006 is very similar with the one at the beginning of '90s. Such examples are: 635 *Wood manufactures, nes*; 658

Textile articles (Made-up articles, wholly or chiefly of textile materials); 666 Pottery; 693 Wire products (excluding insulated electrical wirings) and fencing grills. The third group is composed from the products which registered ups and downs, but their competitive advantage at the end of the analyzed period is smaller compared to 1990. For example: 821 *Furniture, cushions etc.* and 848 *Clothing of other than textile fabrics; headgear of all materials.* The furniture industry is considered by many researchers (Dăianu *et al.*, 2001) the main loser in the international competition.

Table 3: The most competitive labor-intensive goods of Romania, 1990-2006

Year Code	'90	'91	'92	'93	'94	'95	'96	'97	'98
831	0.0	1.1	0.5	0.5	0.5	0.5	0.5	0.5	0.7
841	9.1	2.2	2.9	5.6	7.9	9.2	10.8	11.1	12.6
842	0.2	5.4	2.3	5.7	7.9	10.1	11.5	12.4	12.8
843	0.0	2.0	2.4	2.6	2.5	2.6	2.4	2.0	2.8
844	0.0	0.7	0.8	1.2	1.8	1.9	2.2	1.8	2.8
845	2.5	1.2	1.1	1.6	1.9	2.5	3.2	3.4	3.9
851	2.2	1.5	0.9	2.3	4.2	5.0	6.0	6.1	7.4
635	2.5	2.2	1.7	1.5	1.3	1.4	1.6	2.0	3.1
658	1.9	2.9	0.9	0.8	1.3	1.2	1.2	1.5	2.3
666	1.8	2.4	2.1	2.6	2.7	3.6	4.2	3.9	4.6
693	2.5	1.2	1.7	2.0	0.8	1.1	1.4	1.6	1.9
821	7.1	11.3	9.6	9.0	7.1	7.1	6.2	5.4	5.1
848	2.1	1.0	0.4	0.1	0.2	0.3	0.4	0.6	0.6
	'99	'00	'01	'02	'03	'04	'05	'06	
831	0.9	0.9	1.3	1.5	1.6	1.7	1.5	1.3	
841	14.3	12.9	13.1	12.9	13.3	12.3	11.2	9.9	
842	13.1	13.3	14.4	13.4	13.7	13.0	11.2	10.2	
843	2.2	2.8	3.4	3.9	4.1	4.0	3.6	2.8	
844	2.7	3.7	4.3	3.8	3.6	3.4	3.5	3.0	
845	3.8	3.8	4.1	4.1	4.2	3.6	3.0	2.4	
851	8.6	9.1	10.2	10.2	10.4	8.8	8.0	8.2	
635	3.4	3.6	3.8	3.5	3.9	3.7	3.4	2.9	
658	1.8	1.7	1.8	1.9	2.1	2.3	2.3	2.2	
666	5.1	4.9	4.8	3.9	4.1	3.8	3.4	2.7	
693	1.0	0.7	1.0	0.3	0.9	0.6	1.5	2.1	
821	4.7	4.1	4.1	4.0	4.0	4.0	3.7	3.5	
848	0.1	0.4	0.8	0.7	0.4	0.3	0.2	0.4	

Source: own calculations

In Table 3 it can be noticed that the labor-intensive products' competitiveness is declining. The best examples in this respect are 821, 842, 841 and 851. The majority of them were exported in lohn system and it is declining in

the last years because the labor unit cost is increasing and the comparative position is diminishing.

Table 4 presents the situation for the capital-intensive products. In this category the main classes are: rubber, metal and other basic manufacturing such as: 625 *Rubber tyres, tubes*; 685 *Lead*; 686 *Zinc* with an increasing competitiveness. A decreasing position can be observed in the case of: 673 *Flat-rolled products of iron and non-alloy steel*; 676 *Iron and steel*; and 684 *Aluminum*. The clearest diminishing is to be remarked in the case of manufactures from iron and steel.

Table 4: The most competitive capital-intensive goods of Romania, 1990-2006

Year Code	'90	'91	'92	'93	'94	'95	'96	'97	'98
625	0.3	-0.4	-0.9	-0.1	0.4	0.5	0.5	0.1	0.0
685	-2.6	2.4	1.5	0.5	0.6	0.7	1.3	0.8	1.2
686	-2.3	-1.1	-1.4	-1.1	0.0	0.5	1.0	1.9	1.6
673	5.8	6.6	8.7	10.2	11.1	9.5	8.2	10.5	10.2
676	4.8	5.0	8.3	12.2	8.6	7.0	4.3	6.2	4.3
684	4.1	3.5	4.1	3.0	3.4	3.1	2.5	3.4	3.1
	'99	'00	'01	'02	'03	'04	'05	'06	
625	0.4	0.2	0.1	1.1	2.3	2.3	2.5	2.5	
685	-0.1	2.2	2.3	2.1	3.1	2.6	2.5	1.8	
686	0.1	3.5	3.9	1.6	2.2	1.8	1.9	0.8	
673	9.0	9.2	6.3	8.7	8.3	7.6	7.2	5.5	
676	2.4	1.0	0.5	0.1	-0.2	0.1	0.0	-0.7	
684	3.0	3.3	2.4	2.0	1.5	1.7	1.7	1.8	

Source: own calculations

The last two analyzed groups of products are those technology-intensive separated into two subgroups: easy to imitate and difficult to imitate, respectively, as shown in Tables 5 and 6.

The first category is not very well represented and it has the lowest value in Romania's exports. It is represented mainly by organic and inorganic compounds which, in 2006 have a slightly better position compared to 1990 in spite of many oscillations: 512 *Alcohol, phenol and their derivatives*; 514 *Nitrogen-function compounds*; 522 *Inorganic chemical elements, oxides and halogen salts*; 524 *Other inorganic chemicals*; *organic and inorganic compounds of precious metals*. At the national level 523 *Metal salts, inorganic acid* can also be remarked.

Table 5: The most competitive raw materials-intensive goods of Romania, 1990-2006

Year Code	'90	'91	'92	'93	'94	'95	'96	'97	'98
512	0.1	0.5	-0.3	-1.1	3.1	1.6	0.6	1.8	0.3
514	0.1	0.3	0.4	0.1	0.6	1.6	0.9	1.0	0.6
522	0.3	0.1	1.2	0.0	0.4	0.9	0.5	0.2	0.4
524	1.3	3.4	5.0	4.8	1.9	3.0	4.6	3.9	3.3
	'99	'00	'01	'02	'03	'04	'05	'06	
512	0.0	0.9	0.7	1.3	1.0	1.5	1.0	1.2	
514	0.6	1.7	0.8	0.8	0.6	0.6	0.8	0.4	
522	0.3	0.6	1.0	0.3	0.4	0.4	0.8	0.5	
524	2.4	1.3	1.4	1.5	1.9	2.8	2.1	1.6	

Source: own calculations

The second group is a surprise for anyone who considers Romania the country characterized mainly by low labor costs. It is a class well defined in which an improving competitive position has been gained by: 712 *Steam turbines*; 735 *Parts, nes., for machine tools*; 793 *Ships, boats (inclusive hovercraft) and floating structures* and 883 *Cinematographic film, exposed and developed*. A descending position, although still competitive are: 573 *Polymers of vinyl chloride or of other halogenated olefins, in primary form*; 716 *Rotating electric plant* and 746 *Ball or roller bearings*.

Table 6: The most competitive raw materials-intensive goods of Romania, 1990-2006

Year Code	'90	'91	'92	'93	'94	'95	'96	'97	'98
712	1.1	-0.7	-0.8	1.3	3.5	-0.7	1.2	0.8	0.3
735	1.3	0.1	-0.1	-0.4	0.4	0.4	0.6	1.0	1.5
793	0.7	2.6	3.0	1.2	2.6	2.6	2.8	1.9	2.5
883	-2.1	-0.4	4.6	1.2	-0.6	-0.3	3.2	-0.3	-0.1
573	4.1	4.2	6.0	6.3	9.5	7.3	5.8	5.5	4.0
716	1.3	1.2	1.0	1.0	0.7	1.1	1.2	1.1	1.2
746	5.5	5.8	5.6	6.6	5.6	4.8	5.2	4.9	4.3
	'99	'00	'01	'02	'03	'04	'05	'06	
712	1.0	2.4	0.5	0.3	-0.9	1.8	1.7	1.2	
735	2.1	1.5	1.9	1.7	1.5	1.5	1.8	2.5	
793	3.8	3.1	2.6	2.9	2.4	2.4	2.8	3.3	
883	-0.2	-0.2	-0.1	0.7	1.5	3.7	4.6	2.1	
573	4.5	4.2	2.9	3.3	3.3	4.8	3.5	4.0	
716	1.1	1.0	1.0	0.9	0.8	0.8	0.6	0.8	
746	4.2	4.0	4.3	3.3	2.9	2.7	3.4	3.4	

Source: own calculations

6. Conclusions

The purpose of our paper was to identify the competitiveness of Romanian economy between 1990 and 2006 in light of trade flows. In this respect our analysis went from general to particular. After a general presentation of Romania's trade balance evolution, we tried to bring concrete elements of its specialization. We could see that there are negative aspects such as: a growing trade deficit, relative high concentration of commercial flows and a lack of trade patterns in the first 10 years of transition.

At the microeconomic level, we could remark an opposite evolution of the heavy and light industry. Before 1990 the most developed branch in Romanian's economy was the heavy one which includes the metallurgy, the chemical and the petroleum industry. As revealed in our study all these sectors were very competitive at the beginning of 1990, but had sharply falling. For example we underlined the decline of iron and steel, aluminum, fertilizers, polymers and petroleum products, meanwhile the industries such as rubber tyres, lead, zinc, steam turbines, parts of machine tools and ships, boats have registered an increased competitiveness. A possible explanation for this situation is the lack of raw materials and the corresponding technology.

On the contrary, the light industry has gain advantage in Romania between 1990 and 2006. Its products are mainly designated to consumption and in our country it was very well represented by clothing and accessories, textile articles, footwear, pottery and furniture. The biggest loser of all these is the furniture industry, followed by footwear and the clothing. The last two are slightly declining mainly due to the sharp competition of the Chinese and Turkish products.

But from another point of view, there is a visible improvement in our country position, reflected on the one hand by the capital- and technology-intensive goods' shares in national exports and on the other hand by the results obtained through the comparative advantage indexes. Romania is no longer the country that exports mainly raw minerals, raw forest products but manufactured goods such as: textiles (but decreasing), chemicals, transport vehicles, power generating machines (increasing). Among them the study shows that they are technology intensive products, which is a promising fact for the further specialization of our country and its role in the European Union.

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CALCULATING VALUE AT RISK. CASE STUDY ON THE INTEREST RATE RISK MANAGEMENT

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Abstract. Value at risk assesses financial risk by evaluating the probability of loss that results from stochastic variation of the rate of returns. The methodology is based on historical data reflecting this variation, usually as an estimated probability of default function. The fact that return distributions are characterized by time varying volatility poses exceptional challenges in the estimation. In order to remedy this problem we can use Monte Carlo Simulations. This paper is meant to offer an overview of the main Value-at-Risk models and methods used for the management of interest rate risk, with an emphasis on the Monte Carlo Simulation method.

JEL Classification: G12, G14

Keywords: value at risk, time varying volatility, Historical Simulation, Monte Carlo Simulation, interest rate risk.

1. The use of Value at Risk in the context of banking supervision

Value at Risk is the most used instrument in quantifying the market at which a bank is exposed. Since the presentation of the Group of Thirty in July 1993 its users have increased and VaR has become a standard risk measure for banks, insurance companies, institutional investors and other enterprises. The first who studied this concept was Jorion in 1997, followed by Dowd in 1998 and Saunders in 1999. VaR is used for risk management and also for regulatory purposes. The Basel Committee on Banking Supervision (1996) at the Bank for International Settlements imposes to financial institutions to meet capital requirements based on VaR estimates in the context of the banking supervision, in order to maintain the financial stability of the financial institutions.

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VaR is defined as the expected minimum loss of a portfolio over some time period for some level of probability. From a statistical point of view, VaR entails the estimation of a quantile of the distribution of returns and express the probability that returns or losses (ξ) are smaller than $-VaR$ over a period of time (T):

$$P_{VaR} = P(\xi < -VaR) = \int_{-\infty}^{-VaR} P_T \cdot \xi \cdot d\xi$$

where P_T is the probability distribution of returns over the time horizon T.

In a VaR model we include data on the bank's on and off balance sheet positions, exchanges rates, interest rates, equity and commodity positions. The measurement parameters include a historical time horizon, a holding period and a confidence interval that allows for prudent judgment of the optimal level of protection. The Basel Committee recommends a holding period of 10 days trading, an historical observation period of a minimum of one year and a 99th percentile confidence level.

2. The Value at Risk methodology

Depending on the approaches, the internal models of the market risk could be classified into three major categories: the Historical Simulation Method, the Parametric Method (Variance-Covariance Method) and the Monte Carlo Simulation Method. The main differences among VaR methods are related to the way they address the problem of how to estimate the possible changes in the value of the portfolio. When the returns are normal, VaR is equivalent to using the variance as a risk measure. When risk is sensitive to rare events and extreme losses, we can build models based on simulation of VaR. When risks are recurrent, VaR can be estimated by using historical time series while for new situations, scenarios simulation or the construction of the theoretical models are needed. The existing models can be classified into three categories: nonparametric (Historical Simulation, Monte Carlo, Stress Scenarios), parametric (Risk Metrics and GARCH) and semiparametric (Extreme Value Theory, CAViaR and quasi-maximum likelihood GARCH).

Non-parametric models are simulation or historical models. Among simulation approaches, we distinguish between full valuation and partial valuation models. A full simulation approach (Monte Carlo VaR, Historical Simulation, Stress Scenarios) creates a number of scenarios for the risk factors and then, for each scenario, performs a complete revaluation of the portfolio, thus giving the profit-loss distribution of the portfolio. A partial valuation approach uses simulations to create the distribution of risk factors but does not fully revalue the portfolio. Instead, it makes use of delta or delta-gamma approximations to obtain the portfolio value. The VaR is set equal to the percentile of the observed daily return distribution at the required level of confidence. The main drawback of these approaches is that extreme percentiles are difficult to estimate precisely without a large sample of historical data.

Parametric models such as delta-normal are based on statistical parameters such as the mean and the standard deviation of the risk factor distribution. Using these parameters and the delta of the position, VaR is calculated directly from the risk factor distribution. Models such as RiskMetrics

(1996) and GARCH propose a specific parameterization for the behavior of prices. The main advantage of these methods is that they allow a complete characterization of the distribution of returns and there may be space for improving their performance by avoiding the normality assumption.

Recently, alternative methods have been proposed to estimate Value at Risk, such as applications of Extreme Value Theory (Danielsson and deVries (1998) or Gouriéroux and Jasak (1998)) and applications of regression quintile technique such as in Chernozhukov and Umantsev (2000) and Engle (1999). Extreme Value Theory seems to be a very general approach to tail estimation. The main strength is that the use of a GEV distribution to parameterize the tail doesn't seem to be a very restrictive assumption, as it covers most of the commonly used distributions. The Conditional Autoregressive Value at Risk, or CAViaR model was introduced by Engle and Manganelli (1999) and models directly the evolution of the quintile over time, rather than the whole distribution of the portfolio.

The quality of a VaR model depends on its distributional assumption about the market risk factors and its valuation model. The empirical facts about financial markets are very well known, since the pioneering works of Mandelbrot (1963) and Fama (1965). They can be summarized as follows:

- the distribution of financial variables is leptokurtotic (it has heavier tails and a higher peak than a normal distribution);
- equity returns are typically negatively skewed;
- squared returns have significant autocorrelation, volatilities of market factors tend to cluster. This is a very important characteristic of financial returns, since it allows the researcher to consider market volatilities as quasi-stable, changing in the long run, but stable in the short period. Most of the VaR models make use of this quasi-stability to evaluate market risk.

As in any modeling technique, a very important aspect is the validation of the underlying model and assumptions. In practice, for a given probability and for a number of observations of the gap between the estimated figure of VaR and the actual one, the number of times the model fails should be in a certain interval in order for the model to be validated. A similar methodology was accepted by The Basel Committee to evaluate the accuracy of internal models. Especially when the confidence level is high (as is the case of models in compliance with BIS regulations – 99%), is very high, implying a temporal gap of at least one year between the implementation of the model and its validation. A more efficient method of validating the model is using the confidence intervals instead of the actual values for estimating the gap between model and reality results, but this approach means that the risk will not be summarized in a single straightforward value.

With regard to accuracy, the risk managers should be concerned with whether the model's ex-post performance is compatible with the theoretically desired level. The regulatory capital-adequacy framework also provides an incentive to develop efficient models, that offer enough coverage in relation to the risk so that the supervisors' requirements can be met with the minimum amount of capital that is required to be held.

3. Case study on the interest rate risk management

In order to determine the exposure of a bank's portfolio to the interest rate risk we will calculate the VaR indicator of a hypothetical portfolio of financial instruments in lei and euro for a 10 days horizon. VaR will be calculated on daily data of ROBOR, EURIBOR and LIBOR published by the National Bank of Romania from 01.01.2007 to 31.05.2009.

We will suppose that the loan portfolio of the bank has the following structure:

- loans with one year maturity – 3.000.000 EUR, at EURIBOR (1 month) + 2% margin;
- loans with one year maturity – 2.000.000 USD, at LIBOR (1 month) + 3% margin;
- loans with one year maturity – 7.000.000 LEI, at ROBOR (1 month) + 3% margin;

The observations on the interbank offered interest rates are available on a period longer than what we took in consideration, but we have considered that the recent observations provides a better estimation on the risk of the portfolio.

The Romanian Interbank Offered Rate for LEI at three months has been very volatile, rising from 7% to 20% in the period analyzed. It has faced a period with extreme variations from 17.10.2008 to 23.10.2008 when it has reached a maximum of 49.81% because of the lack of liquidity in the Romanian banking system. The 3 months EURIBOR has raised in the second semester of 2008 to 5.4% because of the lack of liquidities in the European market and also because of the increased inflation in the euro zone. From the beginning of 2009 it has decreased due to the European Central Bank policy, which has reduced the level of main refinancing operation to 1.5%. The 3 months LIBOR has deeply increased in October 2008 and reached 4.82%, due to the collapse of Lehman Brothers which inevitably conduct to turbulences on the international markets. In the recent period all the rates have decreased due to the rising of the market liquidity.

The daily rentabilities were determined by logarithmation of the series of interbank offered rates and it were obtained 611 daily rentabilities. The graphs below show a lot of extreme variations that took place on the monetary market.

Figure 1: The evolution of ROBOR

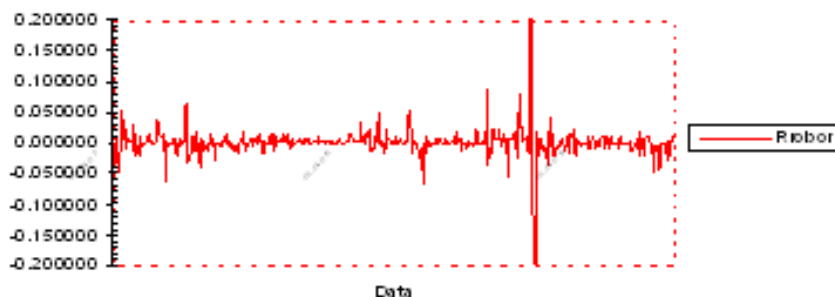


Figure 2: The evolution of EURIBOR

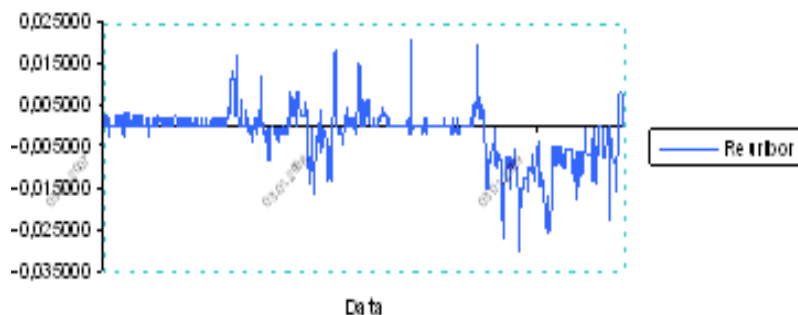


Figure 2: The evolution of LIBOR

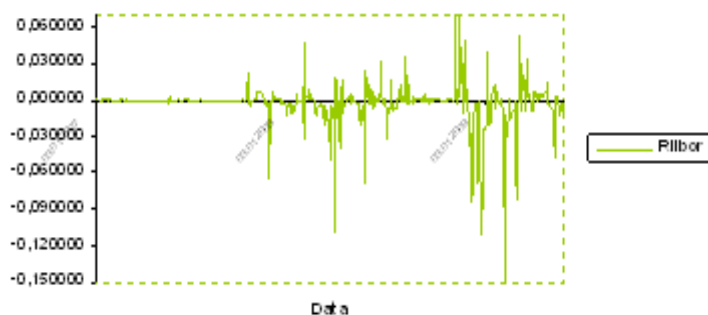


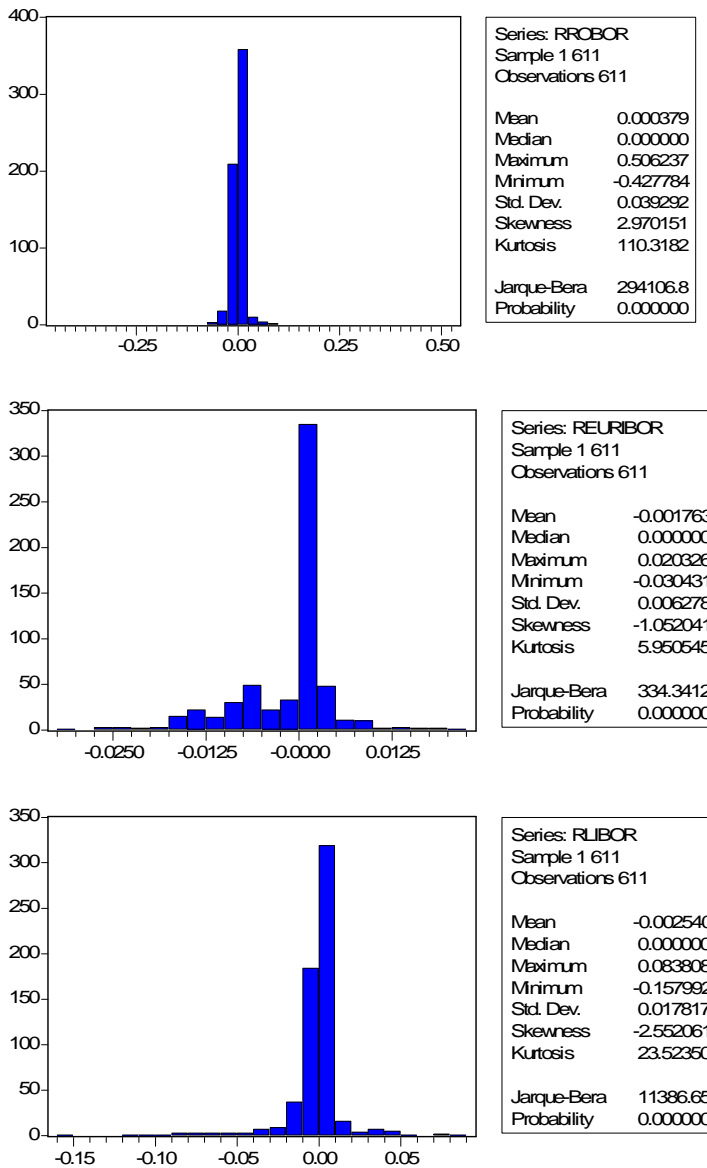
Table 1: The distributions' moments

	ROBOR	LIBOR	EURIBOR
Mean	0.000379	-0.001763	-0.002540
Median	0.000000	0.000000	0.000000
Maximum	0.506237	0.020326	0.083808
Minimum	-0.427784	-0.030431	-0.157992
Standard Deviation	0.039292	0.006278	0.017817
Skewness	2.970151	-1.052041	-2.552061
Kurtosis	110.3182	5.950545	23.52350
Jarque Berra Test	0.000379	-0.001763	-0.002540

Analyzing the histogram of rentabilities we will obtain leptokurtic distributions, which are sharper than the normal ones. This is indicated by the value of the kurtosis: 110.31 (ROBOR), 5.95 (EURIBOR) and 23.52 (LIBOR). Analyzing the skewness, which are is positive in the case of ROBOR and negative in the case of EURIBOR and LIBOR, we observe that the rentabilities are left placed (ROBOR) and right placed (EURIBOR and LIBOR) in comparison with the normal distribution. According to all these factors, the distribution of the rentabilities presents fat tails, which correspond to the extreme variations that took place on the money market. In the last year e series of extreme negative values have taken place. This can lead to an overestimation of VaR, especially that the method describes the maximum expected loss. Here appears the “volatility clustering”

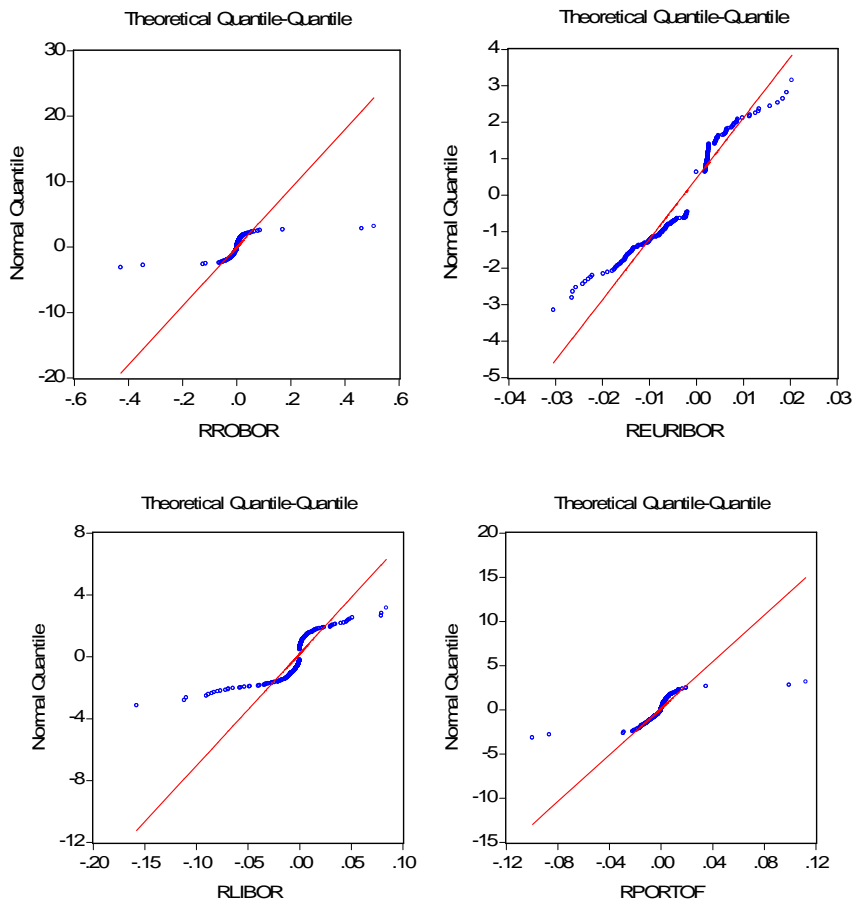
phenomena, which can be remedied by the homoscedasticity models EWMA and GARCH.

Figure 4: The moments of the distributions



Analyzing the normal distribution' quintiles (represented by a continuous line) with the analyzed distribution' quintiles (represented by an interrupted line) we observe that the last ones divert from the theoretical ones, which sustains the rejection of the null hypothesis.

Figure 5 : The quintiles of the distributions



Applying the ADF and the Philippe-Peron Tests it will be observed that the series composed of the interest rates' rentabilities have one unit roots (the value of the ADF tests are lower than the critical values for each level of confidence), which means that it is needed a first order differentiation in order to become stationary. In this case the null hypothesis is rejected, the series being stationary.

Table 2 : The ADF Test

	ROBOR	EURIBOR	LIBOR
ADF statistic	-11.51448	-6.064887	-8.962737
Critical values			
1%	-3.973346	-3.973220	-3.973220
5%	-3.417289	-3.417227	-3.417227
10%	-3.131040	-3.131003	-3.131003

The high volatility of the interest rates presented above leads to some problems in estimating the evolution of the interest rates and of the allocation of capital for market risk on behalf of the historical data. In order to correctly estimate the portfolio value at risk we will use Monte Carlo simulation and then we will compare the results with the historical simulation. The first step consists of doing some simulations, after which we will find the quintiles of the distributions for each simulation.

Historical Simulation

Through historical simulation we determine the hypothetical value of the portfolio taking into consideration the historical variation of the risk factors, without making an assumption about the rentabilities' distribution. In order to model the evolution of the interest rates in a stochastic manner we have to know the correlations between the three variables. The correlation matrix calculated on the historical data will be:

$$R = \begin{pmatrix} 1.0000000 & 0,0000710 & 0,0000094 \\ 0,0000710 & 1.0000000 & 0,0000125 \\ 0,0000094 & 0,0000125 & 1.0000000 \end{pmatrix},$$

where the variables' order is: LIBOR, EURIBOR, ROBOR.

In establishing the probability by which it can be calculated the maximum loss of the portfolio it will be used a confidence coefficient $\alpha=2,33$ which correspond to a probability of 99%, the recommendation of BNR. In calculating the daily VaR it will be used the next relationship:

$$VaR_i = -V_{i,0} \times \alpha \times \sigma_i,$$

where $V_{i,0}$ - is the market value of the portfolio, and σ_i - represents the volatility.

Interest rate	Standard deviation
EURIBOR	0,0000708
LIBOR	0,0000727
ROBOR	0,0000896

Applying the above formulae we will determine the maximum potential losses of the portfolio.

Table 3 : The daily VaR using historical simulation

Interest rate	Volatility	Exposure in tho	Daily VaR (99%) in thou RON
EURIBOR	0,0000708	3.000.000 EUR	2.289,92
LIBOR	0,0000727	2.000.000 USD	1.349,31
ROBOR	0,0000996	7.000.000 LEI	1.624,48

From the table above it is observed that the maximum possible daily loss (2.289,92 thousand LEI) can be caused by the exposures on EURIBOR, which is followed by the exposures on ROBOR, the maximum possible loss in the last case is 1.642,48

thousand lei daily.

Because the interest rates are correlated it will be necessary to determine the daily VaR for the entire portfolio, taking into consideration the correlations between the interest rates and between the foreign exchange rates:

$$VaR_{pf}^2 = \sum_{i=1}^n \sum_{j=1}^n VaR_i \times VaR_j \times \rho_{ij}$$

We will obtain a daily VaR value of of 1.983,36 lei. In order to determine the VaR for a 10 days time horizon, we will apply the next formulae:

$$VaR_{pf,h} = VaR_{pf} * \sqrt{h}$$

And it will be obtained 6.721,94 lei, which represents the maximum possible loss of the portfolio for the next ten days.

Monte Carlo Simulation

The daily VaR through Monte Carlo Simulation were obtained using the next algorithm:

- we used the Cox-Ingersoll-Ross model to describe the evolution of the interest rates;
- we have calculated the relative and cumulative probabilities and than we have associated intervals to each value of the random variable;
- we have generated three series of i.i.d. variables for each interest rate, which was applied the Cholesky transformation in order to obtain correlated random variables, taking into consideration the correlation between the ROBOR, LIBOR and EURIBOR;
- on the next step we have determined a possible evolution for each interest rate;
- we have repeated the steps above 10.000 times obtaining a probabilistic evolution of the possible losses;
- finally we have determined the VaR from the quintiles of the distributions generated above.

Table 4 : The daily VaR using Monte Carlo simulation

Interest rate	Exposure in tho RON	Daily VaR (99%) in thou RON
EURIBOR	3.000.000 EUR	3.213,55
LIBOR	2.000.000 USD	1.892,77
ROBOR	7.000.000 LEI	2.115,65

We will obtain a daily VaR value of 2.578,56 lei and a 10 days time horizon VaR of 8.154,12 lei, which is grater than the VaR obtained through Historical Simulation.

4. Conclusion

This paper aims at computing accurate estimates for the portfolio's risk by constructing the loss distribution with some methodologies widely used in the banking system and recommended by the Basel Committee on Banking

Supervision. From the results above we can see that through Monte Carlo Simulation we obtain a greater VaR, because the method is more sensitive to risk than the Historical Simulation. Using the last method for portfolios characterized by time varying volatility can lead to the underestimation of the risk, but on the other hand it is more attractive for meeting the level of the capital required by the authorities. Although from a supervision perspective historical simulation is an acceptable model, it is recommendable the attempt to improve its performances by adjusting the historical database.

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THE ROLE OF INTEREST INCOME AND NONINTEREST INCOME ON THE PERFORMANCE OF FOUR LARGE SOUTH-AFRICAN BANKS

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Abstract. Over the past decade, there has been an increase in the contribution of non-interest income, relative to interest income, to the total income of banks. This paper investigates the effect of this shift in income on the efficiency and profitability of the banks. Data Envelopment Analysis (DEA) in conjunction with profitability ratios is used to estimate and compare the performance of the four largest banks in South Africa over a period of ten years. There is evidence that non-interest income may lead to higher efficiency, but mixed results were found with regard to profitability. The practical implication of this study is that banks should focus more on non-interest income as a source of income as a result of its multidimensionality, while interest income is only single dimensional as a result of the fixed gap between the Repo rate set by the South African Reserve Bank and the prime interest rate.

JEL Classification: C50, C61, D24, G21, L25

Keywords: Data Envelopment Analysis; return on assets; return on equity

1. Introduction

Banks are regarded as managers of risks and in managing these risks, they try to maximise the wealth of the stockholders. Traditionally, banks act as intermediaries between lenders (surplus economic units) and borrowers (deficit economic units) in the economy and therefore banks exist because of the conflict between the requirements of lenders and borrowers, in terms of risk, return and term to maturity. According to Faure (1999), banks facilitate the flow of funds from surplus economic units to deficit economic units by issuing financial liabilities that are acceptable as assets to the lenders and use the funds so obtained to acquire claims that reflect the requirements of the borrowers. In the economy, banks thus borrow money from the surplus units and lend money to the deficit units.

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Over the past decade, banks have experienced that their profits are under pressure and led to the debate about how efficient the South African banks really are. Various factors contributed toward this situation, e.g. banks showed the lack of providing financial services to everyone (Hawkins, 2004); banks also demonstrated the inability to introduce new financial products (Akinboade and Makina, 2006); the operating costs outgrowing the bank's income during 2000 (Hawkins, 2004); while banks experienced an increase in staff costs (Department of Bank Supervision, 2002); savings accounts being costly (Hawkins, 2004); and customers not paying fair prices for financial services (Hawkins, 2004).

To some extent, this situation forced banks to rethink their marketing strategy. Over the last number of years, there has been a change in the composition of bank income. In comparison to interest income, banks on an average earn more non-interest income than before (Department of Bank Supervision, 2002). In order to maintain profitability and to ensure an acceptable return to shareholders, banks diversified their services with various types of cross-selling, resulting in an increase in non-interest income.

This paper attempts to answer two questions: Firstly, does the shift in composition of bank income have any effect on the relative efficiency of a bank? Secondly, does the shift in composition of bank income have any effect on the profitability of a bank?

In order to answer both questions, the shift in the composition of bank income must first be determined. In order to answer the first question, Data Envelopment Analysis (DEA) was used to estimate the technical efficiency, allocative efficiency, cost efficiency and scale efficiency of the four largest banks in South Africa over a period of ten years. In the DEA analysis, two models were used to distinguish between the effects of the two different outputs, namely interest income and non-interest income. In order to answer the second question, the three profitability ratios in the Du Pont analysis were applied to each bank. Therefore, the null-hypotheses to test are firstly, that there is no relationship between the efficiency change of a bank and the shift in the composition of its income and secondly, there is no significant relationship between the profitability of a bank and the shift in the composition of its income.

DEA has previously been used to study the performance of banks at the firm/corporate level (e.g. Drake, 2001; Devaney and Weber, 2000; Berger and Humphrey, 1997; Mendes and Rebello, 1999; Resti, 1997), and some studies used DEA in conjunction with financial ratios, such as Author (2004) and Yeh (1996), who found that DEA efficiency estimates are tools to compensate for the weaknesses of financial ratios. Halkos and Dimitrios (2004) also found that DEA can be used as an alternative, or complement, to financial ratio analysis and Hassan Al-Tamimi and Lootah (2007) found that financial ratios fail to consider multiple outputs that are provided by multiple inputs and they are outperformed by DEA. The superiority of DEA, which uses multiple inputs and multiple outputs, over financial ratios, which use only a single input and a single output, is also confirmed by Chen (2002). This study differs from the previous ones, because it does not compare the relationship between DEA efficiency estimates and financial (profitability) ratios, which are both performance measures, but only determines whether the extent in the shift in the income composition affects both their efficiency and profitability ratios.

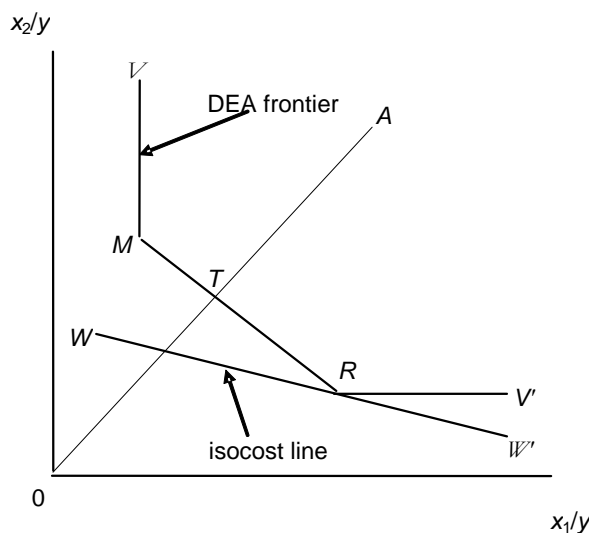
The remainder of the paper is divided into the following sections. Section 2

describes the DEA approach for measuring efficiency. In Section 3, the data and the model for the analyses are discussed. The profitability ratios that are used in evaluating bank performance are discussed in Section 4. In Section 5, the results from the DEA estimation as well as the results from the financial ratios are presented. The paper is concluded in Section 6.

2. Data Envelopment Analysis

Farrell (1957) defined a simple measure of firm efficiency, which could account for multiple inputs, and proposed that the efficiency of any given firm consisted of two components: technical efficiency, or the ability of a firm to maximise output from a given set of inputs; and allocative efficiency, or the ability of a firm to use its inputs in optimal proportions, given their respective prices (Avkiran, 1999; Coelli et al., 2005). Cost efficiency (also referred to as economic or total efficiency) is the result of combining these two measures (Coelli et al., 2005). A firm is said to be scale efficient if it operates on a scale that maximises productivity (Avkiran, 1999). Scale efficiency measurement will be helpful to determine increasing return to scale (IRS), meaning a firm can be more productive by increasing its scale of operations, or decreasing return to scale (DRS), meaning a firm can be more productive by decreasing its scale of operations (Coelli et al., 2005).

Figure 1: Two-input single-output DEA frontier



Data Envelopment Analysis (DEA) can be used to estimate the four main types of efficiency, namely technical, allocative, cost and scale efficiency. In practice, the measurement of these efficiencies involves the estimation of production frontiers. DEA effectively estimates the frontier by finding a set of linear segments that bind (or envelop) the observed data (Coelli et al., 2005). For example, assume the observed data comprises two-input single-output Firms M, R and A. The DEA estimate of the production frontier will be the piecewise linear

surface (convex hull) VMRV' depicted in Figure 1. It is important to note that MV and RV' are parallel to the respective axes. A firm producing on this part of the frontier does not represent an efficient point, because the use of the respective inputs can be reduced without any reduction in output (Coelli et al., 2005).

Charnes et al. (1978) developed DEA as a linear programming technique to evaluate the efficiency of public sector non-profit organisations. According to Molyneux et al. (1996), Sherman and Gold (1985) were the first to apply DEA to banking. The original model proposed by Charnes et al. (1978) and adopted by Sherman and Gold (1985) is formulated as follows:

Objective function:

$$\max E_o = \frac{\sum_{i=1}^k u_i \Psi_{io}}{\sum_{j=1}^m v_j X_{jo}}, \quad (\text{i.e. maximise } \frac{\text{output index}}{\text{input index}}) \quad (1)$$

where

o = the branch being assessed from the set of $r = 1, 2, \dots, n$ bank branches;

k = the number of outputs at the branches;

m = the number of inputs at the branches;

Ψ_{ir} = observed output i at branch r ;

X_{jr} = observed input j at branch r .

Constraints:

$$\frac{\sum_{i=1}^m u_i \Psi_{ir}}{\sum_{j=1}^m v_j X_{jr}} \leq 1 \quad r = 1, \dots, n \quad (\text{boundary constraints}) \quad (2)$$

$$u_i, v_j \geq 0, \quad i = 1, \dots, k, \text{ and } j = 1, \dots, m \quad (\text{non-negativity constraints}) \quad (3)$$

The above analysis is performed repetitively, with each bank branch in the objective function, producing efficiency ratings for each of the n branches. The solution sought is the set of (u_i, v_i) values that maximise the efficiency ratio E_o of the bank branch being rated, without resulting in an output/input ratio 1 when applied to each of the other branches in the data set. (For a more detailed discussion on the DEA methodology, see Cronje (2002), Avkiran (1999) and Coelli et al. (2005)).

3. Data and models

Data were obtained from the four largest banks in South Africa. The South African financial sector is currently being dominated by four large banks, namely ABSA, First National Bank, Nedbank and Standard Bank. These four banks control over 85% of total deposits and assets in South Africa (Okeahalam, 2006). The descriptive statistics are presented in Table 1.

Table 1: Descriptive statistics (values in rand million)

Variable	Mean	Std dev	Min	Max
Total deposits	24685	126721	105780	705843
Total loans	223027	124950	93718	646781
Interest income	26714	10893	4121	59836
Non-interest income	9650	5471	1467	24747
Operating expenditure	5305	2803	1304	13852
Staff costs	5841	2948	2202	14488

The following models were specified:

Model 1 was specified to estimate the efficiency of the bank under the “traditional” function of a bank, namely to lend money in return for interest paid to the bank.

Outputs: Model 1: y_1 = rand value of loans
 y_2 = rand value of interest income

Model 2 was specified to estimate the efficiency of the bank under the “non-traditional” function of a bank, namely to lend money and render a large number of services in return for non-interest income.

Outputs: Model 2 y_1 = rand value of loans
 y_2 = rand value of non-interest income

Inputs: Model 1 and 2: x_1 = rand value of deposits
 x_2 = rand value of total operating expenditure (excluding staff costs, interest paid and depreciation)
 x_3 = rand value of staff costs.

Input prices: w_1 = (interest paid)/ x_1
 w_2 = production price index (Index P0142.1 by Statistics, South Africa)
 w_3 = x_3 /(number of staff)

Limited agreement exists in the banking literature on defining outputs, inputs and prices for the inputs. Up to five approaches have been suggested, of which the production approach and the intermediation approach (or variations thereof) are the most commonly used ones. According to Berger et al. (1987), under the production approach, banks produce accounts of various sizes by processing deposits and loans, incurring capital and labour costs. Under this

approach, operating costs are specified in the cost function and the number of accounts is used as the output metric, while average account sizes are specified to control for other account characteristics. Under the intermediation approach, banks intermediate deposited and purchased funds into loans and other assets. Under this approach, total operating cost plus interest cost are specified and the output is specified in currency units.

According to Resti (1997), a pivotal issue throughout the whole literature based on stock measures of banking products, is the role of deposits. On the one hand, it is argued that they are an input in the production of loans (intermediation or asset approach). Yet, other lines of reasoning (value-added approach, or user cost approach) suggest that deposits themselves are an output, involving the creation of value added, and for which the customers bear an opportunity-cost.

In this paper, the intermediation approach is adopted. The main reason for using this approach is because the production approach requires the number of accounts and transactions processed (output measures under the production approach), which were unavailable. Measuring scale and technical efficiency using DEA requires data on output and input quantities, while measuring allocative and cost efficiency also requires data on input prices.

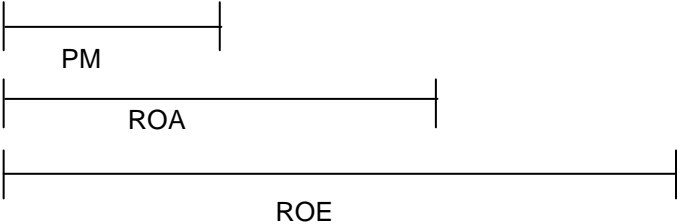
The inputs used for both models are to some extent similar to those used by Sherman and Gold (1985), Rangan et al. (1988), Aly et al. (1990), and Berger and Humphrey (1991). The outputs for Model 1 correspond to those used by the latter three authors. The outputs for Model 2 are a modified mixture of those used by Charnes et al. (1990) and Yue (1992). According to Favero and Papi (1995), non-interest income (y_2 in model 2) can be regarded as a proxy for various services provided by banks, which are usually neglected by a strict acceptance of the intermediation or asset approach.

4. Profitability ratios

The profitability ratios of the Du Pont analysis are used in this study. This analysis indicates how return on equity (ROE) is affected by turnover/assets, the net profit margin (PM) and leverage (assets/ equity) (Brigham and Ehrhardt, 2005:460). Correia et al. (2007) state that the strength of this analysis is the fact that three broad categories of a firm are explained, namely “those associated with income, those associated with investment, and those associated with capital structure”. Figure 2, taken from Correia et al. (2007), is a simple, but very informative explanation of the Du Pont analysis. See also Brigham and Ehrhardt (2005), Horngren et al. (2009) for similar expositions.

Figure 2: Du Pont Analysis

$$ROE = (\text{net profit/sales}) \times (\text{sales/assets}) \times (\text{assets/equity})$$



5. Results

5.1. The shift in income composition

In an attempt to determine the role of interest income and non-interest income on the performance of the four largest South African banks, two ratios are calculated. They are the contribution of interest income to total income and the contribution of non-interest income to total income. In Table 1, the contribution of interest income to total income is exhibited.

From Table 1 it is clear that since 1998 the trend is that, on average, there is a gradual decline in the contribution of interest income to total income. This is confirmed by the negative annual compounded growth rate for all the banks over the ten-year period. Bank A experienced the largest decrease, namely where $i = -3.51\%$, i.e. $54.59\% = 78.05\%(1 + i)^{10}$.

Table 1: Contribution of interest income to total income (Percentage)

Year	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	Grow
Bank A	54.59	48.32	48.40	52.37	56.75	55.13	57.93	63.49	71.35	78.05	-3.51
Bank B	50.78	45.40	58.63	59.03	67.16	59.55	59.38	60.54	71.11	65.12	-2.46
Bank C	74.72	72.11	67.50	63.13	68.13	67.28	65.83	68.50	73.90	75.44	-0.10
Bank D	64.91	66.50	63.13	64.19	72.29	71.78	71.43	73.69	76.52	80.19	-2.09
Avg.	61.25	58.08	59.41	59.68	66.08	63.44	63.64	66.56	73.22	74.70	

The contribution of non-interest income to total income is presented in Table 2. From the results it is clear that there was an upward trend in the contribution of non-interest income to total income over the period 1998 to 2007. Bank B experienced the largest compounded annual growth rate where $i = 4.27\%$, i.e. $23.18\% = 35.22\%(1 + i)^{10}$.

Table 2: Contribution of non-interest income to total income (Percentage)

Year	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	Grow
Bank A	16.79	19.52	21.13	19.57	17.10	17.30	16.45	14.87	11.73	13.10	2.51
Bank B	35.22	38.32	30.05	23.63	18.19	26.46	25.41	25.33	18.07	23.18	4.27
Bank C	18.58	23.94	24.64	21.72	19.26	19.57	21.87	19.30	15.84	14.50	2.51
Bank D	26.84	27.32	27.76	28.16	25.91	26.78	26.66	26.31	23.48	19.81	3.08
Average	24.36	27.27	25.89	23.27	20.11	22.53	22.60	21.45	17.28	17.65	

5.2 DEA efficiencies

The software package DEAP Version 2.1 by Coelli (1996) is purpose-built to solve the DEA problem and has been used in this paper to generate estimates of efficiency.

The average efficiency estimates for the banks are presented in Table 3. From the results it can be seen that all the banks (total at the bottom of the table) experienced an improvement in average technical efficiency (TE) moving from Model 1 (interest income as one of the outputs) to Model 2 (non-interest income as one of the outputs). In the case of all the banks, the average relative technical efficiency estimate improved from 87.6% to 95.7%, which means that, on average, the banks were able to use their inputs more efficiently, resulting in an increase in output without any increase in input. According to Avkiran (1999), technical efficiency investigates how well the production process converts inputs into outputs

(i.e. effective implementation of the production plan). The banks can, for example according to Model 2, on average still increase their output by 4.3% without any increase in inputs.

The average relative allocative efficiency (AE) estimate for all the banks deteriorated from 93.2% to 90.0%. This means that the banks were not able to select that mix of inputs (given their respective prices), which produces a given quantity of output at minimum cost. According to Avkiran (1999), allocative efficiency is defined as the effective choice of inputs *vis-à-vis* prices, with the objective of minimising production costs (i.e. selection of an effective production plan). Cost efficiency (CE) is the product of allocative efficiency and technical efficiency ($CE = TE \times AE$), and because of the 8.1% improvement in technical efficiency under Model 2, and a 3.2% deterioration in allocative efficiency under Model 2, the end result is an improvement of 4.7% (86.1% - 81.4%) in cost efficiency under Model 2. There is a slight improvement of 0.4% in scale efficiency (SE) under Model 2.

With regard to the average efficiency estimates, all four banks experienced an improvement in technical efficiency moving from Model 1 to Model 2. Bank A experienced an improvement of 4.2%, Bank B an improvement of 12.7%, Bank C a slight improvement of 0.4% and Bank D an improvement of 15.3%. In the case of allocative efficiency, Banks A, B and D experienced a decrease in efficiency while in the case of Bank C there was no change in allocative efficiency. Banks B, C and D experienced an improvement in cost efficiency, while Bank A experienced deterioration in cost efficiency. Banks B and D experienced an improvement in scale efficiency, while Banks A and C experienced a deterioration in scale efficiency.

(Because of space constraints, the detail discussion of the results of the individual banks will be restricted to one bank, Bank A (arbitrarily selected), while in the case of the other three banks, some aspects will be highlighted.)

Turning to the results for the individual banks, it is clear from Table 3 that, moving from Model 1 to Model 2, Bank A experienced an improvement in technical efficiency during years 4 to 9. Under Model 1, the bank was on two occasions fully technically, allocatively, cost and scale efficient. This was during year 2 and year 10. This means that the bank was using its resources optimally (TE), the distribution of its resources was optimal (AE), and this resulted in a cost efficiency of 100%. During these two periods, the bank was operating at the right size (SE). On six occasions the bank was operating at increasing returns to scale (irs), meaning that the bank was operating at a scale that was too small and on one occasion the bank operated at decreasing returns to scale (drs), meaning that the bank was operating at a scale that was too large. On three occasions the bank was operating at the optimal scale.

Table 3: Relative efficiency estimates of banks

Bank A	Model 1					Model 2				
	TE	AE	CE	SE	Return	TE	AE	CE	SE	return
1	0.996	0.991	0.987	0.961	lrs	0.943	0.986	0.930	0.795	irs
2	1.000	1.000	1.000	1.000	-	0.914	0.988	0.902	0.810	irs
3	0.917	0.996	0.914	0.934	lrs	0.914	0.986	0.902	0.854	irs
4	0.867	1.000	0.867	0.919	lrs	0.891	0.990	0.882	0.907	irs
5	0.785	0.965	0.757	0.995	lrs	0.875	0.891	0.779	0.976	lrs
6	0.836	0.967	0.809	0.997	Drs	0.930	0.894	0.831	0.985	lrs
7	0.817	0.980	0.800	0.989	lrs	1.000	0.894	0.894	1.000	-
8	0.906	0.847	0.767	0.996	lrs	0.993	0.807	0.801	0.989	Drs
9	0.912	0.825	0.753	1.000	-	1.000	0.797	0.797	0.985	Drs
10	1.000	1.000	1.000	1.000	-	1.000	1.000	1.000	1.000	-
Average	0.904	0.957	0.865	0.979	-	0.946	0.923	0.872	0.930	-
Bank B										
1	0.962	0.931	0.896	0.875	lrs	0.962	0.931	0.896	0.875	lrs
2	1.000	1.000	1.000	0.918	lrs	1.000	0.993	0.993	0.896	lrs
3	0.942	0.990	0.933	0.877	lrs	1.000	1.000	1.000	1.000	-
4	0.876	1.000	0.876	0.795	lrs	0.971	0.974	0.946	0.960	lrs
5	0.807	0.959	0.773	0.946	lrs	1.000	0.834	0.834	0.995	lrs
6	0.902	1.000	0.902	0.944	lrs	0.910	0.992	0.903	0.913	lrs
7	0.809	1.000	0.809	0.889	lrs	0.894	0.950	0.849	0.988	lrs
8	0.766	0.996	0.763	0.898	lrs	1.000	0.907	0.907	1.000	-
9	0.722	1.000	0.722	0.917	lrs	1.000	1.000	1.000	1.000	-
10	0.685	1.000	0.685	0.960	lrs	1.000	1.000	1.000	0.971	Drs
Average	0.847	0.988	0.836	0.902	-	0.974	0.958	0.933	0.960	-
Bank C										
1	0.915	1.000	0.915	0.930	lrs	1.000	1.000	1.000	0.825	lrs
2	0.786	1.000	0.786	0.924	lrs	1.000	0.938	0.938	1.000	-
3	0.754	1.000	0.754	0.904	lrs	1.000	0.868	0.868	0.991	lrs
4	0.658	0.954	0.627	0.998	Drs	1.000	0.808	0.808	1.000	-
5	0.719	0.975	0.701	0.980	Drs	1.000	0.738	0.738	1.000	-
6	0.828	0.933	0.772	0.924	Drs	0.882	0.880	0.777	0.992	lrs
7	0.702	0.963	0.676	0.983	Drs	0.841	0.879	0.740	0.996	lrs
8	0.751	0.829	0.623	0.939	Drs	0.909	0.857	0.779	0.999	lrs
9	0.849	0.712	0.604	0.950	Drs	0.972	0.762	0.741	1.000	-
10	1.000	1.000	1.000	0.911	Drs	1.000	0.734	0.734	1.000	-
Average	0.956	0.846	0.807	0.993	-	0.960	0.846	0.812	0.980	-
Bank D										
1	0.996	0.991	0.987	0.961	lrs	0.918	0.983	0.903	0.887	lrs
2	1.000	1.000	1.000	1.000	-	0.868	0.942	0.817	0.940	lrs
3	0.917	0.996	0.914	0.934	lrs	0.916	0.905	0.829	0.951	lrs
4	0.867	1.000	0.867	0.919	lrs	0.908	0.783	0.711	0.996	Drs
5	0.785	0.965	0.757	0.995	lrs	0.929	0.915	0.850	0.996	Drs
6	0.836	0.967	0.809	0.997	Drs	0.954	0.886	0.845	0.988	Drs
7	0.817	0.980	0.800	0.989	lrs	1.000	0.842	0.842	0.983	Drs
8	0.906	0.847	0.767	0.996	lrs	0.995	0.755	0.751	0.965	Drs
9	0.912	0.825	0.753	1.000	-	1.000	0.722	0.722	0.961	Drs
10	1.000	1.000	1.000	1.000	-	1.000	1.000	1.000	0.984	Drs
Average	0.796	0.937	0.746	0.944	-	0.949	0.873	0.827	0.965	-
Total	0.876	0.932	0.814	0.955		0.957	0.900	0.861	0.959	

Under Model 2, the bank was fully technically efficient during years 7, 9 and 10. During year 10, Bank A was also fully allocatively, cost and scale efficient. Not once did the bank experience any improvement in allocative efficiency, but between years 5 and 9 the bank experienced an improvement in cost efficiency. During years 7 and 8 the bank also experienced an improvement in scale

efficiency. On six occasions the bank operated at increasing returns to scale (irs), two occasions at decreasing returns to scale (drs) and at optimal scale on two occasions. Under Model 1, on three occasions the bank operated at the optimal level.

The relative efficiency estimates for Bank B, Bank C and Bank D are also presented in Table 3. It is clear that on eight occasions the bank experienced an improvement in technical efficiency moving from Model 1 to Model 2. Under Model 2 the bank was fully technically efficient on six occasions and fully allocatively efficient and cost efficient on three occasions. There has been only one improvement in allocative efficiency and no improvement in cost efficiency. On three occasions the bank was operating at the optimal scale, but most of the time the bank operated at increasing returns to scale (irs). Not once, under Model 1, did the bank operate at the optimal scale.

Bank C has on nine occasions improved in technical efficiency moving from Model 1 to Model 2, and on six occasions the bank was fully technically efficient. On nine occasions there has also been an improvement in cost efficiency as well as scale efficiency, while half of the time the bank was operating at increasing returns to scale (irs) and the other half of the time it was operating at the optimal level.

With regard to Bank D, moving from Model 1 to Model 2, the bank experienced an improvement in technical efficiency on six occasions and was fully technically efficient on three occasions. At no time did the bank experience any improvement in allocative efficiency and only on three occasions improvement in cost and scale efficiency. Most of the time the bank was operating at decreasing returns to scale (drs) and at no time the bank was operating at the optimal scale. Under Model 1, the bank was operating at the optimal scale on three occasions, but most of the time at increasing returns to scale, meaning that it is too small.

5.3. Profitability ratios

According to the results from Table 4, it is clear that Bank D was the best performer on ROE (49.12%) and ROA (3.28%). With regard to ROE, this means that the bank was able to earn the highest percentage return on each Rand of stockholder's equity (ROE) and earn the highest net income per Rand of average assets owned during the ten years under investigation. From a pure profitability perspective, it is clear that Bank D outperformed the other three banks.

Bank A is in the second place when ROE (38.37%) and ROA (2.57%) are taken into consideration and in the third place for PM (8.98%). Bank B was the worst performer on ROE (24.21%) and ROA (1.24%); however, the bank was the best performer on PM (16.83%). Bank C was in the third place on ROE (28.39%), ROA (2.26%) and the fourth place on PM (8.75%),

Table 4: Profitability ratios (Percentage)

Return on equity (ROE)											
Bank	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	Avg.
A	39.82	40.71	45.22	46.44	45.55	44.3	32.42	32.1	30.22	26.89	38.37
B	7.99	14.16	31.99	33.45	33.92	38.14	31.97	34.72	32.45	-16.7	24.21
C	30.07	27.03	22.41	19.17	29.04	27.21	32.11	24.35	29.27	43.26	28.39
D	73.21	72.79	68.21	50.68	50.85	45.53	36.77	31.66	27.86	33.8	49.14
Return on assets (ROA)											
A	2.65	2.87	2.89	3.03	2.96	2.71	2.36	2.18	2.16	1.91	2.57
B	0.48	0.86	1.81	1.57	1.5	1.54	1.73	1.87	1.96	-0.93	1.24
C	2.18	1.96	1.72	1.3	1.62	2.06	2.65	2.56	3.1	3.39	2.26
D	4.27	4.16	3.64	3.21	3.31	3.81	2.85	2.44	2.24	2.91	3.28
Profit margin (PM)											
A	13.97	15.05	13.7	11.33	8.55	3.74	8.62	3.21	5.77	5.85	8.98
B	20.28	21.3	22.22	17.81	13.86	16.62	17.22	16.11	10.06	12.87	16.83
C	12.21	12.92	13.02	3.72	-4.13	3.76	0	31.98	4.83	9.15	8.75
D	20.06	18.29	16.57	18.18	14.96	13.6	16.5	15.28	6.68	6.6	14.67

5.4. Comparison between shift in income composition, change in DEA efficiencies and profitability ratios

This section investigates the statistical relationship of the shift in the income composition of banks on the change in DEA efficiency estimates in Model 1 and Model 2. Furthermore, the relationship between the shift in the composition in income and the profitability will also be investigated. Pearson's correlation coefficient (r), which is based on the least square regression analysis, can be helpful in this regard. In order to test the null-hypothesis, at least ten observations are required to determine the correlation between two variables (Sekaran, 2006; Hanke et al., 2001:73). Finally, the null-hypothesis is tested at a one, five and ten percent significance level.

Table 2, which shows the contribution of non-interest income to total income over the period 1998 to 2007 (ten observations), was used as the basis for Table 5. An upward trend in the contribution of non-interest income to total income was experienced. A correlation coefficient is then calculated between the information in Table 2 and Table 3. The annual difference between the DEA efficiency estimates, moving from Model 1 to Model 2, is determined and compared to the annual weight of non-interest income to total income. For example, a strong positive correlation coefficient will indicate that the upward trend in the non-interest income/total income ratio also leads to a higher efficiency in non-interest income and a lower efficiency in interest income and *vice versa*.

Table 5 also indicates the correlation coefficients between the annual weight of non-interest income to total income (Table 2) and the annual profitability ratios in Table 4. For example, a strong positive correlation coefficient will indicate

that the upward trend in the non-interest income/total income ratio also leads to a higher relative profit and *vice versa*.

Table 5: Correlation (r) between the shift in income composition and DEA efficiency estimates and profitability ratios

Bank	ΔTE	ΔAE	ΔCE	ΔSE	ROE	ROA	PM
A	0.866 ¹	-0.535 ³	0.903 ¹	0.870 ¹	0.838 ¹	0.871 ¹	0.694 ²
B	0.923 ¹	-0.022	0.948 ¹	0.339	-0.287	-0.233	0.854 ¹
C	0.172	0.229	0.250	0.321	-0.672 ²	-0.715 ²	0.055
D	0.744 ¹	-0.484 ³	0.457 ³	0.547 ³	0.570 ²	0.469 ³	0.877 ¹

¹ Significant at a 99 percent confidence level, ² Significant at a 95 percent confidence level, ³ Significant at a 90 percent confidence level

Table 5 also indicates which correlation coefficients are significant. For each correlation coefficient a p-value, which is an indication with how much confidence the null-hypothesis is rejected or not rejected, was calculated to determine whether the null-hypothesis is rejected at a significance level of one, five and ten percent, respectively if $p < \alpha = 0.01$, $= 0.05$ and $= 0.1$, respectively (two-tailed).

The following summarises the most important findings in Table 5, namely that the upward trend in the non-interest/total income ratio leads to:

- A significant increase in the technical efficiency of non-interest income and a decrease in the technical efficiency of interest income for Bank A, Bank B and Bank D (and Bank C is only slightly more technical efficient for non-interest income).
- A significant decrease in the allocative efficiency of non-interest income and an increase in the interest income efficiency for Bank A and Bank D, where Bank B is only slightly less allocatively efficient with non-interest income and slightly more allocatively efficient with interest income and Bank C slightly more allocatively efficient with non-interest income and slightly less allocatively efficient with interest income.
- A significant increase in the cost efficiency of non-interest income and a decrease in the cost efficiency of interest income of all the banks (except for Bank C, where the relationship is not significant).
- A significant increase in the scale efficiency of non-interest income and a decrease in the cost efficiency of interest income of Bank A and Bank D (not for Bank B and Bank C, where the relationship is not significant).
- Significantly favour the ROE and ROA of Bank A and Bank D, but has the opposite effect on Bank B and Bank C.
- Significantly favour the PM of all the banks (except Bank C, where the relationship is only marginal).

6. Conclusion

The purpose of the paper is to attempt to answer two questions: Firstly, does the shift in composition of bank income have any effect on the relative efficiency of a bank? Secondly, does the shift in composition of bank income have any effect on the profitability of a bank? Data from the four largest banks of South

Africa were analysed over a ten-year period.

There is evidence that all four banks experienced an improvement in relative technical efficiency moving from Model 1 to Model 2. This is the result of the banks being able to improve in converting inputs into outputs accompanied by an increase in output without any increase in inputs.

All the banks (except Bank C that kept its estimate unchanged) experienced deterioration in the relative allocative efficiency moving from Model 1 to Model 2. This indicates that the banks were not able to select that mix of inputs (given their respective prices) that produces a given quantity of output at minimum cost. The banks were thus unable to select an effective production plan.

All the banks experienced a significant (except Bank C) improvement in relative cost efficiency moving from Model 1 to Model 2. The main reason is that the technical efficiency increased more than the deterioration in the allocative efficiency.

In the case of scale efficiency, all the banks on aggregate as well as Bank B and Bank D experienced improvement in average relative scale efficiency. This means that these banks were moving closer to their optimum size. Bank A and Bank D experienced deterioration in average relative scale efficiency meaning that they were moving further away from their optimum size.

All the banks simultaneously experienced an increase in their profit margins ratios and their non-interest/total income ratios. This indicates that the shift from interest income to non-interest income has a higher margin between the non-interest income and input costs than in the case of interest income and inputs.

The upward trend in the non-interest income/total income ratio favours only the ROA of Bank A and Bank D, while it leads to a lower ratio for Bank B and Bank C. This means that the shift in income generates more profit for Bank A and Bank D and/or the shift in income requires keeping fewer assets. The opposite is true for Bank B and Bank C.

Finally, the upward trend in the non-interest income/total income ratio favours only the ROE of Bank A and Bank D, while it leads to a lower ratio for Bank B and Bank C. This again means that the shift in income generates more profit for Bank A and Bank D and/or the shift in income requires them to keep less equity. The opposite is true for Bank B and Bank C.

There is evidence that since 1998 there has been a gradual decrease in the contribution of interest income to total income, with a gradual increase in the contribution of non-interest income to total income. In analysing bank performance, with the aid of DEA, it is evident that banks should concentrate on non-interest income as a source of income as this could contribute toward improved efficiency. These banks still need to improve their input mix ratios, the only efficiency measure that reacts negatively for three of the banks as result of the income compilation shift. Nevertheless, this negativity is cancelled out by the huge improvement of technical efficiency that is indicated by the positively improved cost efficiency for all the banks.

The shift in income compilation does not have such a clear effect on the profitability ratios and it is to some extent contradictory to efficiency estimates. This is because the shift in income compilation favours the profit margin of all the banks, but only two of the banks experienced a positive relationship between this shift and their ROA and ROE ratios, while the other two experienced a negative relationship.

To summarise, the majority of efficiencies and profitability scores are favoured by the shift in income from interest income to non-interest income. Interest income is single dimensional in the sense that the South African Reserve Bank sets the Repo rate and a fixed percentage is added to the Repo rate to arrive at the Prime overdraft rate. Non-interest income is multidimensional with various options available in rendering services to bank clients, e.g. selling a combination of services to their clients. It is evident that banks should concentrate on non-interest income as a source of income as this could contribute toward improved efficiency and to some extent to improved profits. Banks should move away from the traditional role of intermediation (intermediation approach) to a role of producing various services (production approach) In this process, cross-selling is important as many clients are looking for one-stop banking services.

With the contradictory results obtained by using DEA and profitability ratios, it is important to use both methods of analysis as the use of only one method may lead to biased results.

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THE EFFECT OF TRANSITING FROM CASH ACCOUNTING TO ACCRUAL ACCOUNTING ON PERFORMANCE IN THE PUBLIC SECTOR

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Abstract. The study of Romanian public accounting system starts from the following hypothesis: the organization performance – including the one of public institutions – could be shown in the financial statements, respectively performance is highly brought forward through shifting from cash accounting to accrual accounting by offering more benefits compared to the existing situation before the reform. We tested the second hypothesis in two stages. Firstly, by analyzing the literature, we identified and rated the benefits that accrual accounting offers compared to cash accounting. Secondly, we transformed these benefits into themes and categories in the case of a content analysis of the Romanian financial statements before and after reform. By applying certain economic analysis procedures we confirmed our hypothesis that accrual accounting is superior to cash accounting.

JEL Classification: M 40, M 41, P 20

Keywords: financial statements, managerial reform, public sector, content analysis

1. Introduction

Throughout the world the public sector is running according to *the management rules of private organizations*, their services being filtered through the investments theory. Once the resources management is superseded by result management there is a call for establishing the agent's performance responsibility (Biot-Paquerot and Rossignol, 2006).

In general, the *assessment of performance* is made using complex systems that include knowledge from a multitude of areas: social sciences, management, sociology, accounting, psychology, mathematics, information technology etc. (Mitu, Drăcea and Popa, 2007). Our study is based on the accounting techniques of assessing performance. The accounting system contributes to the highlighting of performance both by managerial and financial accounting.

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At present, *managerial accounting* changes from being a figure/number supplier to a supplier of elements that assess performance and management (Collier, 2003: 9). It is involved at different degrees and in different organizations in: value based management, non-financial systems of performance assessment, quality management approaches, activity based management, strategic management accounting. Out of these intercessions we will focus in this study on value based management. An economic perspective of value created by the firm is stated by Grant (1998), quoted by Collier (2003) who sees created value to be allocated to customers, suppliers and equity risk-takers. In order to create this value a business strategy should imply the establishment of performance objectives and then the assessment of results.

Financial accounting is also more and more focused on creating value for shareholders and other stakeholders, in close relation with managerial accounting. Both are information sources for planning, decision making and control. As a matter of fact creating and communicating value to stakeholders is directly connected to financial accounting (as financial accounting is its stewardship), managerial accounting being a derivative or a development of financial accounting. In parallel with the two account information sources we find the entity's strategy that implies the rest of the entity's guiding functions besides the financial ones: marketing, human resources and technical. Financial accounting serves this strategic objective of organizations through the quantitative (financial) values contained in the financial statements meant to inform different categories of stakeholders regarding its objectives, concepts and methodology. Using the financial statements one can observe the financial measure of performance that derives from the financial function of the organization. In the last decades though models that contain non-financial measures of performance have been developed as a response to the limits of financial measures that show performance only on the short run. Examples of such models are: the Balance Scorecard (Kaplan and Norton, 1992; 1993; 1996; 2001), the scorecard developed by the French industry, Performance Pyramid (Lynch and Cross, 1991), Result and Determinants Framework (Fitzgerald *et al.*, 1991) quoted by Colliers (2003). All these models reflect performance on the long run that is connected to internal and external economic factors of the entity. Our study uses financial measures of performance quantification.

In the case of financial reporting two solutions can be identified (named according to case systems, principles, premises or accounting postulates) namely accrual accounting and cash accounting. The first one is specific for corporations while the second one was used for a long time in the public sector. They represent a fundamental dichotomy in financial reporting.

Accrual accounting, compared to *cash accounting*, offers in dynamic a better reflection of the business' financial performance. (Collier, 2003:32). The majority of studies in the literature that approached this subject have come to this conclusion even if they criticized it. Mainly it presents the risk of altering the reported performance in order to meet the expectations of capital market analysts in order to obtain value for shareholders (this practice is named earnings management).

As far as we are concerned we will analyze performance in the public sector by using financial accounting techniques that offer through their reporting mainly financial measures of performance to stakeholders. The analysis is based

on the specifics of this sector that does not use all the incentive mechanisms in order to reach the organizations' strategies (Biot-Paquerot and Rossignol, 2006). This is the reason why, although in the last decades we notice an effective *managerial reform in the public sector* which is meant to link the public sector to the neo-liberal market principles, the process is not yet considered fully resolved. The main difficulty represents the specific nature of public organizations in relation to management, control and stakeholders.

2. Objectives and research methodology

We based our analysis on the following hypothesis: the organization's performance – including the one of public institutions – could be shown in the financial statements (1), hypothesis which we consider tested, respectively performance is highly brought forward through shifting from cash accounting to accrual accounting – one of the components of the international managerial reform in the public sector -, by offering more benefits compared to the existing situation before the reform (2). In other words, accrual accounting reflects more accurately those elements (that represent analysis themes for us) which can define the organization's performance on the short run. We wish to test the second hypothesis in this paper.

To that effect our study has two objectives: identifying and ranking the benefits offered by accrual accounting compared to cash accounting, respectively testing those benefits that we consider „precise” for the Romanian financial reports.

To reach these objectives we resorted to:

a) describing the managerial reform of the public sector as it is seen on the international level but also in Romania (chapter 3 of the study);

b) identifying the theories that explain the shift from cash accounting to accrual accounting and explaining them in relation with the specific management, control and users of public organizations (chapter 4 of the study);

c) identifying and ranking the benefits offered by accrual accounting against cash accounting; in order to do this we used content analysis (as an approach of archival research) of literature studies, analysis in which we applied the comparison procedure and economic analysis procedures (the punctuation technique and the SWOT technique) (chapter 5 of the study);

d) testing the degree of effectiveness that accrual accounting's benefits have through a content analysis of financial statements required in Romania; the analysis was an underlying themes type and it followed up clusters of words that refer to the same theme or element/group of the financial statements; to this we added the comparison procedure (chapter 6 of the study).

In the ending part of the study we present discussions regarding the results obtained in chapters 4-6 of the material, the conclusions, limits and perspectives of the research.

3. Public sector reform in the world and in Romania

3.1 The managerial reform worldwide

Globally, the reform on accounting in the public sector is a component of the economic reform worldwide, based on neo-liberal principles like: anti-inflation monetary policy, fiscal discipline at the macroeconomic level that will lead to balanced public budgets and microeconomic reforms for free trade and extension

of the business sector (McKinnon, 2003 quoted by Elwood and Newberry, 2007). All these are used in order to reduce the government's extent and power while developing the business environment. Moreover, because after a long post war period of governments' expansion that peaked between 1970 and 1980, the relatively large dimension of the public sector in the OECD member countries was seen as one of the causes for economic growth reduction in those countries (Elwood and Newberry, 2007).

In Australia (one of the first countries that focused on the shift), the reform took place both at the federal level and states' level, between 1976 and 1996, profoundly in the period 1980-1990 (Scott, McKinnon and Harrison, 2003).

In Europe the reforms on management and organization in the public sector started at the end of 1990 (Spathis and Ananiadis, 2004). Just like on the international level, the changes focused on improving efficiency, effectiveness and accountability in the public sector. Thus, the reform was based on adopting new management practices in areas like healthcare, education, central and local administration. This developed in 6 dimensions: privatization, market comparison, decentralization, output focus, quality systems and implementation intensity. The reform was justified by the high level of bureaucracy – which is defective and resource consuming, through the free market - which is the most efficient method of scarce resource allocation, and finally through the management techniques of the private sector – which represent an adequate model for the public sector (Connoly and Hyndman, 2006).

For the last 25 years, in the UK (another state in which the reform was significant) numerous changes have taken place in the public sector that targeted the advancement of planning, control, transparency and accountability. In the same period, mostly between 1980 and 1990, similar reforms were conducted in other Western Europe countries (Guthrie *et al.*, 1991; Pollitt and Bouckaert, 2000 quoted by Connoly and Hyndman, 2006).

3.2 Introducing accrual accounting worldwide

Some authors name it the financial management and accountability reform (Scott, McKinnon and Harrison, 2003). Another notion used was „new public financial management” and it targeted significant changes of the scope, scale and style of the management and activity in the public sector (Guthrie *et al.*, 1999 quoted by Windels and Christiaens, 2007). The scope was for the government's and other public organizations' financial statements to be more broad and easily understood through accounting – an important management instrument (Spathis and Ananiadis, 2004). For the past years concepts like cost, efficient, economy and effectiveness are more and more present (even in political discourses) regarding the shift from cash accounting to accrual accounting.

At the international level, the orientation towards accounting and financial reporting based on the accrual accounting's principles first appeared at the end of 1980 in Australia and New Zealand. The flow extended to the Great Britain and USA, as all these countries are strongly influenced by the managerial philosophy (Lye, Perera and Rahman, 2005). Out of these countries, New Zealand adopted a total transition to accrual accounting (starting from 1992), and so at the end of the millennium it had the most complete publication this accounting system's elements. The USA was at the other pole, as it made gradual changes that did not concern all its states. It is estimated that, starting with 2002, half of the OECD member states

will use forms of accrual accounting in their financial statements (Connoly and Hyndman, 2006).

In Europe the new financial regulations created a new legal framework regarding the European Union's budget financial management. In order to finalize the transition to accrual accounting, the European Commission asked for two types of accounts: budgetary accounts, intended for the public authorities and based on the concept of treasury and general accounts, based on accrual accounting (Spathis and Ananiadis, 2004). Many studies have analyzed the new forms and techniques of accounting and critically assessed these changes in the Western Europe countries (Pallot, 2001; Ellwood, 2003 quoted by Windels and Christiaens, 2007).

Accrual accounting was introduced for the UK's local authorities in the middle of the 19th century, and in the healthcare system by the reforms introduced at the beginning of the 90's. Then, in 1993 it was brought up for admission by the central authority as resource accounting, and it was implemented in the following years (until 2001) (Connoly and Hyndman, 2006).

3.3 The Romanian case

According to the reports published by the Organization for Economic Co-operation and Development (OCDE), the European Union Council's decision from Helsinki in 1999 to start the negotiation process for Romania's integration in the EU in 2007, was the starting point of the changes carried on in the public institutions' management system. Thus the efforts to accelerate the economic, social and political convergence to the EU structures became indispensable through the transfer of the „acquis communautaire” into the internal legislation, and also by implementing these legal measures.

In the context of ample transformations, a series of international publications like *General Trade and Accounting* or *Bulletin of Accountants* analyzed the post communist evolution of Romanian accounting, showing the significant moments of its transformation within the international and national context of their yielding. Calu D. (2005) defines this matter as the starting point of the Romanian accounting system's openness towards the international reality. The completion of these transformations sighted the reach of the European accounting system's level, based especially on accrual accounting having as a support the International Public Sectors Accounting Standards (IPSAS). Implementing the new standards implied simplifying the processes, increasing the productivity level and decreasing the operational costs.

The Romanian public accounting system is divided into three periods: the starting point represents the public accounting's socialist period that at least from the point of view of legislation and theoretical fundamentals did not end in 1989 (the year that the communist regime ended) but continued until 2002, as it is characterized by the cash basis accounting; the period between 2003 and 2005 that marked the start of the public accounting's transition from the cash basis system to the accrual basis system; the period from 2006 until now that recognizes an accounting organizational system based on accrual accounting. In our study we will focus on the period comprised until 2003 and from 2006 until present. We account for these decisions based on the following arguments: the first interval is characterized by a cash basis accounting system that at its end (2003) was influenced by incipient elements specific to accrual accounting. These elements were imposed as a result of the Ministry of Public Finance's obligation to

restructure the budgetary accounting by supplementing the cash flow accounting with accrual accounting (e.g. the reevaluation and amortization of the public institution's assets, setting up impairments and other elements that define accrual accounting). Our analysis relates to this period from the cash accounting's point of view. The second period highlights the accrual accounting system with its features specific to public institutions (e.g. maintaining the budget rendering account whose content keeps elements specific to cash accounting, showing paid expenses and cashed incomes).

In conclusion, by presenting and analyzing the two periods we try to identify the accrual and cash accounting systems with the interconnection that existed at one point between them.

If we pass from the normative level to the practical level we can not state that up until now the Romanian practice rose up to the accounting regulations regarding performance assessment through accounting indicators or not. The managers did not follow too often performance or at least not within the systems accepted globally. Little public institutions were preoccupied by customer (citizen) satisfaction, accountability, efficiency (Mitu, Drăcea and Popa, 2007). This context is a further argument for our attempt to demonstrate the additional share of accrual accounting in highlighting and explaining the public sector's performance, as a simple measure at hand for the agent and specific stakeholders. We unassailably sustain the Romanian public authorities' intercession to adhere to IPSAS standards.

4. Economic theories used for explaining the public sector accounting reform

In this chapter, our intention is to state (1), and then to singularize to the public sector (2), those economic theories on which we build our study. After analyzing the literature we did not succeeded in obtaining an overall image of the theoretical framework applicable to public entities, a framework that could support or deny the on going reform in the accounting system of these entities. We have noticed only indications of some of the theories, as the basis of the specific intercessions of some of the studies that we analyzed, for example the stakeholders theory (Scott, McKinnon and Harrison, 2003), the property rights system assumed by the agency theory (Biot-Paquerot and Rossignol, 2006) or building up a specific theory regarding factors that led to change in an given economic, social and political context (Lye, Perera and Rahman, 2005).

Our study takes into account the entire public sector (and not a particular public activity), the financial measures of performance (not the non-financial ones) and a broad enough context (considering that we are analyzing financial statements of accrual accounting, respectively cash accounting, that, essentially, have international recognition). Related to this objective of the research, we think it is necessary that we state a general theoretical framework adapted to this sector. Our starting point will be the classic economic theories or their alternatives that we interpret for the public entities. It is not a goal for us to exhaustively elaborate on the subject, but to overview for grounding our future actions, that need a theoretical justification.

Theoretically speaking, we can notice that the study is linked to financial reporting generally, and to performance and its reflection in financial statements. Because of these, we estimate that we must refer to theories linked to financial

informing (A) and consequently to those related to performance (B). Both theoretical initiatives will be singularized to the case of public institutions (C) in the second part of the reasoning in this subchapter.

A. Theories regarding financial reporting

Among these, the agency theory is placed first as a traditional theoretical approach. In time, alternative approaches were added to it (Colliers, 2003: 94-96). Out of these we are particularly interested in the social reporting, respectively the institutional theory. The last one is a point of interest for our study.

B. Theories regarding performance

A necessary ingredient for ensuring performance and thus value for shareholders (and other social partners), considering the separation between managers and owners, in the majority of large entities, is the control of the actual work of managers. Control is based on the notion of „contract” mirrored in two theories: the agency's and transaction costs' theory.

C. The singularization of economic theories to the public sector

- The agency theory (see for examples Fama, 1980; Alchian, 1991; Foss *et al.*, 1999)

The standard economic theory (i.e. the agency theory) takes as given the property rights system. The organizational effectiveness (1) and the contractual relationships (2) inside organizations are dependant on these system's quality and structure (Biot-Paquerot and Rossignol, 2006). The organizational effectiveness is maximized when agents (managers or project bearer) have themselves property rights, becoming actual residual claimants and contributing as such to the benefits and risks generated by this property risks.

In the public sector, more or less noticeable depending on the type of activities, the property rights system is weakened due to legal limitations (Biot-Paquerot and Rossignol, 2006). Managers are not attracted by the ownership of property rights due to their non-transferable nature, belonging to the state. This is the point from where problems linked to stirring up and controlling their activity emerge, all being amplified by their non-profit purpose and non-distribution nature of the public sector. Further on, the costs of state control grow too big, making the public authority more tolerant to discretionary practices typical to managers of the correspondent entities. Therefore, one resorts to alternative control mechanisms for solving problems that arise between different stakeholders.

In the end, the agency theory is valid both for public institutions and for private organizations (corporations) because in public entities (in all their forms, as compared to corporations where small entities are not subject to the agency theory - see Deaconu *et al.*, 2008) it is also the case of separating owner (the government) from manager. The last one must inform the government through financial statements of the manner of capitalizing the allotted resources. This outlines the importance of accrual accounting that can offer more information regarding cost, efficiency, frugality and effectiveness than cash accounting.

Another topic for discussion within the agency theory is that of the costs involved by the information asymmetry. In public organizations, theoretically speaking, the agency's costs run high because managers are ready to invest more of the organization's resources for maximizing utility. This is a reaction to the non-distribution restriction on profit. The alternative control mechanism could cut down these costs. Practically, in relation to the accounting system we estimate that, if cash accounting required small costs relative to a partial information (mainly, it

does not describe all assets, payables and the economic effect of transactions) and to a weakened control performed by the public authority, accrual accounting requires, especially for its implementing period, higher costs (i.e. Connolly and Hyndman, 2006; Scott, McKinnon and Harrison, 2003; Elwood and Newberry, 2007; Duhovnik, 2007). Still, the benefits implied by the adoption of accrual accounting would substantiate in additional control solutions that could compensate for the additional implementation costs and in time would reduce the agency's costs.

- The institutional theory

Any innovation or reform, implicitly that regarding public sector management, needs justification and lining to the existing perceptions for ensuring its legitimacy and more generally its acceptance (Munir, 2005 quoted by Windels and Christiaens, 2007). The institutional theory pinpoints the rules imposed to organizations by third persons, mainly by the government.

We are using this theory in our study for explaining the public accounting reform, more precisely for justifying the opportunity of shifting to accrual accounting. It is not our aim to apply these to more substantial purposes and find out which agents have played a decisive role in the process of adopting the reform (for example, local organizations - internal factors and the organizational context - external factors).

- The stakeholders' theory

The theory takes into account not just shareholders but also other groups of persons or interests that have an influence or that are influenced by an organization (Gray et al. (1997) and Ulman 1985 cited by Scott, McKinnon and Harrison, 2003).

For the public sector the stakeholders' theory is applicable to the following: it is consistent with the theoretical conception of accounting shift (towards accrual accounting) as being contextual, derived from external forces, social and political ones (Scott, McKinnon and Harrison, 2003); it provides the basis for identifying external factors, connected to the institutional theory described above; it explains the level of performance, potentially increased through the use of accrual accounting that offers managers new control measures.

5. Benefits of accrual accounting

For outlining and scaling the assumed and/or tested in practice benefits of accrual accounting versus cash accounting we studied the literature on the subject of management reform and international public sector accounting. We have used the content analysis method (Smith, 2003: 147-149; Dawson, 2002) identifying the different *elements* that authors used to state advantages and disadvantages, both of accrual accounting and of cash accounting. We copied these elements for each individual study, also keeping the number of citations of each category within the respective study, through a vertical (within one study) and horizontal (of all the studies) analysis. We have not analyzed the conclusions of the studies, for avoiding the multiplication of the number of citations that had already been mentioned in their content. The elements were embodied in the studies using a simple term, phrase or sentence, for example „accountability“, „more accurate costs“ or „better information for decision making“. The corresponding list is not attached to our study.

In the second part we have proceeded to open coding on a line-by-line basis (see further also Lye, Perera and Rahman, 2005), using the technique of comparison, sorting and integration. In this way we have clustered elements into themes, expressed and cited by us using a concise terminology, where applicable - e.g. „accountability”, „costs”, „decision making”. In shaping certain themes, some of our own interpretations were needed or streamlining the message for obtaining the gist. As an example, „improves the equity investment decisions” was included in „fixed assets” theme, that are expressed in a more relevant manner as existence, dynamics, consumption through accrual accounting. The final themes were centralized and divided into 2 categories according to the message and possibility of testing namely general and punctual. These are shown in Table 1. Each theme was assigned a number of points, relatively to the number of citations in the total studies (the scoring technique borrowed from economic analysis). Moreover, themes were differentiated into benefits (+) and limitations (-), resorting to another technique of economic analysis, SWOT (strength, weaknesses, opportunities and threats), which we have adapted. Pluses for accrual accounting were considered both the specific direct cited benefits and the limitations of cash accounting. By the same token, we took minuses for accrual accounting both its direct limitations and the benefits cited for cash accounting.

Lastly, we have converted all the elements mentioned as pluses and minuses into benefits of accrual accounting, by compensating pluses with minuses within the same given theme (see Table 2). We simultaneously compensated the scores initially allotted the different themes. Two of the limitations for accrual accounting could not be compensated (high costs and risks as compared to the assumed benefits, respectively the risk of political influences. Although the first theme has got 5 points, we have not considered these aspects, both out of the impossibility of introducing them in our analysis scheme and for the fact that they refer rather to post- practical implementation benefits. We are discussing the benefits generally cited, not restricting the notion to the proved ones. And for these reasons also, the theme „Volume and quality of the information” is cancelled as benefit because of the assigned score (Table 1).

The themes that reflect the benefits of accrual accounting were hierarchized by their correspondent scores in this way providing also a relevant criterion for classification in practice and for future research with the purpose of the materialization of these benefits in practical activities. With regard to our opinion, we have decided to test - within the framework of financial reporting in Romania - only the punctual themes. Out of the mentioned ones we have eliminated the « expenses » and « incomes » theme, on the basis of the arguments presented in the next chapter.

6. The analysis of financial statements before and after the implementation of accrual accounting in the Romanian public sector

6.1. Comparative presentation of the financial statements of public institutions

In the cash accounting public sector system, the purpose of yearly financial statements is to determine the situation of the patrimony and of the financial results of the institution. In the particular case of Romania, these make up a set of documents issued by the Ministry of Finance, consisting of the following

compulsory files (according to Decree no 117/2004): balance sheet, rendering account of the public institution's budget and appendices of which: expenses run-down, liquidity for special use means, payables and receivables statement, overdue payments, the status of balance accounts for liquidity accounts of commercial banks and state treasuries, the status of tangible assets, synthetic indexes of the rendering of income and expenses budget, the situation regarding the rendering of the employed budgetary expenses.

The main purpose of financial statements, according to accrual accounting, is to provide information regarding the public institution's financial position, performances and modifications of the financial position, to an increasingly large number of users involved in the economic decision making process. Their components, in Romania, are as follows (according to DPFM no. 616/2006): balance sheet, account of patrimony result, budget rendering account, status of the adjustments of home equity/net assets structure, situation of cash flows, as well as appendices among which we cite the accounting policies, explanatory notes, liquidity for special use means, payables and receivables statement, overdue payments, the amount in offbalance sheet accounts obtained from operations generated by the management of the general consolidated budget.

The professional harmonization achieved by the International Public Accounting Standards Board – IPSASB, prescribes via IPSAS 1 the general guidelines for issuing financial statements, indications regarding their structure, together with the minimum requirements for the content of public institutions' financial statements on an accrual accounting basis.

A diagram presentation that we analyze herein, of the financial statements typical of the two types of accounting systems used in Romania until 2003, respectively from 2006 on, are shortly described in Table 4 Analysis of financial statements before and after reforms.

6.2. Results of the content analysis of financial statements

We have tested the second hypothesis of our study (Chapter 2) by performing a content analysis within a case study, more specifically the financial statements of the Romanian public accounting before and after reform.

We focused on the assumed and/or tried benefits called „punctual” i.e. a better reflection of fixed assets, of payables, of financial position and results of the period. Incomes and expenses could not be tested using this method of content analysis due to its lack of relevance. Considering an equal volume of information in both sets of financial statements, their content is totally different. The difference between accrual and cash accounting consisting of the items mentioned above, reflecting the dichotomy between the two systems. We therefore do not consider them comparable in order to integrate them in our study.

The basis for the content analysis herein was the assumption that a larger volume of information and a more comprehensive description express better the theme in question.

We have first analyzed the financial statements before reform, meaning the year of 2003. This year represents the entrance in a transition period towards a total shift of cash accounting into accrual accounting, taking into account that accrual accounting elements were already embedded in the public sector. For the year 2003, the specific regulations made use of the name „Accounting report” for describing the entire set of financial statements. In our study we used standardized

documents as: Balance sheet, Expenses run-down (Appendix no. 14 according to the Decree no. 117/2004), Budgetary financing (Appendix no. 16) and Receivables and Payables statement (Appendix no. 18). We left out Liquidity for special use means and The Account of Public Institution budget rendering (Appendix no. 10 from the cited document) because those are not subject to the selected themes for testing. The Accounting Report also contained the Report analysis based on the balance sheet and the Calculation and Underlying Indicators. The last two documents' content does not offer information for supporting our research; it exclusively refers to calculation formulas of financial and economic indicators.

We have chosen as useful for our study the following financial statements required from the public sector after the reform: Balance sheet (Appendix no. 1 according to DPFM no. 616/2006), Patrimony result account (Appendix no. 2), Overdue Payments (Appendix no. 30), Statement of Payables and Receivables of local public institution (Appendix 40b) - these will be referred to as standardized format reports. Within the report called „Statement of Payables and Receivables of public institution” (as a standardized format report) we have selected only the reporting elements on an accrual basis, taking into account that the respective document provides details regarding payables and receivables in a mixed manner, both on accrual and cash basis. The others appendices or financial reports components have been left out either for not being relevant for the analyzed themes, either for having a typical format of some of the public institutions (e.g. the general consolidated budget or the social care system). Our focus was on documents applicable to all public institutions, not to one specific sector. Besides the standardized format reports, we have carried out a content-analysis of the accounting policies and explanatory notes - seen as appendices to financial statements (DPFM no. 616/ 2006). These have provided extra reporting requirements regarding the themes that we have observed.

Within standardized format financial statements we have considered just the rows that reflect precise elements for analysis, not the rows that require totals and subtotals. In the „Accounting policies and explanatory notes” record we have taking into consideration all the sentences and citation within a requirement, with regard to one specific element, that resembles the punctual themes established for the analysis, thus eliminating generic phrases.

The steps of the content analysis are cited below:

a) we have separated the established themes, for example fixed assets, in several categories that reflect the different types of contribution to the benefits of the entire theme. More specifically, for the theme of „fixed assets” we have identified 4 categories: available resources at a certain moment, dynamics, depreciation and assessment. Some differences are observed between cash accounting reporting and the accrual accounting within the structure of „Accounts payable”. Each category was expressed using a word or an expression, as equivalent textual units (Smith, 2003: 149).

b) we have calculated the category's variable: the number of rows from all standardized format documents, then adding the number of sentences/citations from the reporting named „Accounting policies and explanatory notes”. The calculation formula used for the category's variable was:

$$C_i = \frac{N_{Ci}}{T_{No}}$$

where C_i – the category's variable, based on the number of rows and sentences/citations.

N_{Ci} – the number of occurrences of i category

T_{No} – total number of rows from financial statements added to the number of sentences/ citations

c) we calculated the theme variable, by aggregating the variables from the same theme categories, based on the formula:

$$T_i = \sum_{i=1}^n C_i$$

where T_i – the category's variable, based on the number of rows and on the number of sentences/citations

d) by calculating the themes and categories' variables both for the situation before and after the reform, we drawn up a comparative situation of the two financial reporting. The results are shown in Table 3.

7. Discussions and conclusions

We have classified the benefits of accrual accounting versus cash accounting identified in the recent literature as general and punctual and we consider them useful for future researches regarding substantiation of these benefits in different national and sectorial circumstances. The punctual ones were tested through a case study - general financial statements of public institutions in Romania. Romania, like other European countries, has joined the global trend of reforming the public sector's management, assimilating also the basic component of the reform: embracing the accrual accounting instead of cash accounting. We have concluded, mainly by using the content-analysis as a research method, that accrual accounting outlines better the effect of the organization's management on performance and facilitates control over it from the costs, efficiency, frugality and effectiveness point of view.

The benefits of accrual accounting are objectified at the end in Table 3 that outlines the comparative condition of the content variables used. The superiority of accrual accounting reporting is quite obvious regarding the consistency and diversity in numbering the categories that make up the analysis themes, in other words regarding the benefits of reporting in the domain of the public sector's performance reflection. For example, the „fixed assets” theme presents the 0,136 variable in the case of accrual accounting as compared to 0,007 – the value for cash accounting. The figures show a difference of 184% that represents the extra information provided by accrual accounting regarding a relevant theme for the organization's management.

By demonstrating the advantages of accrual accounting, we here justify international intercessions, and specifically those of Romanian public authorities, of a shift towards an accounting system designed initially for the private sector management. The results of our analyses are consistent with the agency theory saying that main stakeholders (the public authority) have the right and can be informed more completely, considering a reasonable cost/benefit ratio. They are also consistent with the institutional theory that legitimates and justifies the existence and actions of public organizations. And lastly, the results of our research are consistent with the stakeholders' theory that explains firstly the external factors of shifting towards accrual accounting (see further - managerial

reform around the Globe and in Romania). Also, the theory emphasizes the role of the main public sector stakeholder that has the power to influence the organization and management through their actions. We believe that this power derives rather from the degree of stronger control via accrual accounting than from economic or legislative sources (Roberts, 1992 and Gray *et al.*, 1997 cited by Scott *et al.*, 2003).

With regard to the limitations of our study, we have identified the following: we have taken into account the assumed benefits not necessarily the already proved ones in implementation studies, we have not used case study regarding financial statements issued by organizations within the analyzed time scale, but the format of financial statements when testing the codified benefits from specific literature. Lastly, we have not tested the generic themes, just the punctual ones.

In correlation to the above said, the topic of our research can be continued by analyzing the change factors in Romania, the extent and the ways through which accrual accounting was implemented in the public sector or by measuring the substantiation of the assumed benefits of public accounting on a certain sector of these services.

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CAPITAL STRUCTURE DECISIONS OF THE ROMANIAN FIRMS

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Abstract. This paper investigates the characteristics of the Romanian firms, which represent the determinants of the capital structure according to modern theories on capital structure, and the relationship between these characteristics and firms' debt ratio. The average debt ratio of Romanian companies is lower than that observed in the case of companies in the developed countries. We elaborated a panel data model, which highlights the influence of capital structure determinants such as profitability, tangibility, firm size and growth opportunities on the debt ratios of Romanian firms. Our results are consistent with both trade-off and pecking order theories of capital structure.

JEL Classification: G32

Keywords: capital structure, panel data, theories of capital structure

1. Introduction

The issue of optimal capital structure and its determinants has been the main focus of financial research for more than five centuries. The groundwork of this research is represented by the seminal work of Modigliani and Miller (1958) related to the irrelevance of the capital structure for the value of the firm. The subsequent studies (Jensen & Meckling, 1976; Myers, 1984; Miller, 1977) have mostly focused on the relaxation of the assumptions made in the Modigliani and Miller paper (i.e., perfect market and no taxes), including in the capital structure models variables such as: taxes, bankruptcy costs, information asymmetries, and agency costs. These models represent the basis of the modern capital structure theories (i.e., trade-off theory, pecking order theory and agency theory).

The current state of research is characterized by the lack of an underlying general theory of capital structure (Myers, 2001). The modern theories are conditional theories that differ in their relative emphasis on the factors that affect debt-equity ratio (Constantinides, 2003).

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Despite this lack of a general theory, the generated literature has identified several macroeconomics and firms' specifically explanatory factors of capital structure. Some of these factors are similar for all countries, but there are also differences in capital structure choices between countries due to the unique institutional structure of each country.

Most of the capital structure studies have been realized for developed economies which are characterized by institutional similarities and have similar financing decisions (Rajan and Zingales, 1995; Wald, 1999). Therefore, the studies for developing countries tried to determine whether capital structure determinants in these countries support the hypotheses of capital structure theories developed to explain Western economies (Chen, 2004, Delcoure 2007). The results showed that firms' capital structure in developing countries follows a "new pecking-order theory".

Extending the studies conducted for developing countries, the purpose of this paper is to determine whether the capital structure determinants in Romania support the theories of capital structure (i.e., trade-off theory, pecking order theory, and agency theory) and the empirical evidence for other developed and developing countries.

The remainder of this paper is organized as follows. Section 2 outlines the theories of capital structure and the determinants of financing decisions suggested by these theories. Section 3 provides an overview of Romanian capital market characteristics. Section 4 presents the model and the research methodology. Section 5 describes the results of the estimation and Section 6 presents the conclusions.

2. Capital Structure Theories and Previous Empirical Findings

Our predictions are based on the assumptions of trade-off, pecking order and agency theories, more specifically how firms' debt ratio varies according to the determinants of capital structure.

In what follows, we will briefly review the determinants of the capital structure which are underlined by the each of the aforementioned theories.

2.1. The trade-off theory

The trade-off theory states that the optimal debt-equity ratio balances the corporate tax advantages of debt against the cost of financial distress. According to Myers (1984), a firm that follows the trade-off theory sets a target debt ratio and then gradually moves toward the target.

This target debt ratio varies according to the firms' characteristics. For example, large, safe firms with a large proportion of tangible assets tend to borrow more than small, risky firms with mostly intangible assets. Also, firms with high profitability and valuable growth opportunities tend to borrow less and firms with more profitable assets in place, fewer investments, less volatile earnings and net cash-flow have higher leverage (Myers, 2003).

2.2. The pecking-order theory

The pecking order theory elaborated by Myers and Majluf (1984) is based on information asymmetry. Myers and Majluf (1984) showed that, if investors do not know the true value of a firm's assets, then equity may be mispriced by the

market. If firms are required to finance new projects by issuing equity, underpricing may be so severe that new investors capture more than the net present value of the new project, which could result in a net loss to existing shareholders. This issue of underinvestment can be avoided if the firm finance the new project using financial resources that are not undervalued by the market (Harris and Raviv, 1991). Amongst the financial resources a firm can use are included internal funds and riskless debt.

Myers (1984) denoted the above mentioned situation as pecking order theory, which states that in the first place firms will finance new investments with internal funds, then with low-risk debt and finally with equity as a last resort.

According to pecking order theory, more profitable firms borrow less, because they have more internal financing available and less profitable firms require external financing, and consequently accumulate debt (Myers, 2003).

2.3. The agency theory

According to agency theory initiated by Jensen and Meckling (1976), the interests of managers are not aligned with those of shareholders, and managers tend to waste free cash flow on perquisites and bad investments. The solution for these agency problems could be dividends and especially debt which force managers to pay out more of the firm's excess cash. A firm's free cash flow is determined by its assets in place and the size of its profitable investments. In order to control the agency costs created by free cash flow, firms with more profitable assets in place use a large fraction of their earnings to debt payments. Thus, monitoring previously identified investment opportunities, the debt ratio should be positively related to profitability. The issues of underinvestment and asset substitution, which arise when debt is risky and the stockholder-bondholder agency problem occurs, lead to the prediction that firms with more investments have less leverage (Jensen and Meckling, 1976; Myers, 1977). Finally, according to the agency theory, dividends and debt are substitutes for controlling free cash flow problems, so the predicted relationship between target leverage and target payout ratio should be negative.

2.4 Previous empirical findings

The empirical studies tried to establish how debt ratio varies according to firms' characteristics using panel data models which includes both macroeconomic and firms specific factors. Most of the studies were conducted on American companies and the results were extended to other countries regardless their economic characteristics.

An important study of Frank and Goyal (2003) examined the importance of 39 macroeconomic and firms' specific factors for the publicly traded US firms' leverage. The authors used a linear regression with one year lagged factors and data for the period 1950-2000. The findings indicated that debt ratio is positively related to firms' size and tangibility, but negatively related to risk and market-to-book ratio. From the theoretical perspective, the financing behaviour of American firms is explained by the trade-off theory assumptions.

In order to explain the differences between financing decisions of firms in developed countries and those from developing countries, Booth and collaborators (Booth, Aivazian, Demircuc-Kunt, and Maksimovic, 2001) analyzed the capital structure of companies from 10 developing countries. The authors used an

unbalanced panel model and the fixed effects method in order to establish the determinants of both total debt ratio and long-term debt ratio of the firms from the sample. The total debt ratio was negatively correlated to profitability, tangibility and market-to-book ratio and the long-term debt ratio was positively correlated to tangibility. The differences between developed and developing countries in terms of firms financing decisions are explained by the fact that debt ratio is influenced by GDP growth rate, inflation rate and capital market development.

Similar results were found for CEE countries, including Romania, by Nivorozhkin (2005) using a dynamic adjustment model in order to study the optimal capital structure of the firms. More specifically, the debt ratios of the companies from CEE countries are lower than those from developed countries and they are positively correlated to income variability, tangibility, firm's size, but negatively correlated to profitability, firm's age and net trade credits.

Another important result obtained by Nivorozhkin (2005) was related to the fact that the speed of the firm's leverage adjustment tends to increase as the distance to the target leverage increases.

All the aforementioned results seem to validate the existence of both, different and similar determinants of capital structure across the developed and developing countries. As a consequence, there is a need of taking into account the specific characteristics of the Romanian capital market in order to identify the factors that influence the firms financing decisions.

3. Romanian Capital Market

Since the Romanian revolution in 1989, a major objective of the successive governments has been to promote reform programmes in all sectors: politics, economics, local administration, etc. A very important implemented measure was the development of a Romanian capital market which was founded on the privatisation programme. By 2002, Romania had privatized many major state-owned enterprises with the help of the World Bank, the International Monetary Fund (IMF), and the EU. Nonetheless, an estimated 45% of industrial assets remain owned by the state, particularly in the energy and mining sectors. The private sector in 2002 accounted for an estimated 65% of gross domestic product (GDP).

Bank privatization did not begin until 1998 and has proceeded slowly with the share of state-owned bank assets exceeding 50% through the late 1990s. The largest state-owned banks were overburdened with non-performing loans, which reached 70% of total loans for some banks. Furthermore, 2% of GDP was allocated for bank restructuring in 1999. As a consequence of the government support for banks domestic debt substantially increased. However, domestic credit to private sector remained low, averaging 12% of GDP for the period 1996-2000.

The Romanian capital market has two components: The Bucharest Stock Exchange (with around 70 companies listed) and RASDAQ market (with around 1600 companies listed). All the listed companies are divided into three groups based on some specific criteria, more specifically tier 1, tier 2 and tier 3.

The macro-financial environment of Romania is typical for countries moving from centrally planned to market-oriented economies. Since 2000, the government has implemented macroeconomic policies which are supportive for economic growth (i.e., a disciplined fiscal policy, a tight monetary policy). These improvements resulted in GDP growth of above 7% for five consecutive years

(2003-2007). In addition, inflation declined steadily (during the years 2003-2007 it has seen a low of 2,3% and a high of 6,3%), the fiscal deficit was brought under control, foreign exchange reserves increased to historic highs and external debt was held to a comfortable level.

Foreign direct investment in Romania has increased dramatically, growing by 600% since 2000 to around \$ 13.6 billion or \$ 2.540 per capita by the end of 2004. All these macroeconomic factors had an important influence on the financing decisions of Romanian firms.

4. Model and Research Methodology

4.1. Variables of the model

According to the aim of this study, that is to determine the factors which influence the Romanian firms' capital structure, we use some variables and their measurements largely spread in the existing literature.

The dependent variable used in our panel data model is the *debt ratio*, which can be measured through different proxies. The main difference among debt ratio proxies concerns the use of book values versus market values. Because of the data limitations, we used book values rather than market values. Following the De Miguel and Pindado (2001) and Nivorozhkin (2005) approaches we defined the debt ratio as the ratio between the book value of total debt and total debt plus the book value of equity.

The explanatory variables which affect the debt ratio of the Romanian firms were selected based on the assumptions of the capital structure theories and the findings of the previous studies.

The first explanatory variable which is mentioned in both theories of capital structure (i.e., trade-off and pecking order) is *profitability*. The trade-off theory predicts a positive relationship between debt ratio and profitability, because a higher profitability results in more income to shield. Contrary to the assumptions of the trade-off theory, the pecking order theory predicts that more profitable firms will have a lower debt ratio, because firms use first of all, as financing sources, the available internal funds.

Following approaches initiated by Rajan and Zingales (1995) and Nivorozhkin (2005), we use the ratio of earnings before interest and taxes to total assets as a proxy for profitability and predict a negative relationship between debt ratio and profitability.

In the financial literature (Diamond, 1991; Rajan & Zingales, 1995; Titman & Wessels, 1988) *firm size* is one of the most important factors which influence the debt ratio. Large firms are more likely to be debt-financed in comparison with smaller firms and there are several reasons for this. One of the reasons is mentioned by Titman and Wessels (1988) who suggested that larger companies tend to be more diversified and, thus, less prone to bankruptcy. In other words, larger companies have a higher debt ratio which is one of the assumptions of the trade-off theory. Another reason is stipulated by Diamond (1991) who observed that larger firms have a reputation of good payers and a long existence and subsequently have priority to procure the debt financing.

In Romania, the firm size can be measured either through the number of employees or through net sales. Because net sales are a more appropriate proxy

for our goal, we use the natural logarithm of net sales and predict a positive relationship between firm size and debt targets.

Another determinant of optimal capital structure used in many studies (Cornelli et al., 1998; Nivorozhkin, 2002; Rajan and Zingales, 1995) is *tangibility* calculated as the ratio between tangible fixed assets and total assets. Tangible assets serve as collateral and this hypothesis suggests a positive relationship between tangibility and debt ratio of firms. Although the results for developed countries (Rajan and Zingales, 1995; Titman and Wessels, 1988) support this hypothesis, those for developing countries indicate a negative relationship between debt ratio and tangibility (Cornelli et al., 1998; Nivorozhkin, 2002). In developing countries, the importance of tangible assets as collateral is limited by a number of factors such as underdeveloped and inefficient legal systems, illiquid secondary market. Based on the aforementioned results, we expect to find a negative relationship between debt ratio and tangibility of the Romanian firms.

According to the trade-off theory, firms with great *growth opportunities* tend to borrow less than firms which hold more tangible assets, because growth opportunities cannot serve as tangible assets. Similarly, the pecking order theory argues that firms with high growth opportunities should use less debt for financing, because they may hold more options for future investments than firms with low growth opportunities (Myers and Majluf, 1984). Following the Chen (2004) approach, we used the ratio of sales growth to total assets growth as a measure for growth opportunities and we predict a negative relationship between debt ratio and growth opportunities.

4.3 Regression model

The basic regression model that we used in order to estimate the coefficients of the capital structure determinants is as follows:

$$D_{i,t} = \alpha_1 + \alpha_2 Profitability + \alpha_3 Firmsize + \alpha_4 Tangibility + \alpha_5 Growth + u_{it} \quad (1)$$

where $i = 1, 2, \dots, 109$ is the number of the firms from the sample, $t = 1, 2, \dots, 5$ is the number of years of observations and $D_{i,t}$ is the debt ratio.

u_{it} is a disturbance term defined as :

$$u_{it} = \mu_i + v_{it} \quad (2)$$

Where μ_i is an unobservable individual effect and v_{it} denotes the remainder disturbance.

This study used data from the financial reports of 109 Romanian public-listed companies for the period 1995-2000. Financial firms (i.e., banks, insurance companies and investment trusts) were excluded from the sample because the balance sheets of these firms have a different structure from those of nonfinancial ones. The firms with any missing observations of each variable included in the model and those with negative financial results were also omitted.

The average debt ratio of the Romanian sample (0, 35 or 35%) is modest in comparison with those of developed economies: 52% for the United States, 69%

for Japan,73% for Germany and 54% the United Kingdom (Rajan and Zingales, 1995), but is similar in comparison with those of transition economies: 43% for Czech Republic and 34% for Russia (Delcours, 2007) .

5. Results and discussions

For the estimation of the model we used two estimation methods: fixed effects and random effects. The results of the estimation are presented in Table1.

Table 1. The Regression Results

Independent variables	Fixed effects	Random effects
Profitability	-0,344***(0.000)	-0,316***(0.000)
Size	0.067***(0.000)	0.036***(0.000)
Tangibility	-0.315***(0.000)	-0.294***(0.000)
Growth opportunities	0.001 (0.329)	0.002 (0.277)
R ²	0.86	0.14
Adj. R ²	0.82	0.13

*** Significant at 1% level

As indicated in Table 1, the fixed effects method has a statistical advantage over the random effects method, because the fixed effects model has the highest R². In order to test the fixed effects method versus random effects method we used the Hausman specification test. The test statistic is 13,02 and is asymptotically χ^2 with four degrees of freedom. The random effects method is rejected in favour of the fixed effects method at a 10% critical level.

Furthermore, both estimation methods found a statistically significant negative correlation between profitability and debt ratio which support, at first glance, the pecking order hypothesis. But, similar to the financing behaviour of firms from the other CEE countries, Romanian banks provide short term loans rather than long-term loans to firms, so the firms have to finance their investment with equity. In addition, in Romania shareholders' protection laws are weak. Thus, managers prefer retained earnings as financing source because this is the quickest and easiest source of financing a firm. These financing behaviours support Chen's (2004) so-called new pecking order theory which states that firms use as financing sources first retained earnings, then equity, and finally debt.

The relationship between the firm size and debt ratio is positive and statistically significant. This result supports the trade-off prediction, which states that large firms are more diversified, less prone to bankruptcy and, as consequence, they have a higher debt ratio. Another explanation for the obtained positive relationship between debt ratio and firm size could be related to the fact that banks give more credits to the large firms, because these are more credible.

Relative to the firms with high proportions of tangible assets, we found that these have a lower debt ratio because the coefficient is negative and significant. This result contradicts the trade-off hypothesis, which states that tangible assets are used as collateral, and the results of empirical studies conducted for developed countries (Rajan and Zingales, 1995; Titmann and Wessels, 1988). On the other

side, this result supports the evidence for developing countries (Cornelli et al., 1998; Nivorozhkin, 2002).

The relationship between growth opportunities and debt ratio is positive, but is not statistically significant.

10. Conclusions

The purpose of this paper was to examine the determinants correlated to the firms' debt ratios that have been mentioned in the previous studies validating the theories that are at work in explaining the financing decisions of the Romanian firms.

The average debt ratio for Romanian firms is 35% compared to a mean of 66% for the G7 countries (Rajan and Zingales, 1995) and it is quite similar to a mean of 50% for firms in developing countries (Booth et al., 2001).

For our purpose, we developed a panel data model using data from 109 Romanian public-listed companies for the period 1995-2000 and we estimated the model using the fixed-effects and random-effects methods. The results indicated that the fixed-effects method has a slight advantage over the random-effects model which means we will take into account the findings obtained by the most efficient method.

Our predictions about the relationships between debt ratio and determinants of the Romanian capital structure were confirmed, excepting the growth opportunities. The results show that the firm size is positively related to the debt ratio, while the profitability and tangibility are negatively associated with debt ratio. Thus, these results confirm some of the assumptions of the trade-off and the pecking order theories which partially explain the financing decisions of Romanian firms.

Taking into account the fact that financing decisions of the Romanian firms are influenced by the economic reality, firms prefer equity to debt financing because equity is a "free" source of capital. This financing behaviour of the Romanian firms follows the "new pecking order theory" initiated by Chen (2004).

To sum up, the findings of this study suggest that capital structure choices of the Romanian firms are different from those of the companies from developed countries, but quite similar with those from developing countries.

Acknowledgments

This paper was supported by Grant PN II IDEI 2366.

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