GSIM Measurement of the Effects of the EU accession of the Balkans and Turkey on Agricultural Trade

Mario Holzner *

Abstract:

In this paper, the global simulation model (GSIM) for the analysis of global, regional, and unilateral trade policy changes by Francois and Hall (2003) was applied to the agricultural trade between the EU, the Balkans and Turkey. This was done in order to measure the effects of an EU accession of the Balkans and Turkey. Most of the changes in welfare after a full liberalisation of agricultural trade between the Balkans and Turkey on the one hand and the EU on the other hand can be expected in the accession countries themselves. It is estimated that incumbent EU members will be affected only to a minor extent. It was also estimated that the exchange rate risk is not very high.

Keywords: Trade Policy Modelling, Southeast Europe, Turkey, EU Integration, Trade in Agriculture, Real Exchange Rate

JEL: F15, F17, F31, Q17 **DOI: 10.2478/v10033-008-0001-0**

1. Introduction

The aim of this study is to analyse the effects of a potential EU accession of all the Southeast European countries (SEECs) and Turkey on agricultural trade with the incumbent EU member countries and Austria in particular. The study is financed by the Federal Ministry of Agriculture, Forestry, Environment and Water Management of the Republic of Austria. The effects of a full trade liberalisation of both processed and unprocessed agricultural goods shall be measured using the global simulation model (GSIM). The model estimates trade effects, welfare effectsz (producer surplus, consumer surplus and change in tariff revenue) and price and output changes. Also, the impact of a real exchange rate distortion on agricultural trade shall be analysed. Here we focus specifically on Turkey, as all the other Balkan countries have a *de facto* fixed exchange rate *vis a vis* the euro, a currency board, have even taken over the euro as legal tender, or will enter the European Exchange Rate Mechanism soon. Apart from falling trade barriers, 'beggar-my-neighbour' exchange rate policy is often considered as a threat.

The study is based on earlier, similar research done on the measurement of the costs of protection and real exchange rate distortion in Southeast Europe (see Holzner 2004, 2006a, 2006b) as well as analysis of the development of Central and East European agriculture in an EU context (see Lukas and Pöschl, 2003).

2. The Model

The model that will be applied in this study is the global simulation model (GSIM) for the analysis of global, regional,

*Holzner:
The Vienna Institute for
International Economic Studies (WIIW)
Oppolzergasse 6, 1010 Wien, Austria
e-mail: Holzner@wiiw.ac.at

and unilateral trade policy changes by Francois and Hall (2003)[1]. The model is a multi-region, imperfect substitute model of world trade, employing a partial equilibrium approach.

Using a fully-fledged general equilibrium model (which would have to include a full endogenisation of income and expenditure levels across the region) would be too ambitious a task for this project, especially given the short period since the Balkans have settled into an economic region without major military-political conflicts that had serious impacts on data availability and behavioural stability. However, the partial equilibrium approach implies also some useful advantages because it allows for a relatively rapid and transparent analysis of a wide range of commercial policy issues with a minimum of data and computational requirements. In any case, a general equilibrium model does not seem to be useful as the Balkans lack proper and necessary input-output tables.

Having the limitations of the partial equilibrium approach in mind, useful insights can be drawn with regard to relatively complex, multi-country trade policy changes at the industry level. The results of the GSIM allow the assessment of importer and exporter effects related to tariff revenues, exporter (producer) surplus, and importer (consumer) surplus.

The model requires the input of a bilateral trade matrix at world prices, an initial matrix of bilateral import tariffs and export subsidies in ad valorem form, a final matrix of bilateral import tariffs and export subsidies in ad valorem form, export supply elasticities, aggregate import demand elasticities and elasticities of substitution. Using additional data, domestic production subsidy effects can also be fit into the framework. For a more detailed description of the model see Francois and Hall (2003).

3. The Data

The data necessary to run the GSIM model is thus detailed tariff[2] (as well as data on subsidies) and trade data (including data for trade with self, i.e. sales in the domestic market) as well as estimates of demand, supply and substitution elasticities. In our model we want to estimate the effects of trade policy changes in agricultural trade on the following world regions and countries: Austria, EU-14[3], New Member States (NMS)[4], East Balkan Countries (EBC)[5], West Balkan Countries (WBC)[6], Turkey and the Rest of the world (ROW). Moreover we want to focus our analysis on both unprocessed and processed agricultural goods.

All the necessary data was taken from the Global Trade Analysis Project (GTAP) database, Version 6.2. The original data represents the situation in the year 2001. However in order to achieve a current ('2006') base year data set we simulated in the first step the EU accession of ten new member states (NMS). The results of this simulation are used as a base for the modelling of the EU accession of the Balkans and Turkey.

The export supply elasticity (1.5), aggregate import demand elasticity (-1.25) and the elasticity of substitution (5) were adopted from Francois and Hall (2003). However, in the case of the EU-14 and the ROW an 'infinite' export supply elasticity (100) was assumed. This flattens out the supply curves and is in line with a small vs. large country assumption.

These are certainly very simplified assumptions. However, due to scarce data it would be almost impossible to estimate 'true' elasticities. It could be thought of employing average elasticities as e.g. described in 22 industry studies by Messerlin (2001). There especially the elasticities of substitution seem to be in general much lower than 5. However, in the literature an elasticity of substitution of 5 is used quite often (see also Fujita, Krugman and Venables 2000).

4. The Results

After feeding the model step by step with the initial bilateral trade matrix (including trade with self), at world prices, the initial matrix of bilateral import tariffs and export subsidies in ad valorem form, the final matrix of bilateral import tariffs and export subsidies in ad valorem form, as well as the production subsidies and the elasticities, the following output is estimated: trade effects, welfare effects (producer surplus, consumer surplus and change in tariff revenue) and price and output changes. This task was done for processed and unprocessed agricultural goods separately. A full liberalisation of trade between the Balkans, Turkey and the EU countries was assumed. West and East Balkan countries and Turkey are assumed to take over the EU's trade protection measures against the rest of the world. Trade protection of the rest of the world against the Balkans and Turkey was assumed to change to the current level of protection *vis a vis* the EU. In short this can be called a 'year 2020 scenario'. We also analyse agricultural trade in a scenario where Turkey is assumed to devalue its real exchange rate by 10%, while the other Balkan countries have a fixed exchange

1 The GSIM model can be downloaded, implemented in an Excel spreadsheet, from Joseph Francois' Homepage at: http://www.intereconomics.com/handbook/Models/Index.htm

2 Data is trade weighted.

3 Pre-2004 EU member states, excluding Austria.

4 Ten countries that acceded the EU in May 2004.

5 Romania and Bulgaria joined the EU in January 2007.

6 Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia.

rate regime against the EU. We will deal with these two scenarios separately.

4.1. EU accession scenario '2020'

In this simulation we compare the situation before the accession of Romania and Bulgaria with a hypothetical situation where all the Balkan countries as well as Turkey became members of the EU. We model for unprocessed as well as processed agricultural goods trade.

According to our results a big southeastern EU accession would generally have positive net welfare effects in the unprocessed agricultural sector of all countries and regions involved (see Table 1). Gains for the incumbent EU members (Austria, EU 14, NMS) appear to be rather modest. Romania and Bulgaria (EBC) would profit most in the medium and long run. Their net welfare gain would make about 700 mn USD. This is even assuming that the high EU subsidies would be borne by themselves. Given that the EU subsidies scheme does not change by that time, the EBC unprocessed agricultural sector would be subsidised by close to 6 bn USD. The WBC net welfare gains are at around 200 mn USD and those of Turkey close to 50 mn USD. These stem from strong gains both in consumer and producer surpluses, which are caused falling overall consumer prices due to the annulment of tariffs and a heavy increase in producer and export subsidies.

The effects for the incumbent EU members are negligible. Austria, for instance, would have a net welfare gain of 7 mn USD. In terms of change in output, the old EU members would face a marginal decrease of 0.1% to 0.2%. On the other hand, it is estimated that the acceding countries could increase their output quite strongly. The output of unprocessed agricultural goods in the WBC region could expand by a quarter, and that of the EBC and Turkey by about 20% and 10% respectively.

Apart from some increase in trade flows across regions, the major source of the estimated output increases in the Balkans and Turkey is a strong surge in trade with themselves. This is due to several reasons. On the one hand, trade liberalisation leads to a general fall in the overall consumer prices due to cheaper imports, but also via competition due to a fall in the price of domestic products (at least in the case of the EBC and Turkey). This, in turn, leads to an increase in domestic demand. On the other hand, domestic producer prices do not fall but rather increase, given that the EU production and export subsidies scheme is applied in the Balkans and Turkey as well. Thus producers do not reduce their output but increase it.

Welfare, Price and Output Effects of an EU accession of EBC, WBC and Turkey in the Unprocessed Agricultural Sector, USD mn

	welfare					other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
Austria	-7	13	-3	3	7	-0.2%	-0.2%	-0.2%	-0.2%
EU 14	-159	276	-57	71	130	-0.1%	-0.1%	-0.1%	-0.1%
NMS	-44	56	-7	24	29	-0.2%	-0.2%	-0.1%	-0.1%
EBC	4755	5901	-4134	5808	713	-13.5%	18.0%	12.0%	-3.7%
WBC	1358	1690	-1594	1251	203	-17.1%	25.8%	17.2%	0.8%
Turkey	1545	1284	-139	2644	46	-5.8%	10.0%	6.7%	-5.6%
ROW	-185	388	-11	13	204	0.0%	0.0%	0.0%	0.0%

Table 1

Table 2 shows the resulting trade matrix after the EU accession of the Balkans and Turkey in the unprocessed agricultural sector. In the upper part the real percentage change of trade quantities is presented, while in the lower part the change in values of trade at world market prices in USD mn is shown. It can be observed that especially Bulgaria and Romania (EBC) as well as Turkey are able to increase their inter- and intra-regional exports after accession to quite an extent, at least in relative terms. In absolute terms, the figures seem to be less impressive. A major change in absolute values is found in trade with

Trade Quantities and Value Changes After the EU accession of EBC, WBC and Turkey in the Unprocessed Agricultural Sector, USD mn

		Trade quantities: percent change						
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-0.1	0.4	0.1	-3.9	-36.2	1.5	0.7
	EU 14	-0.5	-0.1	-0.3	-4.3	-36.6	1.1	0.3
	NMS	-0.1	0.3	0.1	-4.0	-36.3	1.4	0.6
	EBC	66.6	67.0	66.7	17.3	62.0	41.2	47.2
	WBC	-5.2	-4.7	-5.0	17.8	27.2	27.8	16.3
	Turkey	34.9	35.3	35.1	58.9	36.9	6.0	46.5
	ROW	-0.8	-0.3	-0.6	-34.2	-53.2	27.5	0.0

		Trade at world prices: change in values						
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-10.0	0.6	0.0	-0.1	-9.2	0.0	0.4
	EU 14	-5.8	-297.5	-7.2	-7.1	-99.2	3.7	15.7
	NMS	-0.5	2.5	-26.2	-4.6	-85.0	0.1	3.1
	EBC	7.0	153.9	22.4	4632.1	12.0	11.1	116.6
	WBC	-0.7	-7.5	-1.8	1.2	1846.4	4.0	29.8
	Turkey	16.2	312.4	34.9	24.3	8.4	8.9	454.1
	ROW	-2.9	-95.9	-8.1	-96.2	-100.0	311.0	-474.1

Table 2

self of the EBC and the WBC region with a plus of USD 4.6 bn and USD 1.8 bn, respectively. Unsurprisingly, WBC exports to the incumbent EU members do not increase, as these exports were not already facing tariff barriers before accession.

On the other side, Austria, the EU 14 and the NMS do not face any substantial changes in exports to the Balkans and Turkey, the sole exception being a reduction of exports to the West Balkans by about a third. Given the heavy increase of 28% of the WBC trade with self, incumbent EU exporters can't profit from the abolition of WBC tariff barriers. However, in absolute terms, this is not a significant loss. Austria, for instance, would reduce its exports of unprocessed agricultural goods to the WBC by only USD 9 mn. In total, for a country like Austria, the EU accession of the Balkans and Turkey has only a minor effect on the unprocessed agriculture sector. Total exports are estimated to fall by USD 8 mn, total imports increase by USD 13 mn and domestic sales decrease by USD 10 mn.

In the case of the Balkan and Turkish EU accession effects on the processed agricultural sector, the results are quite similar, although of lower magnitude (see Table 3). All the countries and regions are expected to face a modest, positive two-digit USD mn net welfare effect. Only the West Balkans and Turkey might loose about USD 40 mn and USD 45 mn, respectively. This is because in the first case the loss in tariff revenues is significant, and in the second the overall consumer price after liberalisation actually increases, making the consumer surplus is negative. This sector's output is expected to increase or at least stagnate in all the regions. The WBC and the EBC can generate by far the highest output increases with 12% and 6%, respectively.

Again, these output increases are mostly due to a significant surge in intra-regional sales in both the EBC and WBC of USD 3.5 bn and USD 1.2 bn after liberalisation

Welfare, Price and Output Effects of an EU accession of EBC, WBC and Turkey in the Processed Agricultural Sector, USD mn

	welfare					other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
Austria	8	-3	-6	14	14	0.0%	0.1%	0.0%	0.0%
EU 14	60	25	-138	109	56	0.0%	0.0%	0.0%	0.0%
NMS	13	9	-38	60	43	0.0%	0.0%	0.0%	0.0%
EBC	1537	2237	-3671	-18	86	-5.5%	6.4%	4.3%	4.3%
WBC	462	826	-1319	-10	-41	-9.8%	11.9%	7.9%	7.9%
Turkey	170	-111	-53	-52	-46	0.7%	1.5%	1.0%	1.0%
ROW	-97	171	8	-3	78	0.0%	0.0%	0.0%	0.0%

Table 3

Trade Quantities and Value Changes After an EU accession of EBC, WBC and Turkey in the Processed Agricultural Sector, USD mn

	Trade quantities: percent change							
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-0.2	-0.3	-0.3	77.7	5.3	44.7	-0.3
	EU 14	0.0	-0.1	-0.1	77.8	5.5	44.9	-0.1
	NMS	0.0	-0.1	-0.1	77.8	5.4	44.9	-0.1
	EBC	49.5	49.4	49.4	5.7	90.5	108.2	41.2
	WBC	-10.5	-10.6	-10.6	19.6	16.3	73.2	-35.8
	Turkey	56.1	56.0	56.0	83.0	55.3	-2.6	40.5
	ROW	0.1	0.0	0.0	-3.3	-48.7	7.1	0.0

	Trade at world prices: change in values							
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-16.9	-4.3	-0.8	32.6	7.2	4.1	-1.2
	EU 14	0.9	-315.0	-3.3	301.2	44.3	141.6	-20.1
	NMS	0.0	-2.8	-77.9	63.7	34.9	17.8	-2.5
	EBC	5.7	115.5	56.0	3517.9	38.0	15.5	71.3
	WBC	-0.5	-14.5	-4.4	1.2	1215.6	2.1	-56.4
	Turkey	12.8	299.3	55.4	14.1	16.6	-239.2	265.3
	ROW	0.3	1.3	-0.3	-11.7	-117.0	37.6	-153.8

Table 4

(see Table 4). Otherwise it is the EBC and Turkey especially that can increase substantially their exports to the other regions, at least in relative terms. The incumbent EU members face only minor export changes except for the relative change in exports to the EBC and Turkey that are estimated to increase by almost 80% and 45% respectively. However, it has to be noted that an increase of Austrian exports to the EBC of 78% in real terms is related to an increase of some USD 33 mn in world prices only. In total, Austria would experience an increase of exports of USD 38 mn, an increase of imports of USD 19 mn and a decrease of domestic sales of processed agricultural goods of USD 17 mn.

One of the reasons for a more balanced result in the case of the processed agricultural sector as compared to the unprocessed agricultural sector is because here production subsidies are not relevant. In general it has to be said that the effects of an EU accession of the Balkans and Turkey are estimated to be only of a modest magnitude and will not affect both the processed and the unprocessed agricultural sector, especially in the incumbent EU member countries.

4.2. Turkish devaluation

In this simulation we analyse agricultural trade changes in a scenario where Turkey is assumed to devalue its real exchange rate by 10%, while the other Balkan countries have a fixed exchange rate regime against the EU. Here we focus specifically on Turkey, as all the other Balkan countries have a de facto fixed exchange rate vis a vis the euro, a currency board, have even taken over the euro as legal tender or will enter the European Exchange Rate Mechanism soon. Apart from falling trade barriers, 'beggar-my-neighbour' exchange rate policy is often considered as a threat.

Welfare, Price and Output Effects of a Turkish Real Exchange Rate Devaluation of 10% in the Unprocessed Agricultural Sector, USD mn

	welfare					other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
Austria	-4	9	-6	0	-1	-0.2%	-0.1%	-0.1%	-0.1%
EU 14	-141	227	-112	0	-26	-0.1%	-0.1%	-0.1%	-0.1%
NMS	-14	24	-13	0	-3	-0.1%	-0.1%	0.0%	0.0%
EBC	-13	18	-6	0	-2	0.0%	0.0%	0.0%	0.0%
WBC	-5	8	-3	0	-1	-0.1%	-0.1%	-0.1%	-0.1%
Turkey	514	-613	96	0	-3	2.9%	3.5%	2.3%	2.3%
ROW	-312	405	-118	0	-25	0.0%	0.0%	0.0%	0.0%

Table 5

Trade Quantities and Value Changes After the EU accession of EBC, WBC and Turkey in the Unprocessed Agricultural Sector, USD mn

		Trade quantities: percent change						
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-0.1	0.4	0.1	-3.9	-36.2	1.5	0.7
	EU 14	-0.5	-0.1	-0.3	-4.3	-36.6	1.1	0.3
	NMS	-0.1	0.3	0.1	-4.0	-36.3	1.4	0.6
	EBC	66.6	67.0	66.7	17.3	62.0	41.2	47.2
	WBC	-5.2	-4.7	-5.0	17.8	27.2	27.8	16.3
	Turkey	34.9	35.3	35.1	58.9	36.9	6.0	46.5
	ROW	-0.8	-0.3	-0.6	-34.2	-53.2	27.5	0.0

		Trade at world prices: change in values						
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-10.0	0.6	0.0	-0.1	-9.2	0.0	0.4
	EU 14	-5.8	-297.5	-7.2	-7.1	-99.2	3.7	15.7
	NMS	-0.5	2.5	-26.2	-4.6	-85.0	0.1	3.1
	EBC	7.0	153.9	22.4	4632.1	12.0	11.1	116.6
	WBC	-0.7	-7.5	-1.8	1.2	1846.4	4.0	29.8
	Turkey	16.2	312.4	34.9	24.3	8.4	8.9	454.1
	ROW	-2.9	-95.9	-8.1	-96.2	-100.0	311.0	-474.1

Table 6

Assuming that each measure of economic policy can be substituted by another with regard to its effects, we shall feed the GSIM instead of tariff rates with the rate of the initial real exchange rate undervaluation of Turkey and the final overvaluation of all the other regions of 10%. From earlier research we know that a 10% real exchange rate devaluation could be triggered *inter alia* by a nominal exchange rate depreciation of about 65% (see Holzner 2006b). Thus we are checking for quite a substantial policy change.

As was done in the chapter before, we will again look separately at the unprocessed and processed agricultural sectors. For the unprocessed agricultural sector in the analysed regions we find hardly any net welfare effect from a 10% Turkish real exchange rate devaluation (see Table 5). Also, output changes are close to zero. Only Turkey itself can increase output by some 3.5% after depreciation. Please note that in this case information on changes in tariff revenue is inappropriate and should be disregarded. With regard to relative changes in real trade flows we can observe a reduction of Turkish imports by close to 40% and an increase of Turkish exports by about 35% (see Table 6). Most substantially, Turkish exports to the EU 14 are estimated to increase by USD 424 mn. Austia's total exports in the sector analysed would decrease by half a million USD only. Austrian imports would increase by USD 16 mn, and domestic sales would drop by about USD 10 mn.

Again, the simulation estimated for the processed agricultural sector behaves pretty similar. The net welfare effects of a Turkish devaluation are even less important than in the case of unprocessed agricultural goods (see Table 7). While the output of the other regions in the world does not change, Turkish output rises by some 2.6%. Please note again that in this case information on changes in tariff revenue is inappropriate and should be disregarded.

Welfare, Price and Output Effects of a Turkish Real Exchange Rate Devaluation of 10% in the Processed Agricultural Sector, USD mn

	welfare					other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
Austria	-3	5	-2	0	-1	0.0%	0.0%	0.0%	0.0%
EU 14	-101	141	-52	0	-12	0.0%	0.0%	0.0%	0.0%
NMS	-16	23	-10	0	-2	0.0%	0.0%	0.0%	0.0%
EBC	-6	8	-2	0	0	0.0%	0.0%	0.0%	0.0%
WBC	-3	5	-3	0	0	-0.1%	-0.1%	0.0%	0.0%
Turkey	292	-363	54	0	-16	2.2%	2.6%	1.7%	1.7%
ROW	-159	215	-63	0	-7	0.0%	0.0%	0.0%	0.0%

Table 7

Trade Quantities and Value Changes After a Turkish Real Exchange Rate Devaluation of 10% in the Processed Agricultural Sector, USD mn

	Trade quantities: percent change							
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	0.0	0.0	0.0	0.0	-0.1	-41.6	0.1
	EU 14	0.0	0.0	0.0	0.0	-0.2	-41.6	0.0
	NMS	0.0	0.0	0.0	0.0	-0.1	-41.6	0.1
	EBC	0.0	0.0	0.0	0.0	-0.2	-41.6	0.0
	WBC	0.1	0.1	0.1	0.1	-0.1	-41.5	0.2
	Turkey	37.4	37.4	37.4	37.4	37.3	-0.4	37.5
	ROW	- 0.1	0.0	-0.1	0.0	-0.2	-41.6	0.0

	Trade at world prices: change in values							
		destination						
		Austria	EU 14	NMS	EBC	WBC	Turkey	ROW
origin	Austria	-4.4	0.1	-0.1	0.0	-0.2	-3.8	0.2
	EU 14	-1.3	-123.7	-2.3	-0.1	-1.6	-130.9	6.7
	NMS	-0.1	0.1	-22.5	0.0	-1.1	-16.5	1.1
	EBC	0.0	0.0	-0.1	-5.0	-0.1	-9.7	0.1
	WBC	0.0	0.3	0.1	0.0	-5.4	-1.4	0.1
	Turkey	8.9	207.2	38.3	8.8	12.1	201.5	252.2
	ROW	-0.3	-12.6	-1.0	-0.2	-0.3	-221.9	-162.9

Table 8

When looking at the real trade flow changes we can observe a drop of Turkish imports of a bit more than 40% and an increase of Turkish exports of a bit less than 40% (see Table 8). In monetary terms, though, this is much less than in the case of the unprocessed agricultural goods trade. Turkish exports to the EU 14 are estimated to increase by some USD 200 mn. For Austria we find a reduction of total exports by some USD 4 mn and an increase in total imports of processed agricultural goods by about USD 7 mn. Austrian trade with self is expected to fall by more than USD 4 mn.

Taken together, these results indicate no dramatic changes as an effect of a massive Turkish currency devaluation. This is considering the fact that only Austrian output of processed agricultural goods is at a two digit USD bn level. Thus, for instance, an increase of USD 7 mn in imports seems to be rather negligible. However, it is true that, in relative terms, trade changes seem to be substantial.

5. Conclusions

In this research a partial equilibrium model was applied to the agricultural trade between the EU, the Balkans and Turkey. This was done in order to measure the effects of an EU accession of the Balkans and Turkey. Most of the changes in welfare after a full liberalisation of agricultural trade between the Balkans and Turkey on the one hand, and the EU on the other can be expected in the accession countries themselves. It is estimated that incumbent EU members will be affected only to a minor extent.

The results of the simulation of a Turkish exchange rate devaluation are pointing in a similar direction. Turkish output and its trade balance would be improved to a certain extent. However, the other countries would not be affected very much.

In any case it should not be forgotten that all the results of this modelling have to be analysed with great caution, as they are generated with the help of a partial equilibrium model and not a general equilibrium model. A general equilibrium model could find additional second round effects.

Nevertheless, this research indicates that the incumbent EU members, including Austria, do not have to fear an EU accession of the Balkan countries and Turkey. The effects of liberalised agricultural trade seem to be marginal and even the exchange rate risk is not very high.

References

Fujita, M., Krugman, P., Venables, A. (2000), The Spatial Economy - Cities, Regions and International Trade, The MIT Press, Cambridge, Massachusetts, 2000.

Francois, J., Hall, K.,H. (2003), Global Simulation Analysis of Industry-Level Trade Policy, technical paper, Version 3.0: 21 April 2003, mimeo (World Bank).

Holzner, M. (2004), 'GSIM Measurement of the Costs of Protection in Southeast Europe', paper prepared for the project 'Measurement of the Costs of Protection in Southeast Europe' financed by the Jubiläumsfonds of the Oesterreichische Nationalbank, June 2004.

Holzner, M. (2006a), 'GSIM Measurement of the Effect of the SAA in BiH', EPRU Working Paper, No 4, March.

Holzner, M. (2006b), 'Real Exchange Rate Distortion in Southeast Europe', paper prepared for the 'Global Development Network Southeast Europe' (GDN SEE), financed by The World Bank, the Austrian Ministry of Finance and the Oesterreichische Nationalbank (Austrian Central Bank).

Lukas, Z., Pöschl, J. (2003), ‚Bedrohung für Österreichs Landwirtschaft? – Szenarien zur Entwicklung der MOE-Landwirtschaft im europäischen und internationalen Verbund', The Vienna Institute for International Economic Studies (WIIW), Vienna, 2003.

Messerlin, P. (2001), Measuring the Cost of Protection in Europe, Institute for International Economics, Washington DC, September 2001.

Impact of Human Capital on GNP Level

Željko Požega, Boris Crnković *

Abstract

It is possible to achieve faster rates of social growth, greater developement, a better standard of living and narrow the gap between rich and poor countries by changing a government's economic policies so that they emphasize investments in the developement of human potential. An increase in motivation, knowledge, levels of education and team organization, as well as a strengthening of citizens' moral, intellectual and social potential will, as the results of investigations quoted in this article show, bring faster growth of the Gross National Product (GNP). There is still a paradigm prevailing in south-eastern European countries to invest more in physical capital than in human capital. This paradigm is the reason that these countries continue to fall behind the most developed countries in the world.

Keywords: Human capital, Gross National Product, Human Developement Index, physical capital, economic developement, education, intelligence.

JEL: O15 **DOI: 10.2478/v10033-008-0002-z**

1. Opening Considerations

In this article, which consists of three parts, we wish to show the importance of human capital and its influence on the GNP of a given country. In the first part, we give a short outline of the theory of human capital and of the most significant writers who have dealt with this area and their insights. In the second part, we give methodology and data that were used in the investigation and analysis of different countries. In the third part, results are presented that comprise an analysis of the influence of different factors on the GNP of countries generally, as well as individual analyses of south-eastern European countries. The difference between expected and achieved GNP in the year 2003, with regard to available human, physical and financial resources of each country is also shown. The aim of this study is to test the hypothesis that human capital has the largest impact on a country's GNP level per capita.

2. Theory of Human Capital

The human factor is basic in achieving macroeconomic aims. The world today is marked by rapid and thorough changes in the field of business and management, where people and thier motivation, knowledge and creative and developement potentials are the most important factors for competitive advantage on the global market. The way in which we manage human potential is crucial for long term competitive ability, developement as well as the pure survival of any economic entity.

*Požega: Faculty of Economics in Osijek, Croatia, e-mail: osijek@efos.hr

*Crnković: Faculty of Economics in Osijek, Croatia

Today, economics deals more with non-materialistic, that is, non-palpable resources, in which people, their knowledge and intellectual potential play a key role. Among these, human capital has recently become a special interest of economics, with an emphasis on knowledge as the most important resource, followed by information, intellectual property, experience and other factors that can be used in gaining wealth. Today, we exclusively need workers who add a certain value to every process they take part in, who bring value to their company. Because all property is almost equaly accessible to competitors, we should concentrate on the only property that is unique: top-quality workers. Only high motivation, permanent education, expert and flexible people and team work can bring about the efficient achievement of business and development aims.

A sample definition of human capital would be the sum of all human resource attributes that are relevant to the process of social reproduction (Milkovich, Boudreau, 1991.). The theory of human capital has continuously evolved from the middle of the 20th century. J. Mincer is the putative creator of this theory, despite the fact that W. Petty, who evaluated the population of England, as well as some other classical economists who emphasized the importance of human capital at the beginning of the 18th century, wrote about it before (Nadler L., Nadler Z.). A. Smith studied the renting fees of qualified and unqualified workers and stated that education and study are investment in human capital. Individual abilities learned from this education are, in his opinion, not only an aspect of individual worth but of global wealth as well (Walker). In his analysis of resource productiveness, K. Marx puts the expertise of workers first (Ivancevich). Marshall states that from among all the types of capital, human capital is the most essential: education is a national investment, while knowledge is "the most powerful production engine" (Ivancevich). Kuznets claims that the key for success in creating national income is the capital invested in people, and that this capital demands appropriate valorization (Milkovich, Boudreau, 1991.). Fisher highlights human capital when analyzing capital with return rates (Hansen, Knowles). J. Mincer sees human capital as an independent category of capital (Nadler L., Nadler Z.). Blaug classifies human capital into six categories: formal education, business training, acquiring information, job seeking, job migrations and investment in health (Nerdrum, Erikson). On the other side, Schultz sees investment in human capital as an alternative for investments in material production inputs because investing in education, one of the most important parts of human capital, brings returns several times larger than those from investing in equipment (Becker). Lauc divides human capital into moral capital (honor, emotional intelligence, motivation, responsibility, courage, tolerance, etc.), intellectual capital (mental abilities, rational intelligence, knowledge and skills, creativity) and social capital (resources in personal and business connections, working in teams) (Lauc).

Brooks and Nafukho define the development of human resources as a free system used in businesses for the development of every individual through training, with their career development tied to the development of the company as a whole (Walker). McLean defines human resource development as every process or activity that, in the short or long term, develops performance based on knowledge, expertise, productiveness and advances the goals of both the individual and a group, team, business, society, nation or even humanity (Dipietro, Anoruo). Gilley and Maycunich consider the development of human resources a means of facilitating organizational self-evaluation and change through managerial interventions and initiatives to improve the company's characteristics (Walker). Schmidt and Robinson discovered that social capital and mutual relationships have a positive effect on business transactions, production, trust and the ability to handle risk. The benefits of social capital include cutting transaction costs, because it improves cooperation between business clients and processes, improves negotiations and reduces business pressure, incorrect information and unnecessary paper work (Spicker). Salovey and Mayer define emotional intelligence as an intellectual process involved in recognizing, using, understanding and managing personal and other emotional states with the ability to channel these feelings into motivating, planning and achieving success (Hirsch). Emotional intelligence is part of the social capital development process within a company, and as a part of the wider concept of human resources development has a crucial effect on a business subject's productiveness.

While most classic and traditional economists focused on production, workers and financial capital, Romer emphasizes knowledge and technology and states that return rates on physical capital work according to the law of falling income, while return rates in an economy of knowledge and human capital rise and work according to the law of rising income (Romer). One characteristic of knowledge is that a person who has it constantly improves himself/herself, because with more knowledge he/she is more aware of his/her ignorance, which leads to improvement of one's abilities and a rise in social welfare and wealth. Romer also states that knowledge gives a return on investments and is a production factor, like physical capital, workers and raw material. According to the new theory of economic growth, additional work and capital are no longer the only necessities; new and better ideas incorporated in technological progress will generate economic growth as well. The traditional explanation of poverty in underdeveloped countries is their lack of sufficient natural resources or capital goods. Romer states that underdeveloped countries lack sufficient ideas and inventions, not natural resources. If poorer countries invest more in education and do not ruin their citizens' initiative towards creating new ideas, they will quickly gain advantage on the knowledge market and increase their return incomes.

3. Data and Methodology

The results of this analyisis are based on research of the author, Željko Požega, that was conducted for his doctoral dissertation. The basis of this analysis is accessible, and the data collected on different statistic variables (out of 89 variables, 31 were chosen for this investigation by partial corelation) for 177 coutries worldwide both over an extended period (1975-2005, with a projection for 2015)[1] and the year 2003 was analyzed in this article. The year 2003 was chosen because accessible data for that year were the most complete. Some of the variables analyzed in this article are accompanied by explanations of our methods of measurement and calculation. Other variables were calculated by simple statistic measures and are given in absolute numbers (population) or in relative numbers, such as percentage of GNP or of the whole population, or in relation to a citizen (per capita) (urban population, population under 15, population over 65, investments in health care, children mortality rate, investment in education, investment in preprimary and primary educatrion, investment in secondary education, investment in tertiary education, education rate for adults, number enrolled in primary education, number enrolled in secondary education, number of phone lines, number of mobile phone users, number of patents, export, import, direct foreign investments, national debt, investment in army, amount of electricity spent, number of women enrolled in tertiary education in relation to men, number of the population working, number of olympic medals in relation to GNP, GNP and inflation rate).

The Human Developement Index (HDI)[2] is calculated between 0 and 1 and considers the following measures: GNP per capita, literacy rate of adults, rate of school enrollment and expected age. An HDI between 1 and 0,8 is considered high, between 0,8 and 0,6 middle and between 0,6 and 0,4 low. The Gender-Ralated Developement Index measures gender equality in three dimensions included in HDI – length of life and level of health, education and aptness of life standard – adapted and calculated according to inequality between men and women. Educational levels are categorized as pre-primary, primary, secondary and tertiary and are in accordance with the International Standard Classification of Education (ISCED). The combined proportion of enrollment for primary, secondary and tertiary levels of education includes the number of students enrolled in primary, secondary and tertiary levels of education, irrespective of age, as a percentage of the school age population for these three levels. The Index of Press Freedom is measured by analyzing the number of journalists and free media in a given country and the subjective analysis of the freedom of the press on a scale of 1 to 100.

Neuron networks, which are used for analyzing data in this article, are a method of artificial intelligence structured according to the human brain. The reasons why neuron networks often yield better results than statistical methods lie in their ability to analyze insufficient data or hindered data, to cope with problems that do not have a clear single solution and to learn from past experience. Because of these advantages, neuron networks showed success in predicting series of financial data with high levels of variation and fluctuation. The results of many investigations have shown that neuron networks can solve almost any problem more efficiently than traditional modeling or statistical methods. It has been mathematically proven that three-layer neuron networks with limitlessly sensitive transmision function are able to approximate any non-linear function.

Neuron networks consist of two or more layers or groups of processing elements called neurons. The term neuron denotes the basic unit in the model of a neuron network designed for data processing. Neurons are connected in a network so that the exit of each neuron is the entrance to one or more other neurons. According to its direction, a neuron connection can be one-way or two-way, and according to intensity it can be excitatory or inhibitory. Neurons are grouped in layers. There are three main types of layers: incoming, hidden and outgoing. The incoming layer receives incoming data from the outside environment and sends them to one or more hidden layers. In the hidden layer, information from neurons is processed and sent to neurons of the outgoing layer. Information then travels backwards through the network and the weight values of connections between neurons are adapted according to the desired exit. The process in the network is repeated in as many iterations as necessary to reach the exit that is the closeset to the desired (real) exit. In the end, the network exit is presented to the user. Each neuron network goes through three operational phases: a training phase, a testing phase and an operational phase in which the neuron network is used in new cases with unknown results. The training rule represents a formula used to adapt the weight of connections among neurons. Among different trainig rules developed up to now, the most often used are: Delta rule, generalized Delta rule, Delta-Bar-Delta rule, extended Delta-Bar-Delta rule and Kohonen rule.

An analysis of data resulting from the calculation of the coefficient of multiple correlation and regression equations is also given in this article. The influence of independent variables on dependent variables is best

1 Official statistical data of UN, source: http://hdr.undp.org/ and http://unstats.un.org/unsd/

2 The Human Development Index (HDI) has been calculated by the authors.

expressed by multiple correlation, which we get as a linear correlation of zero order. To get the theoretical value of a certain statistical unit, we have to know the coefficient or determine the figure with an independent variable and a constant. In the system of equations with n-1 unknowns:

$$b1r11 + b2r12 + ... + bn\text{-}1r1n\text{-}1 = r1n$$

$$b1r21 + b2r22 + \ldots + bn\text{-}1r2n\text{-}1 = r2n$$

$$b1r31 + b2r32 + \ldots + bn\text{-}1r3n\text{-}1 = r3n$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$b1rn\text{-}11 + b2rn\text{-}12 + \ldots + bn\text{-}1xrxn\text{-}1 = rn\text{-}1,n$$

We get the coefficient of multiple correlation through the formula:

$$R = \sqrt{\sum b_i r_{in}}$$

By entering the relevant data for each statistical unit we get the theoretical value for y with the dependent equation:

$$Y = A + B1X1 + B2X2 + B3X3 + \ldots + Bn\text{-}1Xn\text{-}1$$

which enables us, depending on the quantity of multiple correlation and the variability of the dependent variable, to predict the state of dependent variables within a certain margin of error. The prediction is more accurate as multiple correlation rises.

4. Model of the Neuron Network

The problem of analysing variables for countries in 2003 and the relation of the dependant variable (GNP per capita) and its change stipulated by the changes in independent variables is observed and analyzed by the Neurosolutions programme and the building of neuron networks. Through 30 incoming variables we attempted to measure their influence on one outgoing variable, GNP per capita; that is, the sensitivity of changes in dependent variables to changes in independent variables.

A sample of N=168 layers is distributed in three parts. The network uses the first and biggest part for training (60% of sample, N=101), 20% for crossvalidation (N=33) and 20% (N=33) for testing the data that were unavailable to the network in the phase of training and crossvalidation (so-called outside data). The neuron network that gives the best solutions was composed of these characteristics: a Multilayer Perception Network, a network algorithm 'backward widening', one hidden layer, a number of neurons in the hidden layers 1-20 (auto-optimalization preformed by the sample for crossvalidation is included), a transferable function in the hidden layer, the Sigmond Axon and Tangh Axon, the training rule Delta-Bar-Delta with momentum, step 1, momentum 0,7, one outgoing layer (with regard to one outgoing variable), a transferable function in the outgoing layer, a linear, training rule, momentum, step 1, momentum 0,7, maximum epoch number 1 000 and Batch data processing.

The formula for the training rule that shows the influence of the training coefficient and momentum on adapting the weight in network is:

$$\Delta w^{t}_{ji(k)} = \eta_k \cdot y_{cj} \cdot \varepsilon_i + \alpha_k \Delta w^{t-1}_{ji(k)}$$

where η is the training coefficient, α is momentum and w_{ji} is the weight difference between neuron j and neuron i, y_{ci} is output calculated in the network, and ε is the margin of error.

While designing the network, the best result in the phase of network testing was achieved by changing different training parameters. The network made of 13 hidden neurons with 1 000 training epochs and 0,7 momentum gives the best results. In this case the problem of an overtrained network arose, as a network with 2 000 training epochs gives worse results than one with 1 000 training epochs.

According to the MSE error formula:

$$MSE = \frac{1}{n}\sum_{i=0}^{n-1} (ti - (oi)^2$$

Where ti is for calculated output, oi is desired (real) output and i is the number of outgoing neurons in the network, the aim is to obtain a margin of error smaller than 0,01 so that the reliability of the investigation's results is acceptable. The MSE margin of error is explained as an average aberration between calculated and desired (real) output. In the analysis of data in this article, a mistake of 0,00025 means that the network output deviates 0,00025 from the real output. Error in the phase of crossvalidation after the 989th iteration no longer falls but rises. So the programme stores as the best network that which trains on 989th iterations and uses it in the testing phase.

5. Analysis of GNP Sensitivity

If we observe the results of the statistical analysis of the sensitivity of variables for countries in 2003 (see: Graph 1), we will see that if we take the GNP per capita as the dependent variable with a 0,98 correction coefficient and

a 0,328 standard margin of error, the Human Developed Index variable with a 4 157,9 coefficient (the variable was corrected for the value of GNP, i.e. standard of living (measured by PPP income)) has the highest sensitivity, its coefficient being four times higher than that of the second highest (GRDI) and much greater than most other variables. A very high sensitivity level was also shown with these variables: Gender Related Developement Index (981,1), number of population capable of working (717,1), number of olympic medals in relation to GNP (510,2), number of women related to number of men enlisted in tertiary education (195,2). A slightly smaller coefficient was shown with these variables: investment in health care (65,7), investment in army (56,7), population over 65 (54,99), population under 15 (54,3), investment in education (40,4), national debt (38,2), direct foreign investment (18,5), investment in tertiary education (14,4), investment in pre-primary and primary education (13,96) and mixed correlation for primary, secondary and tertiary education (13,1). The rest of the variables have low coefficients and did not show significant sensitivity levels towards the dependent variable, GNP per capita. The results of this investigation show the causes that brought about greater differences in the stages of developement between countries and that will deepen the gap between the life standards in rich and poor coutries if any, especially the poor ones, do not make significant changes and place an emphasiss on investment in people.

It is interesting that in analysing the equations of dependant variables for countries for 2003 we can see that, with a 0,95 multiple corelation coefficient, out of 177 analysed counties 137 in that year achieved real GNP per capita lower than expected GNP per capita; that is, almost 137 countries with existing human, physical and financial resources in the given year should have achieved a higher level of GNP per capita. Also, only one country achieved real GNP per capita equal to the expected GNP per capita in the given year, Slovenia. Furthermore, only 30 countries in the world achieved GNP per capita greater than expected in the given year. We can say that 30 countries in the world achieved finacial results greater than expected with their human, physical and financial resources.

Among the countries that achieved GNP per capita lower than the expected GNP per capita, the greatest gaps were in Burundi (almost 50 times lower than expected), the Democratic Republic of Congo (46 times lower) and Ethiopia (39 times lower). Among the countries that achieved GNP per capita higher than expected, the most successful were Luxembourg (3,5 times higher than expected), Switzerland (2,8 times higher), Denmark and Ireland (2,5 times higher), USA (2,4 times higher), Norway, Japan and Holland (2,2 times higher), Great Britain (2,1 times higher), Austria and France (2 times higher) and Belgium and Germany (1,8 times higher). With a slightly less favourable relation between real and expected GNP per capita were Australia, the Bahamas, Cyprus, Eritrea, Finland, Greece, Hong Kong, Iceland, Italy, Israel, Canada, Kuwait, New Zealand, Portugal, Singapore, Spain and Sweden.

If we put the data for south-eastern European countries in the given regresion variables equation for 2003 we will see that, for example, Albania, with its human, physical and financial resources should have achieved a GNP per capita of $ 7 941; this is around 4 times higher than the GNP per capita achieved, which was $ 1 933. Furthermore, with its human, physical and financial resources, Bulgaria should have had $ 13 474 GNP per capita in 2003, which is 5 times higher than what it achieved, $ 2 539. Bosnia and Herzegovina should have had $9 533 GNP per capita in 2003, almost 6 times higher than its actual GNP per capita, $ 1 684. Croatia should have had $ 12 633, and it achieved only $ 6 479, roughly half. Macedonia should have had $ 10 596 but it achieved only $ 2 277 (5 times lower). Romania should have had $ 12 119, but it achieved $ 2 619 (4,5 times lower). Finally, Turkey should have had $ 9 265, but it achieved $ 3 399 GNP per capita in that year, which is 3 times lower than expected. The positive examples were Greece and Cyprus. Greece, with its human, physical and financial resources, should have achieved a GNP per capita $ 13 759, which is lower than its GNP per capita of $ 15 608. Cyprus, with its human, physical and financial resources should have achieved a GNP per capita $ 12 878, which is lower than its GNP per capital, which was $ 14 786. Data for Serbia and Montenegro, i.e. ex Yugoslavia, are not available for 2003.

6. Synthesis of the Results

The results of statistical analysis on the sensitivity of variables for countries in 2003 show that the highest sensitivity or influence on GNP per capita was Human Developement. This is the index variable that shows the developing level of human resources in a given country. It was followed by the Gender-Related Developement Index variable, which shows development level in terms of gender; after it came the total working population, the number of olympic medals related to GNP, relation of women to men in tertiary education, etc.

Analysis of the equation of dependent variables for countries in 2003 showed that out of 177 analyzed countries, 137 achieved real GNP per capita lower than expected. 137 coutries, with their existing human, physical and finacial resources in the given year, should have achieved a higher GNP per capita level. Only 30 countries in the world achieved higher GNP per capita than expected in that year, meaning that 30 countries in the world achieved a financial result higher than expected with their human, physical and financial resources. All south-eastern European countries analyzed in this article achieved a lower real GNP per capita with their existing human, physical and financial resources in the given year than expected, with the exceptions of Greece and Cyprus.

It is possible to achieve higher and faster coefficients of social developement, a higher level of development and a better life standard, as well as reduce the gap between rich and poor countries, by changing their economic policies so that countries give priorities to investment in people and in developing human potential. Raising the level of motivation, knowledge, education and team organisation, and strengthening and improving the moral, intellectual and social capital of a population will lead to faster GNP growth, as the results of this investigation show. The prevailing paradigm in south-eastern European countries is to invest more in physical capital than human capital. It is for this reason that the region has fallen behind the most developed countries in the world.

References

Becker, S., "Responding to poverty: the politics of cash and care"
Longman, cop., London, New York, 1997.

Bradshaw, M., J., Dymond, J., P., White, G., W., "Contemporary world regional geography : global connections, local voices"
McGraw-Hill, New York, 2004.

Davey, K. J., "Investing in regional development: policies and practices in EU candidate countries"
Local Government and Public Service Reform Initiative, Open Society Institute, cop., Budapest, 2003.

Delleck, H., Von den Bosch, K., De Lathouwer, L., "Poverty and the Adequacy of Social Security in the EC"
Avebury, Aldershot, 1995.

Fellmann, J., D., Getis, A., Getis, J., "Human geography: landscapes of human activities"
second edition, Wm. C. Brown Publishers, cop., Dubuque, 1990.

Grin, F., Daftary, F., "Nation-building, ethnicity and language politics in transition countries"
Local Government and Public Service Reform Initiative, Open Society Institute: European Centre for Minority Issues, cop., Budapest, 2003.

Hirsch, F., "Social limits of Growth"
Harvard University Press, Cambridge, 1976.

"International Journal of Social Economics", Dipietro, W. R., Anoruo, E., "GDP per capita and its challengers as measures of happiness"
Emerald Group Publishing Limited, 10/2006.

Ivancevich, J. M., "Human Resource Management"
sixth edition, Irwin, 1995.

"Journal of Economic Studies", Hansen, P., Knowles, S., "Human capital and returns to scale"
Emerald Group Publishing Limited, 2/1998.

"Journal of Intellectual Capital", Nerdrum, L., Erikson, T., "Intellectual capital: a human capital perspective"
Emerald Group Publishing Limited, 2/2001.

"Journal of Intellectual Capital", Romer, P. M., "Economic growth"
Emerald Group Publishing Limited, 1/2004.

Lauc, A., "Metodologija društvenih znanosti"
Sveučilište J. J. Strossmayera u Osijeku, Pravni fakultet Osijek, 2001.

Milkovich, G. T., Boudreau, J. W., "Human Resource Management"
sixth edition, Irwin, Boston, 1991.

Milkovich, G. T., Boudreau, J. W., "Personnel/Human Resource Management"
Fifth edition, Business Publications, Inc., Plano, Texas, 1988.

Nadler, L., Nadler, Z., "Developing Human Resources"
Third edition, Jossey-Bass Publishers, San Francisco, Oxford, 1991.

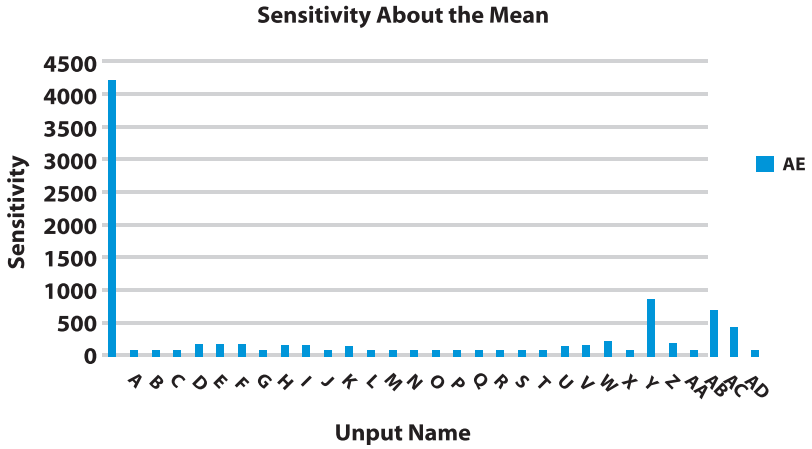
Nikolovska, N., Sundać, D., "Globalization and economic downfall of countries in transition"
Magor, Skoplje, 2002.

Spicker, P., "Poverty and Social Security: Concepts and Principles"
Routledge, London and New York, 1993.

"The World Bank Research Department", Almeida, R., "Local Economic Structure and Growth"
International Economics Department, Commodity Policy and Analysis Unit, 08/2005.

Walker, J. W., "Human Resource Strategy"
McGraw-Hill, Inc., 1992.

Attachment



Sensitivity	AE
A	4157.94043
B	13.14852715
C	0.597405791
D	5.691743374
E	54.33771133
F	54.9911232
G	65.72640991
H	4.420273781
I	40.41278839
J	13.96146297
K	1.182915211
L	14.40869522
M	1.700477242
N	0.598946631
O	6.348370552
P	1.571432114
Q	3.663119793
R	0.326730281
S	19.66231918
T	10.18229961
U	18.51408386
V	38.21792984
W	56.74648285
X	0096917048
Y	981.1262207
Z	195.17453
AA	2.310561419
AB	717.137146
AC	510.0514526
AD	5.621172428

Graph 1. Analy1sis of GNP sensitivity for countries in the world in 2003.

A – Human Developement Index (by partial correlation corrected for GNP value i.e. standard of living (measured by PPP income)
B – Combined relation for primary, secondary and tertiary education
C – Population
D – Urban population
E – Population under 15
F – Population over 65
G – Investment in health care
H – Children mortality rate
I – Investment in education
J – Investment in pre-primary and primary education
K – Investment in secundary education
L – Investment in tertiary education
M – Adult educational rate
N – Number enrolled in primary education
O – Number enrolled in secondary education
P – Number of phone lines
Q – Number of mobile phone users
R – Number of patents
S – Import
T – Export
U – Direct foreign investments
V – Total debt
W – Investment in army
X – Electricity spent
Y – Gender-Related Developement Index
Z – Number of women related to the number of men enrolled in tertiary education
AA – Index of freedom of the press
AB – Number of population capable of working
AC – Number of olympic medals
AD – Inflation rate

Legend – Graph 1.

Calculating VaR in EU Candidate States

Saša Žiković*

Abstract

This paper examines whether VaR models that are created and suited for developed and liquid markets apply to the volatile and shallow financial markets of EU candidate states. To this end, several VaR models are tested on five official stock indexes from EU candidate states over a period of 500 trading days. The tested VaR models are: a historical simulation with rolling windows of 50, 100, 250 and 500 days, a parametric variance-covariance approach, a BRW historical simulation, a RiskMetrics system and a variance-covariance approach using GARCH forecasts. Based on the backtesting results it can be concluded that VaR models that are commonly used in developed financial market are not well-suited to measuring market risk in EU candidate states. Using some of the most widespread VaR models in these circumstances may result in serious problems for both banks and regulators.

Keywords: Abbreviations: EU, VaR, VCV, EWMA, Historical simulation, BRW, ARCH, GARCH

JEL: C22, C53, G15, G18 **DOI: 10.2478/v10033-008-0003-y**

1. Introduction

The impact of allowing banks to calculate their capital requirement for market risk based on their internal VaR models, as well as the impact of regulation changes on banks in less developed countries, has not been well studied. Even in the European Union, not all of the EU-15 member countries have systematically conducted research on the consequences and impact of these changes on their banking sectors. New EU member states and EU candidate states are even further behind in these issues. The group of EU candidate states is comprised of the following countries: Bulgaria, Romania, Croatia and Turkey. Bulgaria started its accession negotiations with the EU in February 2000, and closed the accession negotiations in June 2004. Romania, like Bulgaria, started its accession negotiations in February 2000, and closed the accession negotiations in December 2004. Both countries will become full EU members in January 2007. Croatia and Turkey started the accession negotiations on the same date, 03.10.2005. Croatia is expected to become a full EU member in 2009. This is not the case with Turkey, which still has a long journey ahead of it. Although very different and unique in their own ways, when looking through a financial prism, these countries are similar in certain respects. The EU candidate states are all significantly lagging behind the most developed EU countries in many fields, but especially in matters of financial legislation, market discipline, insider trading, disclosure of information (financial and other), embezzlement, knowledge of financial instruments, markets and associated risks. When investing in these financial markets, banks and investmend funds employ the same risk measurement models for measuring market

* Žiković: Faculty of Economics, University of Rijeka, Ivana Filipovića 4, Rijeka, Croatia,
e-mail: sasa.zikovic@efri.hr

risk and forming provision as they do in developed markets. This means that risk managers presume equal or similar characteristics and behaviour in these markets to developed markets. Using VaR models that are created and suited for developed and liquid markets in developing markets raises concerns whether VaR models developed and tested in these financial markets apply to the volatile and shallow financial markets of EU candidate states. This paper therefore attempts to provide an answer to the question whether commonly used VaR models adequately capture market risk in the financial markets of EU candidate states. Employing VaR models in forming a bank's provisions that are not suited to developing markets can have serious consequences, resulting in big losses to banks' portfolios that could be undetected by the employed risk measurement models. Banks could also be penalized by the regulators via higher scaling factors when forming their market risk provisions due to the use of a faulty risk measurement model.

To this end, variance-covariance methods and historical simulation approaches are used to estimate VaR for official stock indexes from each of the EU candidate states over a period of 500 trading days. In the next step, the performance of the various models is compared over the simulation period with the help of a range of backtesting procedures to determine how accurately the models match the specified confidence intervals.

The paper is structured as follows: Section 2 briefly outlines the VaR approaches on which the calculations in this paper are based. Section 3 provides a brief description of the data used. Section 4 presents and explains the results. Section 5 offers a few concluding remarks.

2. Analyzed VaR Models

The VaR approach is attractive to practitioners and regulators because it is easy to understand and it provides an estimate of the amount of capital that is needed to support a certain level of risk. Another advantage of this measure is the ability to incorporate the effects of portfolio diversification. Many banks and other financial institutions now base their assessment of financial risk and risk management practices on VaR or plan to do so in the future. VaR reduces the risk associated with any portfolio to just one number, the expected loss associated with a given probability over a defined holding period. VaR for a given probability *C* can be expressed as:

$$VaR_c = F^{-1}(C) \qquad (1)$$

where $F^{-1}(C)$ denotes the inverse of cumulative probability distribution of the changes in the market value of a portfolio. Thus, losses greater than the estimated VaR should only occur with the probability *1-C*, i.e. the "tail events", should on average, occur *C*N* times in every *N* trading days.

The variance-covariance approach assumes that the risk factors that determine the value of the portfolio are multivariate normally distributed, which implies that changes in the value of a portfolio are normally distributed. Since the normal distribution is fully described by its first two moments, the VaR of a portfolio is essentially a multiple of the standard deviation. VaR under the variance-covariance approach is given by:

$$VaR = -\alpha\sqrt{w'\Sigma w} \qquad (2)$$

where *w* is a vector of absolute portfolio weights, *w'* is its transpose, *Σ* denotes a variance-covariance matrix and *α* is a scaling factor. The variances and covariances are usually estimated from a daily historical time series of the returns of the relevant risk factors using equally weighted moving averages:

$$\sigma^2_{ij,T} = \sum_{t=T-n}^{T-1} \frac{r_{i,t} r_{j,t}}{n} \qquad (3)$$

where the mean is often assumed to be zero, $\sigma^2_{ij,T}$ is variance (or covariance) at time *T*, *ri,t* and *rj,t* are returns and *n* is the number of observations, i.e. the window length, used to calculate the variances and covariances. Another frequently used estimator is the exponentially weighted moving average (EWMA), which is used in RiskMetrics methodology. In contrast to equally weighted moving averages, the exponentially weighted moving average weights current observations more than past observations in calculating conditional variances (covariances). The EWMA estimator in its recursive form is given by:

$$\sigma^2_{ij,t} = \lambda\sigma^2_{ij,t-1} + (1-\lambda) r_{i,t-1} r_{j,t-1} \qquad 0 < \lambda < 1 \qquad (4)$$

Parameter λ determines the exponentially declining weighting scheme of the observations. One difference between the two estimators is that the equally weighted moving average does not account for time-dependent variances, whereas the exponentially weighted moving average does. A more sophisticated parametric estimator of volatility is a GARCH process:

$$\sigma^2_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon^2_{t-i} + \sum_{i=1}^{p} \beta_i \sigma^2_{t-i}$$

$$\varepsilon_t = \eta_t \sqrt{\sigma^2_t} \qquad (5)$$

where $\eta_t \sim IID\ N(0,1)$

In a GARCH model ε_t denotes a real-valued discrete-time stochastic process whose conditional distribution is assumed to follow a specific probability distribution (Gaussian, Student's T, etc.). The sizes of the parameters α and β determine the short-run dynamics of the resulting volatility time series. Large GARCH lag coefficients β_i indicate that shocks to conditional variance take a long time to die out, so volatility is persistent. Large GARCH error coefficients α mean that volatility reacts intensely to market movements, meaning that if alpha is relatively high and beta is relatively low, volatilities tend to be spiky.

The second approach used in this paper is historical simulation. In contrast to parametric methods, no specific distributional assumptions about the individual market risk factors, i.e. returns, are made, and no variances or covariances have to be estimated. Instead, it is only assumed that the distribution of the relevant market returns is constant over the sample period. Historical simulation VaR can be expressed as:

$$HS - VaR^{C}_{T+1|T} \equiv r_w((T+1)C) \quad \textbf{(6)}$$

where $r_w((T+1)C)$ is taken from the set of ordered returns $\{r_w(1), r_w(2), \ldots, r_w(T)\}$. The BRW approach developed by Boudoukh, Richardson and Whitelaw (1998), combines RiskMetrics and historical simulation methodologies, by applying exponentially declining weights to past returns of the portfolio. Each of the most recent *N* returns of the portfolio, $r_t, r_{t-1}, \ldots, r_{t-N+1}$, is associated a weight, $\frac{1-\lambda}{1-\lambda^N}, \left(\frac{1-\lambda}{1-\lambda^N}\right)\lambda, \ldots, \left(\frac{1-\lambda}{1-\lambda^N}\right)\lambda^{N-1}$ respectively.

The role of the term $\frac{1-\lambda}{1-\lambda^N}$ is simply to ensure that the weights sum to 1, provided $0 < \lambda < 1$. After the probability weights are assigned, VaR is calculated based on the empirical cumulative distribution function of returns with the modified probability weights. To better understand the assumptions behind the BRW approach and its connection to historical simulation, BRW quantile estimator can be expressed as:

$$\hat{q}_{t+1,C} = \sum_{j=t-N+1}^{t} r_j I\left(\sum_{i=1}^{N} f_i(\lambda; N) I(r_{t+1-i} \le r_j) = C\right) \quad \textbf{(7)}$$

where $f_i(\lambda; N)$ are the weights associated with return r_i and $I(\bullet)$ is the indicator function. If $f_i(\lambda; N) = 1/N$ BRW quantile estimator equals the historical simulation estimator. Boudoukh, Richardson and Whitelaw in their paper set λ equal to 0,97 and 0,99, the same coefficients used in this paper.

3. Data and Methodology

For transitional economies such as those of EU candidate states, a significant problem for a serious and statistically significant analysis is the short histories of their market economies and active trading in financial markets. Because of the short time series of returns of individual stocks and their highly variable liquidity, it is practical to analyze the stock indexes of these countries. A stock index can be viewed as a portfolio of selected securities from an individual country. In this paper, the performance of selected VaR models is tested on stock indexes from Croatia (Zagreb stock exchange (CROBEX) and Varazdin stock exchange (VIN)), Bulgaria (SOFIX), Romania (BBETINRM) and Turkey (XU100). To answer which VaR models adequately capture the market risk in the stock markets of the EU candidate states, nine VaR models are tested on the stock indexes of EU candidate states. The tested VaR models are: a historical simulation with rolling windows of 50, 100, 250 and 500 days, a parametric variance-covariance approach, a BRW historical simulation, a RiskMetrics system and a variance-covariance approach using GARCH forecasts. VaR models are calculated for a one-day holding period at 95% and 99% coverage of the market risk. To secure the same out-of-the-sample VaR backtesting period for all of the tested indexes, the out-of-the-sample data sets are formed by taking out 500 of the latest observations from each index. The rest of the observations are used as pre-sample observations needed for VaR starting values and volatility model calibration.

When employing the ARMA-GARCH VCV model the goal, is to capture the dynamic of the data generating process of the return series so that the standardised innovations are independently and identically distributed (IID). The ACF, PACF and Ljung-Box Q-statistic test the presumption of IID in standardized innovations. If the tests do not discover autocorrelation in the standardized innovations employed, the ARMA model can be considered adequate. Squared standardized innovations are tested for autocorrelation and ARCH effects through ACF, PACF and Ljung-Box Q-statistic. The most parsimonious GARCH model based on the Akaike and Schwartz information criterion that passes the tests of autocorrelation and ARCH effects in the squared standardized innovations is chosen to describe the volatility dynamics of the return series. The validity of the analyzed VaR models in EU candidate states is tested by the Kupiec test, the Christoffersen independence test,

the Blanco-Ihle test, the Lopez test, and the RMSE and MAPE measures.

Although there is an abundance of research papers dealing with VaR and market risk measurement and management, all of the existing VaR models have been developed and tested in mature, developed and liquid markets. Testing of VaR models in other, less developed or developing financial market is at best scarce. Žiković, Bezić (2006) investigated the performance of historical simulation VaR models on stock indexes of the EU candidate states. CROBEX (Croatia), SOFIX (Bulgaria), BBETINRM (Romania) and XU100 (Turkey) indexes all show clear positive trends over a longer time period. With the exception of the XU100 index, all of other indexes analyzed exhibit asymmetry and leptokurtosis. Based on performed tests of normality, it can be said with great certainty that these returns are not normally distributed. The tests employed show significant autocorrelation and ARCH effects in the squared returns of all the analyzed indexes. These phenomena violate normality assumption, as well as the IID assumption, which is a necessary requirement for the proper implementation of historical simulation. Results point to the conclusion that even though historical simulation provided correct unconditional coverage for the indexes tested at most of the confidence levels, use of historical simulation (especially based on shorter observation periods) is not recommendable in these markets.

4. Backtesting Results

Based on the ACF, PACF and Ljung-Box Q statistics of the returns and squared returns of analyzed stock indexes from EU candidate states given in tables V – IX, the presence of autocorrelation and heteroskedasticity in the data is obvious. All of the analysed indexes exhibit heteroskedasticity, with VIN, BBETINRM and SOFIX exhibiting autocorrelation in their returns. This finding is troubling for VaR models based on normality assumption, as well as for the nonparametric and semi-parametric approaches that are based on the IID assumption, such as historical simulation and the BRW approach. This is very indicative for risk managers, because the elementary assumptions of many VaR models are not satisfied, meaning that VaR figures obtained for such models cannot be completely trusted. An ARMA-GARCH model performs a transformation of original return data to obtain independently and identically distributed observations. The ARMA-GARCH model successfully captured the dynamics of stock indexes from EU candidate states and produced standardized innovations that proved to be independently and identically distributed. In modelling conditional volatility, a basic GARCH (1,1) model was sufficient for all stock indexes. Estimated ARMA-GARCH parameters for stock indexes of EU candidate states are presented in Table I.

As can be seen from Table I, some of the tested indexes, such as VIN and BBETINRM, show unusually low persistence in volatility but are very reactive to volatility, which will make VaR forecasts based on GARCH volatility spiky. The majority of stock indexes are not even closely integrated, as is presumed by the EWMA volatility modelling that underlies the RiskMetrics model. The estimated GARCH parameters of stock indexes from EU candidate states point to the conclusion that VaR models based on simpler conditional volatility models, such as MA or EWMA, will underestimate or overestimate the true level of risk. The Kupiec test and Christoffersen independence test are usually used to identify VaR models that are acceptable to the regulators, and provide the desired level of safety to individual banks and, due to the contagion effect, to the entire banking sector. The results of the overall acceptance, according to the Kupiec and Christoffersen independence tests, of tested VaR models at 95% and 99% confidence levels and 10% significance level are presented in Tables II and III.

	Mean			Volatility		
	C	AR	MA	K	ARCH (α)	GARCH (β)
CROBEX	0.001014			1.06E -05	0.11082	0.8323
t-stat	(-1.26)			(21 .32)	(11.43)	(93.44)
VIN	0.000278	0.145		1.25E -05	0.1405	0.78932
t-stat	(0.81)	(4.09)		(7.22)	(7.57)	(86.15)
BBETINRM	0.001409	0.1376		7.59E -06	0.17092	0.79299
t-stat	(4.39)	(4.37)		(3.77)	(6.55)	(28.76)
SOFIX	0.000403	0.75972	-0.62566	3.4E -06	0.1 4139	0.84515
t-stat	(4.31)	(4.31)	(-5.79)	(3.96)	(7.39)	(30.22)
XU100	0.001834			1.75E -05	0.070264	0.88758
t-stat	(3.83)			(1.02)	(7.72)	(53.03)

Table I - Estimated ARMA-GARCH parameters for stock indexes from EU candidate states

Model	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Kupiec test	4	2	2	3	0	0	1	0	0
Christoffersen IND test	4	1	0	2	0	0	1	1	3

Table II - Number of VaR model failures according to Kupiec test and Christoffersen independence test, tested on five EU candidate states' stock indexes, 500 observations, at 95% confidence level

Model	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Kupiec test	5	4	3	1	3	2	4	4	2
Christoffersen IND test	5	4	2	1	3	0	1	3	1

Table III - Number of VaR model failures according to Kupiec test and Christoffersen independence test, tested on five EU candidate states' stock indexes, 500 observations, at 99% confidence level

From the data in Table II, it is clear that at a 95% confidence level, the tested VaR models perform very differently, with a majority of VaR models failing the Kupiec test and Christoffersen independence test for at least one stock index. VaR models that passed the Kupiec test across all the analyzed stock indexes are the GARCH VCV model, RiskMetrics system and both BRW models with λ = 0.97 and 0.99. According to the Kupiec test, the worst performer out of all the tested VaR models is the HS 50 model, which failed the Kupiec test for four out of five stock indexes. The HS 50 model is followed by HS 500 with three failures. According to the Christoffersen independence test, the best performers are the HS 250 and both BRW models with λ = 0.97 and 0.99. The worst performers are HS 50 and GARCH VCV. Overall, the best performers according to the Kupiec test and Christoffersen independence test at a 95% confidence level across stock indexes of EU candidate states are the BRW models with λ = 0.97 and 0.99. The worst performers are the HS 50 and HS 500 models. Although it is very informative to look at VaR model performance at different confidence levels, the true test of VaR model acceptability for regulators is its performance at a 99% confidence level, as prescribed by the Basel Committee. According to the results obtained at a 99% confidence level, which are presented in Table III, all of the VaR models failed the Kupiec test for at least one stock index. The situation is somewhat better with the Christoffersen independence test, where HS 250 and BRW model with λ = 0.99 both passed the test. The best performers according to the Kupiec test are the HS 500 model (one failure), the BRW model with λ = 0.99 and the GARCH VCV model (two failures). The worst performers according to the Kupiec test are the HS 50 model (five failures), followed by the HS 100, Normal VCV and RiskMetrics models, all of which failed the Kupiec test for four out of the five tested indexes. Overall, the best performer according to the Kupiec and Christoffersen independence tests at a 99% confidence level across stock indexes of EU candidate states is the HS 500 model, followed by the BRW model with λ = 0.99 and the GARCH VCV model. The superior performance of the HS 500 model at a 99% confidence level can be attributed to a presumed high volatility, which is a consequence of the long observation period of this model and the occurrence of extreme events in the observation period. The worst performer is the HS 50, followed by the HS 100 and RiskMetrics system.

When evaluating the VaR models analyzed according to other criteria, such as the Lopez test, Blanco-Ihle test, RMSE and MAPE, the situation is somewhat different. The best performing VaR models according to these criteria are presented in Table IV.

95%	CROBEX	VIN	BBETINRM	SOFIX	XU100
Lopez test	BRW λ=0,97	BRW λ=0,99	BRW λ=0,99	HS 100	BRW λ=0,99
Blanco -Ihle test	GARCH VCV	GARCH VCV	GARCH VCV	GARCH VCV	GARCH VCV
RMSE	HS 250	HS 500	HS 500	Risk Metrics	Risk Metrics
MAPE	Risk Metrics	Risk Metrics	Risk Metrics	BRW λ=0,97	GARCH VCV
99%					
Lopez test	BRW λ=0,99	GARCH VCV	HS 250	HS 100	HS 500
Blanco -Ihle test	GARCH VCV	GARCH VCV	HS 250	BRW λ=0,99	GARCH VCV
RMSE	HS 50	HS 100	Normal VCV	Risk Metrics	Normal VCV
MAPE	BRW λ=0,97	GARCH VCV	BRW λ=0,99	HS 100	GARCH VCV

Table IV – Best performing VaR model for EU candidate states' stock indexes according to different criteria based on 500 trading days observation period

Rankings from Table IV show that different models are predominant depending on the confidence level used for the analysis. According to the Lopez and Blanco-Ihle tests, the BRW models and GARCH VCV model are constantly among the best performing VaR models for both confidence levels. The HS models and RiskMetrics system are often among the best performers according to the RMSE measure.

5. Conclusion

Based on the backtesting results, it can be concluded that the VaR models that are commonly used in developed financial market are not well suited for measuring market risk in EU candidate states. Tested at a 99% confidence level, the best performers for these markets are the HS 500 model, BRW model and GARCH VCV model. At the same time, HS 500, which was the best VaR model at a 99% confidence level, was among the worst rated VaR models at a 95% confidence level. These findings bear very important implications that must be addressed by regulators and risk practitioners operating in EU candidate states. Risk managers have to start thinking outside the frames set by their parent companies or else banks investing in these markets may find themselves in serious trouble, dealing with losses that they were not expecting. Contrary to widespread opinion, it is not enough to blindly implement the VaR models offered by various software companies. Every VaR software package that a bank is thinking about implementing should be rigorously tested and analyzed to see if it really provides a correct estimate of the true level of risk to which a bank will be exposed. National regulators have to take into consideration that simplistic VaR models widely used in some developed countries are not well suited for these illiquid and developing financial markets. The results obtained show that returns on indexes from EU candidate states are characterized by autocorrelation and heteroskedasticity, which considerably complicates VaR estimation and requires more complex, computationally and intellectually demanding VaR models. Before allowance is given to banks to use internal VaR models that are either purchased or developed in-house, national regulators should rigorously check and analyze the backtesting performance, as well as the theoretical framework of such models for any inconsistencies or unwanted simplifications.

Appendix

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.050	-0.050	3.7330	0.053
		2	-0.013	-0.016	3.9878	0.136
		3	-0.012	-0.013	4.1928	0.241
		4	0.050	0.048	7.8910	0.096
		5	-0.038	-0.033	10.009	0.075
		6	-0.003	-0.005	10.019	0.124
		7	0.002	0.001	10.023	0.187
		8	0.010	0.007	10.174	0.253
		9	0.020	0.025	10.799	0.290
		10	0.001	0.003	10.801	0.373
		11	-0.032	-0.032	12.377	0.336
		12	-0.022	-0.026	13.109	0.361
		13	0.009	0.005	13.237	0.430
		14	0.019	0.020	13.779	0.466
		15	0.024	0.029	14.630	0.478
		16	-0.011	-0.008	14.825	0.537
		17	0.028	0.025	16.011	0.523
		18	-0.011	-0.010	16.192	0.579
		19	0.047	0.046	19.466	0.427
		20	0.002	0.012	19.472	0.491

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.317	0.317	150.06	0.000
		2	0.193	0.103	205.75	0.000
		3	0.185	0.110	257.00	0.000
		4	0.065	-0.039	263.40	0.000
		5	-0.001	-0.050	263.40	0.000
		6	-0.008	-0.017	263.50	0.000
		7	0.023	0.040	264.27	0.000
		8	0.003	0.001	264.28	0.000
		9	0.022	0.024	265.01	0.000
		10	0.009	-0.014	265.13	0.000
		11	-0.009	-0.019	265.26	0.000
		12	-0.010	-0.009	265.42	0.000
		13	0.008	0.021	265.52	0.000
		14	-0.004	-0.004	265.54	0.000
		15	0.035	0.044	267.40	0.000
		16	0.021	-0.005	268.07	0.000
		17	-0.007	-0.025	268.14	0.000
		18	0.006	0.001	268.19	0.000
		19	0.002	0.001	268.20	0.000
		20	-0.013	-0.008	268.47	0.000

Table V - ACF, PACF and Ljung-Box Q test for mean adjusted returns and squared returns for CROBEX index in the period 24.10.2000 - 2.1.2007.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.159	0.159	37.888	0.000
		2	-0.038	-0.065	40.073	0.000
		3	0.032	0.050	41.576	0.000
		4	0.076	0.061	50.190	0.000
		5	0.012	-0.007	50.412	0.000
		6	0.063	0.071	56.439	0.000
		7	0.060	0.024	60.172	0.000
		8	0.006	-0.004	60.229	0.000
		9	0.045	0.047	63.296	0.000
		10	0.068	0.044	70.325	0.000
		11	0.025	0.007	71.289	0.000
		12	0.008	0.004	71.389	0.000
		13	0.005	-0.009	71.422	0.000
		14	-0.001	-0.009	71.424	0.000
		15	-0.008	-0.012	71.487	0.000
		16	0.012	0.005	71.725	0.000
		17	-0.036	-0.047	73.740	0.000
		18	0.017	0.031	74.168	0.000
		19	0.012	-0.004	74.389	0.000
		20	0.011	0.010	74.576	0.000

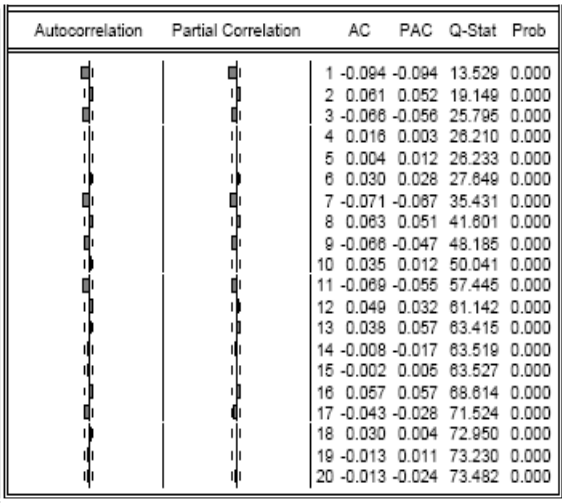
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.031	0.031	1.4092	0.235
		2	0.182	0.181	51.196	0.000
		3	0.001	-0.009	51.198	0.000
		4	0.005	-0.029	51.231	0.000
		5	-0.002	0.000	51.237	0.000
		6	-0.004	0.000	51.263	0.000
		7	-0.004	-0.004	51.293	0.000
		8	0.008	0.010	51.396	0.000
		9	0.006	0.007	51.444	0.000
		10	0.001	-0.003	51.446	0.000
		11	0.001	-0.001	51.447	0.000
		12	-0.003	-0.002	51.458	0.000
		13	0.013	0.014	51.732	0.000
		14	0.046	0.048	54.965	0.000
		15	0.013	0.006	55.233	0.000
		16	0.026	0.009	56.277	0.000
		17	0.018	0.014	56.754	0.000
		18	0.010	0.004	56.906	0.000
		19	-0.003	-0.009	56.917	0.000
		20	-0.005	-0.006	56.950	0.000

Table VI - ACF, PACF and Ljung-Box Q test for mean adjusted returns and squared returns for VIN index in the period 24.10.2000 - 1.1.2007.

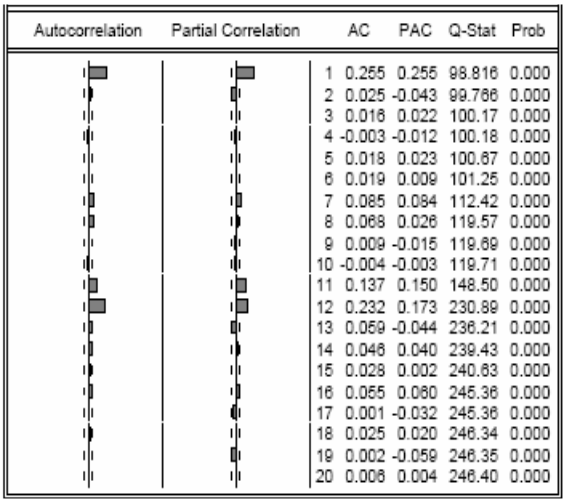
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.112	0.112	18.917	0.000
		2	-0.020	-0.033	19.495	0.000
		3	-0.013	-0.007	19.752	0.000
		4	-0.026	-0.024	20.743	0.000
		5	0.002	0.007	20.749	0.001
		6	0.048	0.046	24.232	0.000
		7	0.063	0.053	30.211	0.000
		8	-0.003	-0.014	30.222	0.000
		9	0.017	0.023	30.659	0.000
		10	-0.020	-0.022	31.277	0.001
		11	0.019	0.028	31.830	0.001
		12	0.019	0.011	32.387	0.001
		13	0.018	0.012	32.883	0.002
		14	0.040	0.035	35.304	0.001
		15	0.008	-0.000	35.367	0.002
		16	-0.032	-0.031	36.904	0.002
		17	0.014	0.024	37.188	0.003
		18	-0.057	-0.067	42.135	0.001
		19	0.021	0.035	42.792	0.001
		20	0.054	0.039	47.289	0.001

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.133	0.133	26.781	0.000
		2	0.072	0.055	34.518	0.000
		3	0.039	0.023	36.836	0.000
		4	0.026	0.014	37.845	0.000
		5	0.032	0.024	39.400	0.000
		6	0.053	0.044	43.639	0.000
		7	0.082	0.068	53.867	0.000
		8	0.014	-0.012	54.170	0.000
		9	0.010	-0.002	54.335	0.000
		10	0.013	0.007	54.605	0.000
		11	0.027	0.021	55.746	0.000
		12	0.023	0.011	56.527	0.000
		13	0.017	0.003	56.948	0.000
		14	0.043	0.033	59.819	0.000
		15	0.022	0.010	60.567	0.000
		16	0.040	0.031	63.055	0.000
		17	0.093	0.079	76.190	0.000
		18	0.034	0.004	77.947	0.000
		19	0.017	-0.003	78.398	0.000
		20	0.008	-0.005	78.506	0.000

Table VII - ACF, PACF and Ljung-Box Q test for mean adjusted returns and squared returns for BBETINRM index in the period 24.10.2000 - 3.1.2007.

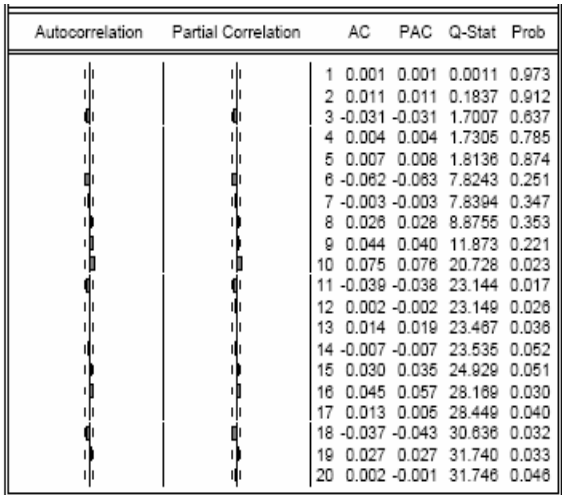


Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.094	-0.094	13.529	0.000
		2	0.061	0.052	19.149	0.000
		3	-0.066	-0.056	25.795	0.000
		4	0.016	0.003	26.210	0.000
		5	0.004	0.012	26.233	0.000
		6	0.030	0.028	27.649	0.000
		7	-0.071	-0.067	35.431	0.000
		8	0.063	0.051	41.601	0.000
		9	-0.066	-0.047	48.185	0.000
		10	0.035	0.012	50.041	0.000
		11	-0.069	-0.055	57.445	0.000
		12	0.049	0.032	61.142	0.000
		13	0.038	0.057	63.415	0.000
		14	-0.008	-0.017	63.519	0.000
		15	-0.002	0.005	63.527	0.000
		16	0.057	0.057	68.614	0.000
		17	-0.043	-0.028	71.524	0.000
		18	0.030	0.004	72.950	0.000
		19	-0.013	0.011	73.230	0.000
		20	-0.013	-0.024	73.482	0.000

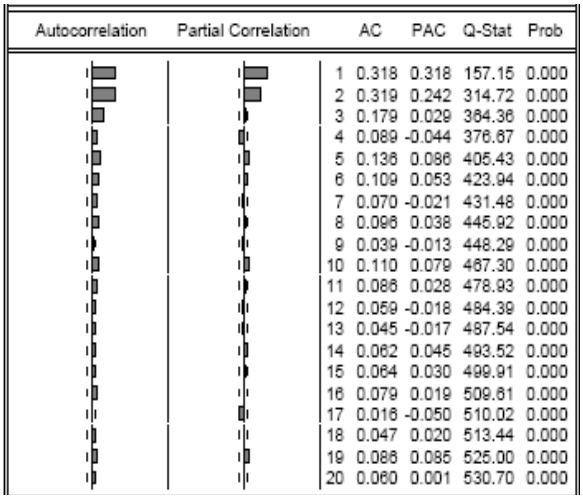


Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.255	0.255	98.816	0.000
		2	0.025	-0.043	99.766	0.000
		3	0.016	0.022	100.17	0.000
		4	-0.003	-0.012	100.18	0.000
		5	0.018	0.023	100.67	0.000
		6	0.019	0.009	101.25	0.000
		7	0.085	0.084	112.42	0.000
		8	0.068	0.026	119.57	0.000
		9	0.009	-0.015	119.69	0.000
		10	-0.004	-0.003	119.71	0.000
		11	0.137	0.150	148.50	0.000
		12	0.232	0.173	230.89	0.000
		13	0.059	-0.044	236.21	0.000
		14	0.046	0.040	239.43	0.000
		15	0.028	0.002	240.63	0.000
		16	0.055	0.060	245.36	0.000
		17	0.001	-0.032	245.36	0.000
		18	0.025	0.020	246.34	0.000
		19	0.002	-0.059	246.35	0.000
		20	0.006	0.004	246.40	0.000

Table VIII - ACF, PACF and Ljung-Box Q test for mean adjusted returns and squared returns for SOFIX index in the period 24.10.2000 - 1.1.2007.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.001	0.001	0.0011	0.973
		2	0.011	0.011	0.1837	0.912
		3	-0.031	-0.031	1.7007	0.637
		4	0.004	0.004	1.7305	0.785
		5	0.007	0.008	1.8136	0.874
		6	-0.062	-0.063	7.8243	0.251
		7	-0.003	-0.003	7.8394	0.347
		8	0.026	0.028	8.8755	0.353
		9	0.044	0.040	11.873	0.221
		10	0.075	0.076	20.728	0.023
		11	-0.039	-0.038	23.144	0.017
		12	0.002	-0.002	23.149	0.026
		13	0.014	0.019	23.467	0.036
		14	-0.007	-0.007	23.535	0.052
		15	0.030	0.035	24.929	0.051
		16	0.045	0.057	28.169	0.030
		17	0.013	0.005	28.449	0.040
		18	-0.037	-0.043	30.636	0.032
		19	0.027	0.027	31.740	0.033
		20	0.002	-0.001	31.746	0.046



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.318	0.318	157.15	0.000
		2	0.319	0.242	314.72	0.000
		3	0.179	0.029	364.36	0.000
		4	0.089	-0.044	376.67	0.000
		5	0.136	0.086	405.43	0.000
		6	0.109	0.053	423.94	0.000
		7	0.070	-0.021	431.48	0.000
		8	0.096	0.038	445.92	0.000
		9	0.039	-0.013	448.29	0.000
		10	0.110	0.079	467.30	0.000
		11	0.088	0.028	478.93	0.000
		12	0.059	-0.018	484.39	0.000
		13	0.045	-0.017	487.54	0.000
		14	0.062	0.045	493.52	0.000
		15	0.064	0.030	499.91	0.000
		16	0.079	0.019	509.61	0.000
		17	0.016	-0.050	510.02	0.000
		18	0.047	0.020	513.44	0.000
		19	0.086	0.085	525.00	0.000
		20	0.060	0.001	530.70	0.000

Table IX - ACF, PACF and Ljung-Box Q test for mean adjusted returns and squared returns for XU100 index in the period 24.10.2000 - 4.1.2007.

CROBEX, VaR 95%, 500 days: 22.11.2004. - 2.1.2007.									
	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures		29		17	27	22	20	17	11
Frequency of failures		0.058		0.034	0.054	0.044	0.04	0.034	0.022
Kupiec test (p value)		0.17647		0.94408	0.29612	0.6879	0.82115	0.94408	0.99886
Christoffersen IND test (p value)		0.10028		0.016105	0.23115	0.012682	0.044012	0.60145	0.23191
Lopez test		4.1685		-7.8737	2.1302	-2.8711	-4.8825	-7.9232	-13.962
Blanco-Ihle test		14.549		8.4001	11.556	9.2428	7.8082	6.196	2.0484
RMSE		0.014141		0.014224	0.014733	0.01421	0.015144	0.014625	0.017295
MAPE		1.7082		3.2469	1.7681	2.1347	2.5436	1.5935	3.1097
Average VaR		-0.0135		-0.01478	-0.01424	-0.01431	-0.01541	-0.0146	-0.01819

CROBEX, VaR 99%, 500 days: 22.11.2004. - 2.1.2007.									
	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	11	13	8	2	7	6	8	6	2
Frequency of failures	0.022	0.026	0.016	0.004	0.014	0.012	0.016	0.012	0.004
Kupiec test (p value)	0.005208	0.000646	0.06711	0.87661	0.13232	0.23708	0.06711	0.23708	0.87661
Christoffersen IND test (p value)	0.01859	0.039413	0.004139	0.89904	0.078954	0.05405	0.10917	0.70234	0.89904
Lopez test	6.06	8.0494	3.0305	-2.9957	2.0337	1.0178	3.0188	1.018	-2.9959
Blanco-Ihle test	4.262	2.9231	1.5147	0.14551	1.9843	0.86425	0.81733	0.92024	0.14484
RMSE	0.018073	0.018682	0.02211	0.026437	0.025755	0.023221	0.021632	0.02128	0.02505
MAPE	1.1596	1.2369	1.2618	0.82793	0.42145	1.0175	1.1696	0.72319	0.50125
Average VaR	-0.01812	-0.01881	-0.02264	-0.02776	-0.02345	-0.0239	-0.02245	-0.02114	-0.02572

Table X - Backtesting results and diagnostics of 500 VaR forecasts for CROBEX index daily log returns, 95% and 99% confidence level, period 22.11.2004 - 2.1.2007

VIN, VaR 95%, 500 days: 5.11.2004. - 1.1.2007.									
	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	29	26	28	31	21	25	23	26	16
Frequency of failures	0.058	0.052	0.056	0.062	0.042	0.05	0.046	0.052	0.032
Kupiec test (p value)	0.17647	0.36861	0.23168	0.09445	0.75905	0.44706	0.61007	0.36861	0.96571
Christoffersen IND test (p value)	0.0238	0.046153	0.017199	0.000244	0.058758	0.03444	0.09888	0.73711	0.53106
Lopez test	4.2758	1.2276	3.2391	6.2525	-3.7946	0.20739	-1.8202	1.1708	-8.8887
Blanco-Ihle test	26.419	17.518	18.553	19.674	16.063	14.324	12.064	12.972	5.663
RMSE	0.016097	0.016169	0.016493	0.015882	0.017003	0.016703	0.018443	0.020107	0.021361
MAPE	1.3691	1.6035	2.7606	2.9751	1.3541	2.2145	2.3416	1.3416	1.7481
Average VaR	-0.01365	-0.01431	-0.01449	-0.01386	-0.01502	-0.01517	-0.01715	-0.01687	-0.01942

VIN, VaR 99%, 500 days: 5.11.2004. - 1.1.2007.									
	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	15	10	8	6	11	7	9	11	4
Frequency of failures	0.03	0.02	0.016	0.012	0.022	0.014	0.018	0.022	0.008
Kupiec test (p value)	6.15E-05	0.013244	0.06711	0.23708	0.005208	0.13232	0.031102	0.005208	0.56039
Christoffersen IND test (p value)	0.007142	0.18573	0.60964	0.70234	0.23191	0.65537	0.14477	0.23191	0.7993
Lopez test	10.121	5.0927	3.0862	1.0755	6.0782	2.0711	4.0767	6.0618	-0.95086
Blanco-Ihle test	6.968	4.2621	3.8453	3.1788	3.3796	2.8325	3.4061	2.8499	1.6071
RMSE	0.024701	0.023815	0.02448	0.023857	0.024015	0.025248	0.025515	0.028251	0.029803
MAPE	1.9975	1.0399	1.2244	1.0299	0.95262	0.97506	1.4688	1.4289	0.86284
Average VaR	-0.02297	-0.02336	-0.02435	-0.02402	-0.02354	-0.02513	-0.02522	-0.02485	-0.02746

Table XI - Backtesting results and diagnostics of 500 VaR forecasts for VIN index daily log returns, 95% and 99% confidence level, period 5.11.2004 - 1.1.2007

BBETINRM, VaR 95%, 500 days: 8.12.2004. - 3.1.2007.

	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	37	33	31	39	27	24	21	26	26
Frequency of failur es	0.074	0.066	0.062	0.078	0.054	0.048	0.042	0.052	0.052
Kupiec test (p value)	0.007661	0.045412	0.09445	0.002701	0.29612	0.52865	0.75905	0.36861	0.36861
Christoffersen IND test (p value)	0.17911	9.46E-05	2.9E-05	0.000337	0.060759	0.000439	0.000937	0.046153	0.58221
Lopez test	12.48	8.5026	6.478	14.605	2.4008	-0.57729	-3.6177	1.3599	1.374
Blanco-Ihle test	26.754	27.65	23.224	37.522	18.484	19.176	16.153	16.135	14.728
RMSE	0.023917	0.024443	0.023342	0.022677	0.025717	0.024351	0.026743	0.02643	0.02731
MAPE	1.8479	3.5237	3.8005	4.793	1.7905	3.2145	4.0299	1.4489	2.2519
Average VaR	-0.02165	-0.02288	-0.02274	-0.02123	-0.02453	-0.024	-0.02681	-0.02534	-0.02618

BBETINRM, VaR 99%, 500 days: 8.12.2004. - 3.1.2007.

	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	16	14	7	11	12	9	9	9	10
Frequency of failures	0.032	0.028	0.014	0.022	0.024	0.018	0.018	0.018	0.02
Kupiec test (p value)	1.73E-05	0.000206	0.13232	0.005208	0.001901	0.031102	0.031102	0.031102	0.013244
Christoffersen IND test (p value)	0.096153	0.054505	0.078954	0.23191	0.28312	0.14477	0.14477	0.56529	0.18573
Lopez test	11.245	9.2492	2.1804	6.2374	7.2322	4.1867	4.2327	4.1948	5.2031
Blanco-Ihle test	9.4729	8.8584	4.5077	7.0397	7.322	4.7247	6.7585	5.9299	5.3488
RMSE	0.042161	0.039568	0.046639	0.044536	0.042127	0.048852	0.037796	0.037812	0.038305
MAPE	1.7007	1.591	0.71571	1.2519	1.2643	0.68579	0.98504	0.92519	0.95511
Average VaR	-0.03771	-0.03659	-0.04656	-0.04505	-0.04048	-0.04846	-0.03866	-0.03673	-0.03672

Table XII - Backtesting results and diagnostics of 500 VaR forecasts for BBETINRM index daily log returns, 95% and 99% confidence level, period 8.12.2004 - 3.1.2007

SOFIX, VaR 95%, 500 days: 23.12.2004. - 1.1.2007.

	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	34	24	26	20	24	19	19	24	11
Frequency of failures	0.068	0.048	0.052	0.04	0.048	0.038	0.038	0.048	0.022
Kupiec test (p value)	0.03026	0.52865	0.36861	0.82115	0.52865	0.87277	0.87277	0.52865	0.99886
Christoffersen IND test (p value)	0.001066	0.000439	0.000134	0.000551	0.12501	0.000312	0.003747	0.025213	0.48129
Lopez test	9.2176	-0.8244	1.2156	-4.8015	-0.84663	-5.8359	-5.8445	-0.84951	-13.924
Blanco-Ihle test	24.12	16.437	19.544	14.522	15.286	13.682	10.563	17.069	4.4519
RMSE	0.014062	0.013605	0.014465	0.013894	0.014703	0.014214	0.015095	0.01342	0.015093
MAPE	2.4589	1.5711	4.3192	4.3616	1.0399	2.818	3.7955	1.3092	2.9352
Average VaR	-0.01193	-0.01239	-0.01348	-0.01408	-0.0131	-0.0135	-0.01498	-0.01255	-0.01529

SOFIX, VaR 99%, 500 days: 23.12.2004. - 1.1.2007.

	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	12	5	4	4	6	3	7	14	5
Frequency of failures	0.024	0.01	0.008	0.008	0.012	0.006	0.014	0.028	0.01
Kupiec test (p value)	0.001901	0.38404	0.56039	0.56039	0.23708	0.73638	0.13232	0.000206	0.38404
Christoffersen IND test (p value)	0.44186	0.75037	0.7993	0.7993	0.70234	0.84892	0.078954	0.004504	0.75037
Lopez test	7.0817	0.024583	-0.98231	-0.97978	1.0323	-1.9912	2.0671	9.065	0.02986
Blanco-Ihle test	7.2067	2.4055	0.87132	0.66356	2.7474	0.43187	3.1911	4.8128	1.2068
RMSE	0.020971	0.023927	0.029184	0.032718	0.0248	0.029247	0.021376	0.019542	0.021869
MAPE	1.5187	0.34913	0.78055	1.0299	0.37656	0.67082	0.79551	2.1571	0.7606
Average VaR	-0.01912	-0.02258	-0.02876	-0.03383	-0.02351	-0.02907	-0.02169	-0.01853	-0.02163

Table XIII - Backtesting results and diagnostics of 500 VaR forecasts for SOFIX index daily log returns, 95% and 99% confidence level, period 23.12.2004 - 1.1.2007

XU100, VaR 95%, 500 days: 7.1.2005. - 4.1.2007.									
	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	39	34	32	31	25	25	36	30	19
Frequency of failures	0.078	0.068	0.064	0.062	0.05	0.05	0.072	0.06	0.038
Kupiec test (p value)	0.002701	0.03026	0.066371	0.09445	0.44706	0.44706	0.012425	0.13085	0.87277
Christoffersen IND test (p value)	0.097731	0.025703	0.002596	0.009505	0.000737	0.005742	0.002539	0.00657	0.032264
Lopez test	14.359	9.336	7.2902	6.3006	0.28061	0.25821	11.361	5.3356	-5.7839
Blanco-Ihle test	17.595	14.06	10.885	11.215	11.726	9.3979	14.646	15.18	7.6577
RMSE	0.023501	0.025414	0.025295	0.025237	0.025591	0.025967	0.023484	0.023468	0.025581
MAPE	2.4913	2.6459	3.0175	3.6234	1.5711	1.7606	3.9252	1.6309	1.5312
Average VaR	-0.02483	-0.0275	-0.02798	-0.02806	-0.0278	-0.02871	-0.02596	-0.02549	-0.02848

XU100, VaR 99%, 500 days: 7.1.2005. - 4.1.2007.									
	HS 50	HS 100	HS 250	HS 500	BRW λ=0,97	BRW λ=0,99	Normal VCV	Risk Metrics	GARCH VCV
Number of failures	11	13	8	7	11	8	10	11	8
Frequency of failures	0.022	0.026	0.016	0.014	0.022	0.016	0.02	0.022	0.016
Kupiec test (p value)	0.005208	0.000646	0.06711	0.13232	0.005208	0.06711	0.013244	0.005208	0.06711
Christoffersen IND test (p value)	0.23191	0.002719	0.10917	0.078954	0.23191	0.10917	0.011969	0.000842	0.60964
Lopez test	6.1327	8.1268	3.1058	2.0866	6.1063	3.0858	5.126	6.1412	3.0833
Blanco-Ihle test	4.5552	3.6683	2.7865	2.1665	3.0075	2.1693	3.6259	4.4323	2.0435
RMSE	0.036097	0.037329	0.036397	0.040116	0.038654	0.040892	0.034312	0.034982	0.03782
MAPE	1.1746	1.9651	1.0524	1.2868	1.5985	1.0524	1.5511	1.3865	0.9601
Average VaR	-0.03694	-0.03896	-0.03935	-0.04285	-0.04061	-0.04325	-0.03728	-0.03677	-0.04028

Table XIV - Backtesting results and diagnostics of 500 VaR forecasts for XU100 index daily log returns, 95% and 99% confidence level, period 7.1.2005 - 4.1.2007

References

1. Boudoukh Jacob, Richardson Matthew, Whitelaw F. Robert, ″The Best of Both Worlds: A hybrid Approach to Calculating Value at Risk″, Risk, Vol.11., No. 5., May 1998. p. 64-67.

2. Jorion, Philippe, ″Value at Risk, The New Benchmark for Managing Financial Risk″, 2nd edition, New York, McGraw Hill, 2001.

3. Manganelli, Simone and Engle, Robert F., ″Value at Risk models in Finance″, ECB working paper series, No. 75., Aug 2001.

4. Žiković, Saša and Bezić, Heri, ″Is historical simulation appropriate for measuring market risk? : A case of countries candidates for EU accession″, CEDIMES conference, Ohrid, FYR Macedonia, 23-27 March 2006.

Is Gold a Hedge Against Turkish Lira?

Feride Ozturk, Sezgin Acikalin*

Abstract

This paper investigates whether gold is an internal hedge and/or an external hedge against Turkish lira (TL) by using monthly data from January 1995 to November 2006. Cointegration test results confirm the long-term relationships between the gold price and consumer price index and between the gold price and TL/US dollar exchange rate. The Granger Tests, based on vector error correction model (VECM), indicate that gold price Granger causes the consumer price index and TL/US dollar exchange rate in a unidirectional way. It is concluded that gold acts as an effective hedge against potential future TL depreciation and rising domestic inflation. Furthermore, gold price may be considered as a good indicator of inflation and hence it can be used as a guide to monetary policy.

JEL : E31, F31, G10 **DOI: 10.2478/v10033-008-0004-x**

1. Introduction

Apart from its use in industrial and medical applications and jewelry, gold has played an important role in the world's economy for thousands of years. The World Council (2005:3-4) states: "Gold is an effective hedge against inflation. In addition, gold is inversely correlated to the US dollar, making it a good currency hedge"; "Gold is a highly effective portfolio diversifier due to its low to negative correlation with all major asset classes"; and "In much of Asia, the Middle East, and the Indian subcontinent, gold is the best possible protection against upheaval both political and economic". The rise in gold prices from $250 per ounce in 2001 to over $650 in 2007 has made interest soar in gold as a financial asset and an economic indicator. It is as popular today as ever.

Buying and holding gold per se should not be considered an investment, at least in the classical sense. If so, why would one prefer investing in gold? Holding gold might be seen somewhat the same as keeping one's savings under the mattress as paper currency. Well, not quite the same, since one looses purchasing power by holding paper currency. However, the price of gold increases, or the purchasing power of gold goes up, if the paper currency depreciates. Accordingly, one might prefer holding gold to protect against a loss in the purchasing power of the paper currency.

Capie et al. (2005) argued that gold could be a hedge in two ways. The first is a hedge against changes in the internal purchasing power of the domestic currency, while the second one is a hedge against changes in the external purchasing power of the domestic currency. In other words, gold offers protection against a weak currency or high domestic inflation levels. If gold is considered to

* Ozturk:
Dunlupinar University,
Department of Economics,
Tavsanli Yolu 10.Km, Kutahya, Turkey
e-mail: fozturk@dumlupinar.edu.tr

* Acikalin:
Dunlupinar University ,
Department of Economics,
Tavsanli Yolu 10.Km, Kutahya, Turkey
e-mail: sezgina@anadolu.edu.tr

be a perfect internal hedge, its domestic currency price should increase at the same rate as domestic price index. If it is a perfect external hedge, its domestic currency price should increase at the same rate as the domestic currency depreciation.

In this paper, motivated by the renewed interest in gold, it is aimed to determine whether gold is an internal hedge and/or an external hedge against TL. Data used in the analyses runs from January 1995 through November 2006. It is used time series unit root tests to examine the stationary properties of the price of gold (GP), consumer price index (CPI), and TL/US dollar exchange rate series. The cointegration framework of Johansen (1988) was applied to test for cointegrating relationships. All tests provided evidence in favor of cointegration, and confirmed the existence of long-term relationships between GP and CPI and between GP and TL/US dollar exchange rate. Furthermore, in order to determine the causal relationships between CPI and GP and between TL/US dollar exchange rate and GP, Granger Causality test based on VECM was employed. The results indicated that GP Granger caused the CPI and TL/US dollar exchange rate (i.e., changes in GP preceded changes in the CPI and TL/US dollar exchange rate) in an unidirectional way. It is concluded that gold acts as an effective hedge against future possible TL depreciation and rising domestic inflation.

Findings also suggested that the gold price may be a good indicator of inflation and hence it can be used as a guide to monetary policy. However, it should be kept in mind that some factors, among others, economic and political factors in other countries, changes in foreign demand for gold, and world supplies of gold have an important role in determining gold prices.

The paper is organized as follows. Section II presents previous studies. Section III provides data, while section IV discusses methodology and presents results. Finally, section V concludes the paper.

2. Previous Studies

Gold has received an immense attention in the empirical literature. Sherman (1986), Jaffe (1989), Chua et al. (1990), Ciner (2001), and Michaud et al. (2006) have focused on the diversification benefits of portfolios including gold; Tandon and Urich (1988), Kitchen (1996), Christie-David et al. (2000), and Lucey and Tully (2006), among others, have examined the effect of macroeconomic news releases on gold prices. A number of studies have reported on the role gold plays as an effective hedge against inflation and possible currency depreciation and the role inflation and the possible domestic currency depreciation play on the gold price. Laurent (1994), for instance, investigated the relationship between the price of gold and wholesale price index in the United States. According to this study two variables closely corresponded over the period 1800-1992, while the price of gold was more volatile than the wholesale price index in the short term. Similarly, Harmston (1998) compared price of gold index, wholesale price index, and purchasing power of gold index (constructed by dividing the first index by the second) in the US (1796-1997), Britain (1596-1997), France (1820-1997), Germany (1873-1997), and Japan (1880-1997). In all five countries gold has been a tendency to return to an historic rate of exchange with other commodities and intermediate goods, meaning that gold is effective as a long-term hedge against inflation. Using monthly data from 1976 to 1999 and cointegration technique, Gosh et al. (2002) also found a long term relationship between the price of gold and US wholesale price index.

Recently, Levin and Wright (2006) investigated both sort term and long term determinants of gold price applying cointegration and VECM techniques over the period January 1976- August 2005. Their findings are three folds. First, there is a long term relationship between the price of gold and US price level. Second, there is a positive relationship between changes in the gold price and changes in US inflation, US inflation volatility, and credit risk, while there is a negative relationship between gold price movements and changes in the US dollar trade-weighted exchange rate and the gold lease rate. The last, in the major gold consuming countries such as Turkey, India, Indonesia, Saudi Arabia, and China gold is effective as a long term hedge against inflation. These studies present firm evidence about gold hedging. More specifically, gold retains inflation hedging properties in the long term despite considerable fluctuations in the short term.

Garner (1995) argued that the price of gold might be good leading indicator of inflation. When expected inflation rises, some investors might switch from financial assets with fixed nominal rates into gold or jewelry. Since the gold supply is relatively fixed, the price of gold might rise rapidly even with a small increase in gold demand. The inflation rate, however, tends to increase more slowly. Consequently, an increase in the price of gold might precede an increase in inflation rate. Reasoning from this point, turning point signals of the price of gold from 1960 to 1995 in the United States is evaluated in this study. It is found that the gold prices tended to signal past inflation upturns.

Mahdavi and Zhou (1997) compared the performance of gold and commodity prices as leading indicators of inflation applying cointegration tests and VECM over the periods 1958:QI-1994:Q4 and 1970:QI-1994:Q4. Their results indicated that out-of-sample forecast of gold is relatively poor which is consistent with the idea that in the short-term price of gold is too volatile. They concluded that the strength of the gold price signaling inflation may vary depending on the time span being examined. Ranson and Wainright (2005) demonstrated the extent to which

the prices of gold and oil serve as leading indicators of unanticipated inflation and interest rates applying an ordinary least squares. They reported that the price of gold is the superior predictor of the next year inflation.

Capie et al. (2005) investigated the extent to which gold price acted as an exchange rate hedge by using weekly data over the period January, 8, 1971- February, 20, 2004. Their cross-correlations and EGARCH results indicated that there was a negative relationship between gold price and sterling-dollar and yen-dollar exchange rates but the strength of this relationship varied over time.

3. Data

The data consists of monthly observations of the GP, quoted in TL per gram, the CPI, and TL/US dollar exchange rate. The sample period running from January 1995 to November 2006 covers a total of 143 observations. The data for the gold price and TL/US dollar exchange rate were taken from the internet data resources of Central Bank of the Republic of Turkey, while the CPI data was from the Turkish Statistical Institute's resources.

Figures 1, 2, and 3 show GP, TL/US dollar exchange rate, and CPI series in levels over time, respectively. The price of gold has varied between the lowest, 0.49 TL at the beginning of 1995 and the highest, 31.86 TL in July 2006. The gold price increased rapidly in the periods from the beginning of 2001 to the end of 2003 and from August 2005 to July 2006. TL followed a depreciation trend over the period of 1995-2002, while the depreciation turned out to be dramatic in 2001 and 2002. An apparent appreciation process of TL has seen from October 2004 to April 2006. Although it depreciated dramatically during May-July 2006, has since held relatively stable. The CPI has been on an increasing trend during the sample period.

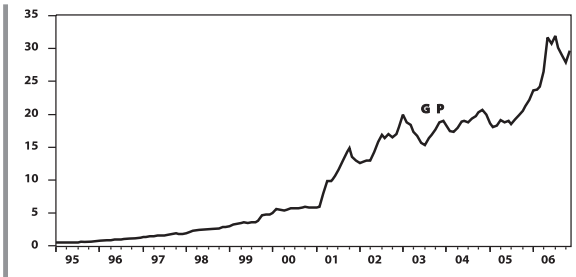


Figure 1. GP in TL, 1995-2006, (monthly)

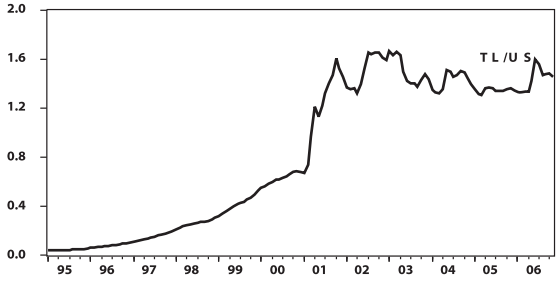


Figure 2. TL/ US dollar exchange rate, 1995-2006, (monthly)

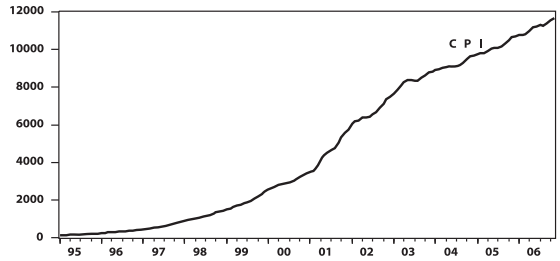


Figure 3. CPI, 1995-2006, (monthly)

4. Empirical Methodology and Results

Before investigating the cointegration relationships between GP and CPI and between GP and TL/US dollar exchange rate, Tramo-Seats method was used to deseasonalise all three series. Augmented Dickey-Fuller (1979) and Phillips-Perron (1988) tests were employed to examine stationarity of all interested variables. The rejection of null hypothesis indicating to unit roots in these tests is interpreted as consistent evidence of stationarity. Table 1 presents the unit root tests statistics for each series. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were applied with and without a time trend variable. It is evident that the null of a nonstationarity could not be rejected at the 5% level of significance for the GP, TL/US dollar exchange rate, and the CPI series with or without a time trend. Therefore, the tests were performed on first differences of series. The ADF and the PP test results, presented at the last three columns of the Table 1, indicate that all series are stationary in their first differences (I(1)).

Sample Period 01/1995 - 11/2006						
	Variables (levels)			Variables (first differences)		
Test Statistic[a,b]	GP	CPI	TL/US$	GP	CPI	TL/US$
ADF (c)	0.21 (1)	1.05 (1)	-0.90 (1)	-8.69 (0)*	-4.17 (0)*	-8.32 (0)*
ADF (t)	-2.60 (1)	-2.5 (1)	-1.49 (1)	-8.75 (0)*	-4.49 (0)*	-8.30 (0)*
PP (c)	0.50	1.75	-0.82	-8.56*	-3.99*	-8.32*
PP (t)	-2.19	-2.62	-1.30	-8.59*	-4.33*	-8.30*

Table 1: Unit Root Tests

[a] The optimal lag length, which are the numbers in parenthesis along with the ADF test statistics, were chosen by using the Schwarz Information Criterion (SIC).
[b] (c) is for the model with a constant term but no time trend. (t) is for the model with a constant term and a time trend.
* Denotes significance at the 1% level. The 1% critical values for the ADF test are -.3.54 and –4.11 for the model with a constant and for the model with a constant term and a time trend, respectively. The 1% critical values for the PP test are -.3.47 and –4.02 for the model with a constant and for the model with a constant term and a time trend, respectively. The 5% critical values for the ADF test are -.2.91 and –3.48 for the model with a constant and for the model with a constant term and a time trend, respectively. The 5% critical values for the PP test are -.2.88 and –3.44 for the model with a constant and for the model with a constant term and a time trend, respectively. The null hypothesis of the ADF and the PP tests is Ho: series contain a unit root versus H1: series is stationary.

Engle and Granger (1987) argued that if two nonstationary series are cointegrated, meaning that the series contain common trend components, there may exist a long-term stable relationship between the two. Having determined the order of integration, cointegration framework of Johansen (1988) is used to ascertain whether CPI and GP and TL/US dollar exchange rate and GP are cointegrated. The results of the cointegration tests are reported in Table 2. Both the Maximum Eigenvalue and Trace Tests statistics indicate that the null hypothesis of no cointegrating vector, r=0, is rejected at the 5% significance level, and hence, there exists at least one cointegrating vector between CPI and GP and between TL/US dollar exchange rate and GP. As further test results show that the null of r=1 can not be rejected at the 5% level, implying that there is only one cointegrating vector between the pairs of variables. Therefore, it is concluded that there are long-term relationships between CPI and GP and between TL/US dollar exchange rate and GP.

Granger (1969) pointed out that if two variables are cointegrated, then Granger causality must exist in at least one direction, either unidirectional or bi-directional. He described a variable x_t as Granger causing another variable y_t, if the inclusion of lagged values of x improves the forecast of y, or equivalently if the coefficients on the lagged x's are statically significant. To verify the existence of a long-run relationship between GP and CPI and between GP and TL/US dollar, the Granger causality test within a VECM is implemented. Formally, different possible Granger causal relations between GP and CPI and between GP and TL/US dollar in levels can be expressed using the parameters of equations (1), (2), (3), and (4) which form VECMs:

$$GP_t = a_0 + \sum_{i=1}^{m} a_i \cdot GP_{t-i} + \sum_{j=1}^{m} b_j \cdot CPI_{t-j} + u_t \quad (1)$$

$$CPI_t = b_0 + \sum_{j=1}^{m} bj \cdot CPI_{t-j} + \sum_{i=1}^{m} a_i \cdot GP_{t-i} + v_t \quad (2)$$

$$GP_t = c_0 + \sum_{i=1}^{m} c_i \cdot GP_{t-i} + \sum_{j=1}^{m} d_j \cdot (TL/US\$)_{t-j} \quad (3)$$

$$(TL/US\$)_t = d_0 + \sum_{j=1}^{m} dj \cdot (TL/US\$)_{t-j} + \sum_{i=1}^{m} c_i \cdot GP_{t-i} + w_t \quad (4)$$

Sample Period 01/1995-11/2006 (k=2)[a]							
		Maximum Eigenvalue Test				Trace Test	
Null[b]	Alternative	Test Statistic	5% Critical Value	Null	Alternative	Test Statistic	5% Critical Value
Variables CPI GP							
r=0	r=1	16.95*	15.89	r=0	r≥1	23.45*	20.26
r≤1	r=2	6.50	9.16	r≤1	r≥2	6.50	9.16
Variables TL/US dollar GP							
r=0	r=1	17.21*	11.22	r=0	r≥1	19.66*	12.32
r≤1	r=2	2.44	4.13	r≤1	r≥2	2.45	4.13

Table 2. Johansen Cointegration Tests

a The optimal lag length k was selected based on SIC in vector autoregressive (VAR) representation.
b r is the number of cointegrating vectors.
* Denotes significance at the 5% level.

where u_t, v_t, e_t and w_t are the white-noise error terms.

The results of Granger causality test are presented in Table 3. The null hypothesis that GP does not Granger cause CPI is rejected, while it is not possible to reject the null hypothesis that CPI does not Granger cause GP. The null hypothesis of GP does not Granger cause TL/US dollar exchange rate is rejected, but the rejection of the hypothesis that TL/US dollar exchange rate does not Granger cause GP could not be possible. In other words, GP Granger causes the CPI and TL/US dollar exchange rate in a unidirectional way.

Null Hypothesis	Chi -sq
GP does not Granger Cause CPI	10.23*
CPI does not Granger Cause GP	2.08
GP does not Granger Cause TL/US dollar	20.21*
TL/US dollar does not Granger Cause GP	3.26

Table 3. Granger Causality Tests Based on VECM

* Denotes significance at the 5% level. 5% critical value for the Chi-sq test is 5.99.

5. Concluding Remarks

In this paper, it is analyzed whether gold is an internal hedge and/or an external hedge against a TL. First, the stationarity properties of the GP, CPI, and TL/US dollar exchange rate series were determined. Then the cointegration framework of Johansen (1988) was applied to test for cointegrating relationships. All tests confirmed the existence of long-term relationships between GP and CPI and between GP and TL/US dollar exchange rate. Furthermore, in order to determine the causal relationships between CPI and GP and between TL/US dollar exchange rate and GP, Granger Causality Test is used based on VECM. The results indicated that GP Granger caused the CPI and TL/US dollar exchange rate (i.e., changes in GP preceded changes in the CPI and TL/US dollar exchange rate) in a unidirectional way. Therefore, it is concluded that gold acts as an effective hedge against future possible TL depreciation and rising inflation. The results also suggest that gold price is an indicator of expected inflation and hence it can be used as a guide for the direction of monetary policy.

References

Capie, F., T.C., Mills, and G., Wood, 2005, "Gold as a Hedge Against the Dollar", Journal of International Financial Markets, Institutions and Money 15.

Central Bank of the Republic of Turkey, http://www.tcmb.gov.tr

Chua, J., G., Stick, and R., Woodward, 1990, "Diversifying with Gold Stocks" Financial Analysts Journal 46.

Ciner, C., 2001, "On the Long-run Relationship Between Gold and Silver:A note", Global Finance Journal 12.

Dickey, D.A., and W.A., Fuller, 1979, "Distribution of the Estimators for Autoregressive Series with a Unit Root", Journal of American Statistical Association 74.

Engle, R.F., and C.W., Granger, 1987, "Co-integration and Error Correction: Representation, Estimation, and Testing", Econometrica 55.

Garner, C., 1995, "How Useful are Leading Indicators of Inflation", Economic Review, Federal Reserve Bank of Kansas City 80:2.

Ghosh, D.L., E.J., Macmillan, and R.E., Wright, 2002, "Gold as an Inflation Hedge?", University of St. Andrews Discussion Paper Series, Department of Economics, No.21.

Granger, C.W., 1969, "Investigating Causal Relations by Econometric Models and Cross-spectial Methods", Econometrica 37:3.

Harmston, S., 1998, "Gold as a Store of Value", World Gold Council, Research Study No.22, http://www.gold.org/value/reserve_asset/index.html. Accessed May 2007.

Jaffe, J., 1989, "Gold and Gold Stocks as Investments for Institutional Portfolios", Financial Analysts Journal 45.

Johansen, S., 1988, "Statistical Analysis of Cointegration Vectors", Journal of Economic Dynamics and Control 12:2.

Kitchen, J., 1996, "Domestic and International Financial Market Responses to Federal Deficit Announcements", Journal of International Money and Finance 15.

Laurent, R.D., 1994, "Is There a Role for Gold in Monetary Policy?", Economic Perspectives, The Federal Reserve Bank of Chicago 18:2.

Levin, E.R., and R.E., Wright, 2006, "Short-run and Long-run Determinants of the Price ofGold",WorldGoldCouncil, ResearchStudyNo.32,http://www.gold.org/value/reserve_asset/index.html, Accessed May 2007.

Lucey, B., and E., Tully, 2006, "Seasonality, Risk and Return in Daily Comex Gold and Silver 1980 - 2002", Applied Financial Economics 16.

Mahdavi, S., and S., Zhou, 1997, "Gold and Commodity Prices as Leading Indicators of Inflation: Tests of Long-Run Relationship and Predictive Performance", Journal of Economics and Business 49.

Michaud, R., R., Michaud, and K., Pulvermacher, 2006, "Gold as a Strategic Asset", World Gold Council, http://www.gold.org/value/stats/research/index.html, Accessed May 2007.

Phillips, P.C.B., and P., Peron, 1988, "Testing for a Unit Root in Time Series Regression", Biometrika 75.

Ranson, D., and H.C., Wainright, 2005, "Why Gold, not Oil, is the Superior Predictor of Inflation", Gold Report, World Gold Council, November.

Sherman, E., 1986, *Gold Investment:Theory and Application,* New York, Prentice Hall.

Tandon, K., and T., Urich, 1987, "Internationa Market Response to Announcements of US Macroeconomic Data", Journal of International Money and Finance 6.

The World Gold Council,2005, "The Value of Gold to Society", http://www.gold.org/pub_archive/index.php?thisDomainID=value&thisSubDomainID=stats

Turkish Statistical Institute, http://www.turkstat.gov.tr

The Use of the Sava River as an International Allocation Problem

Helmut Braun*

Abstract

The use of trans-national common resources like rivers often creates problems between countries, but can also, as some historical examples show, give possibilities for stronger, friendlier political relations. The core of the solution to common resources is precise regulation through trans-national agreements that can be changed only in a Paretian manner. After a short presentation of examples of such agreements, the process of decision-making implemented in the 2004 Sava Framework Agreement will be analysed using economic theory, especially the Coase theorem and simple bargaining theory. Property rights in this agreement seem to be weak, as well as some regulations of the decision process itself. This weakness can be cured by installing a supra-national authority to supervise the decision-making process. In this case, the authority would be the European Union, as all the countries involved are trying to harmonise with the EU.

JEL: O52, P48, Q58, Z00 **DOI: 10.2478/v10033-008-0005-9**

1. Outline of the Problem and Historical Overview

The use of trans-national common resources has always been a source of problems between countries. Rivers and waterways demarcating national borders especially often cause problems in regard to their utilisation: clean, fresh water is essential for biological systems, and fresh water scarcity has been a cause for conflict between people throughout recorded history. Whenever the same interests in utilisation collide, e.g. exploiting natural resources like fish, people are more likely to find a solution because they are interested in exploiting these resources. The littoral states at the source of the course of the river always have the advantage of being the first to exploit these resources, which can also lead to tensions. If interests in its utilisation compete with each other, such as fishing and pollution, then conflicts will arise, like emissions leaked into a river that make fishing dangerous by harming human health, or when fish stocks disappear because of pollution.

On the one hand, therefore, trans-boundary waterways can create political tensions: Israeli-Jordanian conflicts over withdrawals from the Jordan River were a major cause of the Arab-Israeli War in 1967, and water still remains today a source of tension between nations in the Middle East, Africa and Asia, as the example of the pollution of the Amur river shows (Issar and Brown, 2004; OCHA Situation Report No. 2). On the other hand, however, the use of common resources such as rivers can promote peace between the countries involved if an appropriate problem-solving institutional mechanism

* The author is indebted to Prof. Dr. Meho Bašić and to Prof Dr. Štefan Bojnec for helpful comments on the first draft of the paper presented in session K, ICES 2006 and to two anonymous referees who made valuable comments.

*Braun:
University of Regensburg, Faculty of Economics,
Universitäts-Strasse 31,
D-93040 Regensburg, Germany
e-mail: helmut.braun@wiwi.uni-regensburg.de

will be or has been instituted. Such cooperation reveals an important connection between conflict prevention regarding natural resources and confidence-building in general. Environmental co-operation between two or more states often leads to cooperation on more complicated issues. For example, in 1998 a "park of peace" between Ecuador and Peru was an element in solving their territorial dispute (UNEP).

The Sava River, originating in Slovenia, is an important border in the northern part of Bosnia and Herzegovina to Croatia and Serbia (Holbrooke, 1998, pp. 272-273). In the past, the Sava River sometimes was a source of conflicts and tensions. Nowadays, no one disputes this natural borderline anymore and the Sava River has only relatively small problems with competing utilities, especially navigation, which normally does no harm to the quality and quantity of water, the production of drinking-water, fishing, and exploitation of gravel. Cross-bordering pollution by waste-deposits exists on a normal level. To resolve these problems various international agreements have been made in the past. Therefore, we will first show the development and structure of some important agreements.

To tackle our "peace-promoting idea", we present the economic characteristics of common resources, discuss the role of the Coase-Theorem and introduce and analyse the Game-Theoretical Approach. We then demonstrate how the allocation problem was solved in the past, using a few important examples. After this, we have a closer look at the Framework Agreement on the Sava River Basin. Finally, we give a conclusion with an assessment of the solution of the Save Framework Agreement as a too for l promoting peace between the states involved indirectly.

2. Some Examples of International Agreements Concerning Trans-boundary Rivers

The Convention regarding the Regime of Navigation on the Danube signed in 1948 is the international legal instrument governing navigation on the Danube. The so-called "Belgrade Convention" provides for free navigation on the Danube in accordance with the interests of the parties while strengthening the economic relations between themselves and with other nations. According to the Convention, eleven member states[1] are responsible for maintaining their sections of the Danube in a navigable condition for river-going and, in the appropriate sections, to not hinder the navigation of sea-going vessels on the navigable channels of the Danube. The Danube Commission, which consists of one representative from each of the member states, was established to supervise the implementation of the 1948 Convention and to fulfil various other tasks aimed at ensuring adequate conditions for shipping on the Danube. Historically speaking, its basis dates back to the Paris Conferences of 1856 and 1921, which established an international regime to safeguard free navigation on the Danube for the first time. Another relevant question in this context is the harmonisation of technical prescriptions, rules and standards in force on the Danube and the Rhine within the European Union, and those adopted by the United Nations´ Economic Commission for Europe (ECE UNO), with the aim of creating a uniform Pan-European system of inland navigation.

With this cooperation, special attention is given to constantly improving technical and legal conditions of navigation for the vessels of all nations. Environmental issues are not mentioned at all in the Convention regarding the Regime of Navigation on the Danube (http://www.danubecom-intern.org). As navigation is only one kind of the utilisation of the common resource of a "river", other fields of conflict remain unsolved, especially any problems from pollution. The river Danube was used peacefully because the convention worked.

The Helsinki Rules cover different utilisation than that addressed by the Danube Convention. Adopted by the International Law Association at the fifty-second conference held at Helsinki in August 1966, the "Helsinki Convention" for the prevention and use of trans-boundary water courses and international Lakes obliges parties to prevent, control and reduce water pollution. Equitable utilisation, as it had been known in international water law, was defined in Article 4, which provides that a basin state is entitled to an equitable and reasonable share of the beneficial uses of the waters of an international drainage basin. It was recognised that a basin state has a right, not to an equal share of the waters of the basin, but to beneficially use those waters (UNESCO, p. 302). Now, the specific problems of the allocation of the common resource of a trans-boundary river have already been discussed. The Helsinki Rules also include provisions for monitoring, research and development, consultations, alarm systems, mutual assistance, information exchange and public access to information concerning waterways (http://www.internationalwaterlaw.org).

The main international legal document related to international water resources management is the UN Convention on the Law of the Non-navigational Uses of International Water Courses (1997). This Agreement has an authoritative function and covers more issues than any agreements made before. Above all, it indicates a broad agreement among states on the general principles relating to equitable and reasonable resource use, the duty not to cause significant harm, ecosystem protection, management obligations, information sharing, conflict resolution and the protection of the resource during armed conflicts (http://untreaty.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf).

1 These states are Austria, Bulgaria, Croatia, Germany, Hungary, Moldova, Slovakia, Romania, Russia, Ukraine, Serbia and Montenegro.

The Rhine is an important European river with diverse uses, including navigation. Therefore, it is exposed to many hazards. The River Rhine also forms an important ecosystem worthy of protection. Since 1950, the countries along the Rhine have cooperated under the roof of the ICPR to jointly protect the Rhine. ICPR work deals with water quality and emissions, ecology and floods. In addition, all countries bordering the Rhine are united in the Coordinating Committee Rhine. This body deals with co-ordinating the implementation of the European Water Framework Directive. Its basic target is the restoration of the good state of the Rhine and its water within the watershed in a peaceful way between the nations bordering the river Rhine (http://www.iksr.org/index.php?id=295).

These examples give two lessons. The protection of the environment was a goal –or an allocation problem- which was recognized late. The regularities of any common use of the river Danube as well as the Rhine were realized after World War II, when (Western) Europe had to be prepared for unification. In other words, various foreign events promoted a peaceful and wealth-producing cooperation on the use of the common resource of both rivers.

3. The Problem of Trans-boundary Common Resources: Some Theoretical Considerations

3.1. Traditional Theory of Common Resources and Property Rights

In order to preserve a natural environment and to prevent catastrophes like floods or hazardous pollution, preventive measures have to be taken and coordinated. With trans-national common resources such as river basins, co-ordination problems between nations arise from the issue of full open access for all parties to the river. In this case, individuals will overexploit common resources as private benefits exceed private costs. For this reason, these public goods are called "non-excludable", and "non-rivalry" in consumerism, which create problems for market-allocation. First, transaction costs do exist, which entails costs for getting information concerning "prices" of common goods and the costs of bargaining and finding an efficient solution. Second, free-riding-phenomena and the production of externalities occur. This means factual, non-market transaction compensated pollution in a certain area to an amorphous mass of "victims". Every polluter will benefit from this action, weather he stops his polluting or not, or whether he will be paid for stopping pollution or not. The higher the number of "victims," the more difficult it will be to avoid free-riding in the rivalry of consumerism. Every "victim" has to suffer from pollution, and every single "victim" has no rational possibility to pay the polluter(s) any sum of money to give him an incentive to stop pollution. Pollution, therefore, is a common good for all polluters and a common "bad" for all "victims." This is a consequence of incomplete property-rights, which leads to inefficient allocations if one individual user appropriates the common good factually and prevents others completely from using it by, for example, polluting a river in a manner that excludes all others from using the water of the river for drinking or fishing. The two uses mentioned rival one another because of incomplete property rights regarding "clean water" and "water as a deposit of waste"; the public good problem shows why it is impossible to make people pay for clean environment, and why free-riding is a rational reaction. The forces of a free market do not provide the correct economic incentives to save the environment, especially when property-rights are not exactly defined and therefore are not achieved by law (Demsetz, 1964, 1967; Alchian 1977, Posner 1977, Barzel, 1985; Hoppe 1989; Goodstein, 2005, pp. 34-39). In this case, new and exclusive property rights had to be defined by an authority. These property rights had to define any possibility of use, liability, and compensation rules.

The definition of use regarding the common resource of a river, however, is a problem of intermediating between a small number of sovereign parties that are able to hinder any common solution by each of the parties involved. Therefore, these parties play an allocation game with an unknown result concerning a Paretian situation.[2]

In 1960, Ronald Coase showed that every precise definition of property-rights leads to an efficient internalisation of external effects, assuming that the participants have perfect information and the type of bargaining is specified. This result is valid, regardless of to whom the property-rights belong, the "polluter" or the "victim". This also means that the traditional "polluter pays principle" is outdated; the structure of the problem is a reciprocal one (Coase, 1960). External costs are not simply costs produced by a polluter and tolerated by a victim. In most cases they are the result of decisions made by both parties. For example, the victim decided to stay near the factory that pollutes the air or, in another case, a factory-owner decided to build a new factory in the neighbourhood of the victim. Hence, externalities are the joint product of a polluter and a victim, and every governmental regulation that lays the blame on one party will lead to an efficient result only if that party is the one able to avoid the problem at a lower cost. The regulator - in most cases the government - can only guarantee the efficient outcome if it has enough information about the cost of pollution-control (Robson and Skaperdas, 2001, p.2). As long as the parties involved are able to make and enforce contracts in their mutual interest, neither direct

2 In the case of the River Sava, the problem of trans-national common resources is not only the problem of pollution by emissions, but also the navigation on the Sava River, as it is also used for shipping. The common use of a river for shipping, however, was an international problem that was solved in general very early. In these times, however, any environmental problems were not recognised as relevant problems.

regulation nor taxes are necessary to obtain an efficient outcome. The only essential precondition is the clear definition of property rights: who has a right to pollute and who has a right to an unpolluted environment. If this is this assumed, and transaction costs are zero, the market will lead to an efficient allocation (Coase, 1960). In other words, any agreement that is to the mutual benefit of all of the parties concerned leads to an efficient outcome. Who, however, defines effective property rights?

The establishment of clear and strong property-rights is a precondition for successful internalisation by bargaining. In the case of the Sava River, however, property rights are defined in a very abstract manner and hence the prerequisite is only weakly met. Does this provide the chance to finally come to an efficient allocation if problems about use occur?

In regard to the Framework Agreement of the Sava River Basin, the parties can make changes concerning different utilisation, e.g. fishing, fresh water, etc. The precondition for a change is a "consensus," which means that only if there is uniform agreement will a measure be taken. Understandably, it may be difficult to work out such an agreement; the more parties involved, the more difficult it will be to reach a consensus. In case one single party suffers a loss by a new measure, e.g. their territory is polluted by emissions, then a rationally acting individual will not agree to take the measure. Yet the other members have the capacity to persuade the individual - in our case a country - by making up for the loss. Therefore, the parties have to bargain over the compensation.

The parties that want to make the modifications to the agreement, let us say parties 2 and 3, can make an offer to party 1 – the one with the loss. If the offer is high enough, or at least as high as the loss of party 1, then party 1 may agree. But then a few problems arise. If the compensation payment offered by parties 2 and 3 equal the loss of party 1, then there is no real incentive for party 1 to agree. Thus, the other parties have to raise the offer. In case party 1 estimates the profit of the other parties correctly it can demand more. It can demand as much as the whole gains of parties 2 and 3. If it demands more, no solution will be found, since parties 2 and 3 have no incentive to agree because they will suffer net losses from such a high compensation payment. For this reason, the compensation payment will amount to a sum between the loss of party 1 and the profits of parties 2 and 3. However, if transaction costs are not zero, these costs reduce the volume of the sum of the compensation that can be offered. To finally find a solution for the allocation problem, or to change the Sava Framework Agreement itself, the new solution or change has to include an improvement for all of the members. This also means that in case one member is put at a disadvantage by a possible new measure, it is necessary for the others to make up for the disadvantage or loss of the other member. Only by doing this will a consensus be reached. The parties of the Framework Agreement have to bargain in order to find a consensus. In the real world, however, bargaining between two or more parties is not without transaction costs. Can a strong authority on a decision-level above the parties provide a cost-reducing solution that allows bargaining with little or none of these costs?

If the loss of one member is higher than the profit of the other parties, the solution is not efficient and the parties will not ratify such a treaty. Finally, a solution will only be found and implemented if there is an improvement in sum - i.e., all of the members benefit. In economic terms, only if an allocation is more efficient than the previous allocation can the measure that leads to this allocation be taken. The term "consensus" only "allows" improvements, or at least no deterioration. The same can be observed on the "commission level." Only a better allocation, or at least no worse allocation will be implemented. For this reason, this additional level of decision-making seems be considered obsolete. However, a justification for such a commission can be that experts on the Sava River will be chosen who know the facts and are therefore able to come to an agreement more quickly. These experts can realise lower transaction costs.

In order to lead to an efficient allocation, information is necessary. In this case it is assumed that information is distributed symmetrically among the parties involved; the prerequisites of this "system" are that a profit or loss can be reliably estimated. Only if the parties concerned know exactly about the losses and profits of a measure will they be able to make the right decision. Consequently, an exact analysis of risks and potential profits has to be made to show whether a measure is efficient or not. If the parties involved are not able or unwilling to estimate risks and profits exactly, the next decision-level has to take over this task. This decision-level also plays an important role if the bargaining processes are guided by "strategic" lines of discussions, e.g. in regard to the estimation of a "fair" sum of compensation.

3.2. Game-Theoretical Approach: The Prisoner's Dilemma and the Role of an Authority

Before analysing the situation of the use of the Sava River, we first have to show the attributes of the special situation of this trans-boundary "problem," as the attributes of the common resource of a "river" are complex: On the one hand, there are ways of utilising the river, such as navigation, that hardly compete with others, e.g. fishing. On the other hand, the river might be used to get rid of waste or other emissions, which competes with other forms of utilisation such as fishing or extracting drinking water. Hence, the common resource of a "river"

is not clearly a complementary or competing resource. It depends on how the river is used. Furthermore, the attributes "non-rivalry" or "rivalry" depend on who is the first to use the river. In general, everyone can use a river for drinking water, fishing, etc. Yet if the user at the beginning of the course of a river pollutes the river, those that come after will not be able to use the water in the way they intended. For this reason, rivalry in the use of the common resource of a "river" will emerge that will cause problems between the parties concerned.

The attributes of the individuals in this case are clearer: three states with a homogenous structure concerning preferences and utilities, making it easier for them to cooperate. Furthermore, there is an authority, the European Union, which is able to settle disputes, and which is anticipated by the three parties of the Sava Framework Agreement. This authority is able to sanction by general political interventions the non-cooperative behaviour of the three parties in their bargaining. The possibility of mutual sanctions, the possibility of political sanctions by the European Union as an authority, and the possibility of communication facilitate the resolution of conflicts (Holzinger, 2003).

4. The Sava River Basin Agreement

4.1. General Purpose

After the first important meeting regarding the Sava river in November 2001, with Serbia and Montenegro as the participating party and a signatory to the Letter of Intent concerning the International Sava Basin Commission, in December 2004 the Framework Agreement of the Sava River Basin was signed by Bosnia and Herzegovina, the Republic of Croatia and the Republic of Slovenia and came into effect. (http://www.rec.org/REC/Programs/sava/pdf/BackgroundPaper.pdf) The countries agreed to cooperate in a constructive and mutually beneficial manner for: (1) establishing navigation as specified in the 1948 Convention on the Regime on the Navigation on the Danube, international conventions regarding inland navigation, and the resolutions of ECE UNO, and together with the Republic of Slovenia for (2) promoting sustainable development of the Sava Basin by regulating utilisation, protection and management of the Sava Basin water and related natural resources (http://www.stabilitypact.org; http://www.rec.org/REC/Programs/sava/pdf).
It contains the goals of establishing an international regime of navigation, sustainable water management, and undertaking measures to prevent or limit hazards, and reduce and eliminate adverse consequences, including those related to floods, ice hazards, droughts and incidents involving substances hazardous to water (Framework Agreement of the Sava River Basin, p. 2). The Agreement recognises the importance of trans-boundary cooperation towards navigation, water management and sustainable development.

4.2. Decision Making on the First Decision Level

Any change to the Sava River Basin Agreement, as well as termination of the agreement, has to be made by consensus. This means that only if every country[3] agrees can modifications be made. The consequence of this fact is that a country will only agree if it gains an advantage with the change, or will at least not be at a disadvantage. Finally, changes to the agreement will only be made if there is an improvement for one member.

If another member suffers a loss from a potential modification of the agreement, it will be possible for the other(s) to compensate for the loss, e.g. by payment. But this will only be done if the gains are high enough to make up for the loss. Therefore, the change always has to imply a net improvement for the members/countries as a whole; otherwise any compensation high enough to make the one member/country agree will not be paid.

4.3. The Second Decision Level – Same Provision

The Framework Agreement on the Sava River Basin includes a second level, the so-called "Sava Commission" that also will make decisions, (1) aimed to provide conditions for safe navigation; (2) on the conditions for financing construction of navigable waterways and their maintenance; (3) on its own work, budget and procedures. This commission is established and financed by the parties; it has the function of representing each party equally.

The problem is, if no consensus concerning a modification on the agreement is found by the parties, a consensus will hardly be found by the Sava Commission, because the representative of any party will not make a decision that includes more disadvantages than advantages for his party. The "problem" of finding an agreement is only postponed to another level but with the same provisions. Only if there is an improvement for each party, or at least no deterioration, will a decision for a change be made. The advantage of such a commission can only be that it contains experts concerning the issues mentioned above. These experts will be able to find solutions and come to an agreement much more efficiently, in other words more quickly, than the parties themselves.

3 The words "countries", "parties", and "members" are used synonymously in this context.

4.4. Dispute Settlement

If the three parties, Bosnia and Herzegovina, the Republic of Croatia and the Republic of Slovenia, are unable to resolve disputes through negotiation, any party concerned can request that an independent "fact-finding expert committee" be established (http://www.rec.org/REC/Programs/sava/pdf/BackgroundPaper.pdf). This committee consists of three experts, with each party appointing one. The experts select another expert who is not a citizen of the concerned parties and who has the function of a chairman of the expert committee. If the nominated members of the committee are unable to decide on the selection of a chairman, the President of the International Court of Justice can nominate a chairman, who may not be a citizen of any of the countries concerned. The countries concerned are obliged, upon the request of the committee, to provide all information regarding the dispute and to permit the committee to enter their territories and inspect locations, installations and equipment necessary for its work. The experts should be provided with the necessary information in order to know the necessary facts to find an efficient solution. The committee adopts by majority vote the report of its findings. If the report is not adopted by unanimous vote, a dissenting opinion may be submitted that will be included in the report.

Now we will try to summarize the merits and deficits of this agreement, both economically and politically, as a basis for an efficient solution.

5. Conclusion

The aspects discussed can be interpreted as a substitute for weak property rights by strong political interests who define, as strong property rights, the limits of "efficient" bargaining. Additionally, a strong authority like the European Union preserves the "peaceful rules of the game" in the bargaining process between the parties in conflict.

The classic "model" of the prisoner's dilemma demonstrates that if preventive measures against pollution should be taken there will hardly be an efficient solution by weak property rights without the intervention of an authority, e.g. an organisation or government, because every party wants to get a "free-ride." In the case of the Sava River Basin, the European Union could act as such an authority. If a dispute without any solution exists on the level of the parties, the European Union as an authority on a higher level will be able to settle the dispute. Each of the three parties involved in the Sava Framework Agreement are interested in friendship with and potential membership in the European Union.

The intention to stay on friendly terms with the members of the European Union may also work as an incentive for the parties to settle their dispute "efficiently" under the political constraint given by EU authority. This special constellation makes a sustainable cooperation easier and more probable.

The Framework Agreement of the Sava River Basin is the first and fundamental step for cooperation regarding the use of the common resource of a "river". In this case, decision-making in regard of any trans-boundary problem is regulated as well as possible, albeit in a very abstract manner. The Framework Agreement of the Sava River Basin does not define exact property rights in a clear juridical manner as was demanded by Coase: it remains unclear which party, i.e. firms in any of the countries involved, has a right to pollute in a predefined quantity, and which party has the right to demand compensation.

The fact that changes in (or the termination of) the Framework Agreement are possible only by consensus leads to permanent improvements. In other words, only efficient changes will be implemented. The option of bargaining between the parties is possible, so if one suffers a potential loss, the others can offer to pay compensation. The distribution of a rising (common) wealth to the parties by realising an efficient change is part of the bargaining process; here strategies of extortion seem possible. Compared to the first level, there is no improvement in content on the second level, and no guarantee of finding a better solution than on the party-level. The second level, the Sava Commission, does not promise to find a consensus more easily, but it can lower transaction costs if the members of the commission are experts who have more information than the members, predominantly politicians, of the first level. This can lead to results more quickly than on the first level. Speaking in terms of Game-Theory, the problem of trans-boundary environmental problems constitutes a prisoner's dilemma. If it is impossible for the parties involved to find a solution via bargaining. Only a mutually accepted authority, such as the European Union, is able to intervene and help in producing an efficient solution. Since the countries of the Framework Agreement of the Sava River Basin wish to join European Union in a couple of years and the European Union decides autonomously which countries can join it, the European Union is a strong authority. Therefore, the parties should try to prevent their bargaining problems from being left unsolved, especially if they arose from ethnic quarrels.

Currently, the Framework is a good and efficient instrument to avoid trans-boundary problems concerning the Sava River Basin. The examples of the Rhine and the Danube illustrate that such agreements can work and that the Framework Agreement has a good chance of tackling the problem of the trans-boundary common resource of a "river". In the past, agreements like the Framework Agreement of the Sava River Basin often turned out to have been the starting point for the negotiations of more complex issues between countries. Perhaps the Framework Agreement will also create more trust in political relations between formerly hostile parties. This goal is more important than tackling more difficult problems regarding environmental problems in the future.

References:

Alchian, A. (1977): *Economic Forces at Work*, Indianapolis 1977.

Barzel, Y. (1985): "Transaction Costs: Are they Just Costs?", *Zeitschrift für die gesamte Staatswissenschaft 141*: 4-16.

Coase, R. H. (1960): „The Problem of Social Cost", *Journal of Law and Economics 3*: 1-44.

Demsetz, H. (1964): "The Exchange and Enforcement of Property Rights", *Journal of Law an Economics 7*: 11-26.

Demsetz, H. (1967): "Toward a Theory of Property Rights", *American Economic Review* 57: 347-359.

Hoppe, H. H. (1989): "Fallacies of the Public Goods Theory and the Production of Security", *Journal of Libertarian Studies IX*: 27-45.

Iza, A: "International Water Governance", Environmental Law Programme, http://www.iucn.org/themes/law/pdfdocuments/EPLP55EN.pdf
[Accessed 22.03.06].

Friedman, D. (1989): *The Machinery of Freedom*, 2nd Ed., Open Court: La Salle, 1989.

Goodstein, E. S. (2005): *Economics and the Environment*, John Wiley & Sons.

Holzinger, K. (2003): "Transnationale Gemeinschaftsgüter: Strategische Konstellationen, Kollektivhandlungsprobleme und Mehrebenensteuerung", Tätigkeitsbericht 2003, Max-Planck-Gesellschaft zur Erforschung von Gemeinschaftsgütern, http://www.mpg.de
[Accessed 22.03.06].

Holbrooke, R. (1998): „To End a War", Random House.

Issar, A. and Brown, N., eds. (2004): *Climate Change - Environment and Civilization in the Middle East*, Kluwer Academic Publishers.

OCHA: "Situation Report No. 2, Chemical Spill, People's Republic of China/Russian Federation", http://www.ochaonline.un.org
[Accessed 24.02.06].

Posner, R. (1977): *Economic Analysis of Law*, Boston 1977.

Robson A.R.W. and Skaperdas, S. (2001): "Costly Enforcement of Property Rights and the Coase Theorem", CESifo Working Paper, No. 762, August 2002.

REGIONAL ENVIRONMENTAL CENTER: "Framework Agreement of the Sava River Basin", http://www.rec.org/REC/Programs/sava/pdf/BackgroundPaper.pdf
[Accessed 22.03.06].

UNEP: "Protected Areas and World Heritage",

http://www.unep-wcmc.org,
[Accessed 19.02.06].

UNESCO: "Sharing Water- Defining a Common Interest",

http://www.unesco.org/water/wwap/wwdr/pdf/chap12.pdf
[Accessed 22.03.06].

URL: http:// www.internationalwaterlaw.org
[Accessed 22.03.06].

URL: http://www.danubecom-intern.org/ENGLISH/SUMMARY.htm
[Accessed 22.03.06].

URL: http://www.iksr.org/index.php?id=295
[Accessed 22.03.06].

URL: http://www.stabiltiypact.org
[Accessed 22.03.06].

URL: http://untreaty.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf
[Accessed 22.03.06].

URL: http://www.rec.org/REC/Programs/sava/pdf/BackgroundPaper.pdf
[Accessed 27.02.08].

Attractive Investment Images in Southeastern Europe: the Case of Varna, Bulgaria[1]

Theodore Metaxas*

Abstract

Attracting foreign direct investments (FDI) constitutes one of the primary aims of the regions and cities of Southeastern Europe after the fall of communist regimes in 1989. In order to satisfy this aim, cities are characterized by a plurality of efforts to create their images based on their distinctive characteristics and in this way attract investments and specialized human resources. Factors such as agglomeration economies, access to European markets, urban infrastructure, as well as qualitative 'soft' factors such as the quality of life and urban aesthetic, are considered as location criteria for business establishment in potential locations. The aim of the paper is to examine the attractiveness of the city of Varna as an investment destination by using primary data derived from empirical research on Varna's firms. The firms evaluate a variety of factors (urban characteristics), defining Varna's advantages as an investment destination. These advantages were then used to create the proposed 'investment image' of the city.

JEL: L1, O18, R58 **DOI: 10.2478/v10033-008-0007-7**

1. Introduction

Since the fall of the Berlin Wall in late 1989, great changes have taken place in the former socialist countries of Central and South-eastern Europe and the Soviet Union. The liberalization of trade and international flow of foreign capital and specialized human resources are well known factors that have led to fundamental economic and social restructuring, particularly visible in the post-socialist cities after 1989 (Castells 1992; Tsenkova and Nedovic-Budic, 2006:350; Tøndel, 2001; Filipovic and Petrakovic, 2005). On the other hand, competition on the international level has become so intense and intrinsic to local development that cities have to take a more entrepreneurial stance in order to remain at the top of a region and enhance their attractiveness to potential capital, residents and visitors (e.g. Hall and Hubbard, 1998; Williams, 2002; Hinderlink and Titus, 2002). A fundamental variable in the context of cities' competition is FDI attractiveness (Parkinson, 1991; Louri, *et al.,* 2000; MacKinnon and Phelps, 2001; Berkoz, 2001), which contributes to regional development by increasing the capital stock and the productive capacity (Ioannides and Petrakos, 1999; Iammarino and Santagelo, 2000). Post-socialist regions and cities consider the creation of an attractive investment image one of their main priorities

*Metaxas:
Department of Planning and Regional Development,
University of Thessaly,
Pedion Areos, 38334 Volos, Greece
e-mail: metaxas@prd.uth.gr

1 This research is part of a wider project under the title 'Local Economic Development and Cities Competition in Southeastern Europe' in the frame of 'HERACLITES: Studies in Basic Research'. The project is co-funded by the European Union – European Social Fund & National Resources – EPEAEK II. The financial support of these organizations and the contribution of the Polytechnic School of Varna are greatly acknowledged.

in order to become a competitive investment destination. Capital metropolitan cities like Prague, Warsaw and Budapest (European Cities Monitor, 2005; Metaxas, 2006), but also other urban centers such as, Lodz, Rostock, Poznan, Basel (Deffner and Metaxas, 2005; Florek, 2006; Johnson, 1995, etc.) have improved their images in the last decade in order to increase their competitiveness, as well as to establish a sound presence and play a crucial role in the European and International market. For Southeastern European cities, the transition periods have involved economic and social decline alongside the initial efforts invested in economic and social restructuring. The establishment of an attractive investment as well as cultural image received great attention over the last two decades. Especially in the last decade, as the region has stabilized and is approaching integration into the European Union, the new role of cities as promoters of post-industrial development, and as places attracting investment in various well-known productions and activities, has been established. Cities, such as Belgrade, which was named "The city of the future" in Southern Europe for 2006/07 (FDI Magazine, 2006), Plovdiv, as a modern and vibrant urban centre, Zagreb as an economic, scientific and cultural centre in Croatia, are seeking to develop business, culture, tourist and leisure policies in order to attract potential target markets and to fortify their economic development.

Taking into account all the above, the article aims to investigate the potential advantages of Varna, Bulgaria, in becoming a competitive investment destination in attracting foreign capital. In order to satisfy this aim, the article uses original empirical data from a survey conducted among city firms (local and foreign). Based on the findings of the survey, we attempt to outline the investment profile of the city, highlighting its most distinctive characteristics. More specifically, the structure of the article is the following. In the next section, the relationship between firm competitiveness and urban advantages is examined and the survey questions are set, focusing on the city of Varna. In the third section, a background of recent studies present Bulgaria and Varna as investment destinations, while in the fourth section we present the methodology, the profile of the survey and the profile of firms which participated in the survey. In the fifth section, Varna's profile is analyzed. In the sixth section the findings of the survey are presented. In the seventh, the suggested investment profile of the city is presented. In the last section, the article offers important conclusions for both the firms and the city of Varna.

2. Firm Competitiveness, Urban Assets and Location Choice Criteria

Recent studies have shown that the competitiveness of firms is dependent on a variety of factors on both the macroeconomic and microeconomic levels. Macroeconomic factors include taxation, the cost of investments, the cost of research (Chen and Williams, 1999; Rogoff *et al.,* 2004); microeconomic factors include the size and age of the firm (Sapienza, 1991), its ability to attract foreign capital, the absence of planning (Timmons, 1994), the absence of effective management, as well as environmental conditions (Gaskill *et al.,* 1993), that could be obstacles to the firm's competitiveness.

Beyond these factors, however, firm competitiveness is also formulated by the distinctive characteristics or advantages (urban assets), of the firm's location (Begg, 1999; Deas and Giordano, 2001). Several studies examine various factors (urban infrastructure, labour factors, development of networks in European and international markets, factors concerning quality of life – environment, etc.) that are related to the decision-making process of mainly multinational firms as they search for a base location [Meyer, 1996; Lankes and Venables, 1997; Chakrabarti, 2000; Tietjen and Myers, 1998; Scott, 1995, etc.]. For example, studies have shown that foreign firms' decisions concerning choice of location are possibly influenced by their intention of exploiting the benefits from agglomeration economies that exist in the areas of interest (Head et al, 1995; Nachum, 2000; Nachum and Keeble, 2003). Moreover, transportation costs, as well as land and labour costs, are basic factors in the firms' decision-making, (Harrington and Warf, 1995; Miller, 1977; Zhu, 2000), while the role of a place image is crucial in the development of existing economic activities and the attraction of new ones (Kotler et al, 1993; Harvey, 1989). Finally, the availability and the quality of universities and research centres is a factor that influences firms' competitiveness, especially in the fields of technology and innovation (Doutriaux, 2003; Doutriaux and Barker, 1995).

However, the selection of the proper place for firms' establishment is based on the traditional market theory of supply and demand. The criteria evaluated each time by a firm concern, of course, what this area offers– in relation to the competing areas – as well as the capacity of the area to plan and implement the proper competitive promotion policies in order to attract potential target markets.

In addition, a number of the particular factors that compose an urban environment will be presented. The selection of these factors is based on a report by the CEC (1993). This report groups a number of factors (regional and urban characteristics) that serve as location choice criteria. Both the EU report (CEC, 1993) and recent studies (Fest, 2000; Funck, 2000; etc.), apart from traditional economic factors (local market size, labour and land costs etc.), pay particular attention to factors such as the availability and quality of cultural and social organizations in the cities, leisure and education facilities, the existence of investment promotion and support offices and the existence of private – public partnerships. This list is further enhanced with reports from other studies such as D'Arcy and Keogh's (1998, 1999) on land value, Rogerson (1999) and Donald's (2001) on quality of life, Kowalska and Funk's (2000) on

culture, Craglia *et al.,* (1999) on international connections, etc. These factors are used in the present study as well and evaluated as pros or cons for the city of Varna in order to investigate whether Varna can become an attractive investment destination and what the distinctive characteristics of the city are based on, so that a city image as a potential investment destination can be produced and promoted to potential target markets.

Before we start the presentation and the analysis of the case of Varna, a brief presentation of Bulgaria as an investment destination is presented in the following section.

3. FDI in Bulgaria and Varna: Background Studies

The collapse of the communist system in 1989 gave rise to a fundamental change in the development of the states of Central and Eastern Europe, including Bulgaria. On 25 April 2005 Bulgaria signed an Accession Treaty with the European Union and has been an E.U. member since January 2007. For the last five years, the Bulgarian economy has grown steadily at 5% on average, driven mainly by exports and investments (Southeast Europe Investment Guide, 2006: 43).

FDI in Bulgaria has originated mainly from within the EU – more than 75%. Of particular interest is that Greece (the only EU country that neighbors Bulgaria) has invested close to a quarter of a billion US dollars every year for the last four years (Totev, 2005:95). An increasing number of Greek enterprises became active in the areas of South Bulgaria, near the Greek borders, because of the low labour and transportation cost, which helped the creation of an export base (Bitzenis, 2006).

Recent studies have shown the existence of a variety of factors that constitute criteria for the establishment of foreign direct investment in Bulgaria. For instance, in July 2000, KPMG conducted a survey of 230 companies, including 140 of the largest investors according to the FIA (Foreign Investment Agency). The survey included two issues – providing profiles of foreign investors, and descriptions of the investment conditions in Bulgaria. The research shows that the most preferable mode of FDI is majority holdings. Foreign companies say that their main motives for investing in Bulgaria are: the existence of established relations with regular customers from the region, the market potential, the geographical position of the country and the existence of a skilled labour force and low labour costs as a part of the total production cost (KPMG, 2000; Jordanova, 1999; Iankova and Katz, 2003). Furthermore, research carried out in business services that were created after 1996 in Bulgaria that focused on the regions of Varna and Burgas shows that the geographical position of the cities and their industrial characteristics were the main criteria for attracting these businesses (Kolarova, 2003). Similar conclusions have been expressed by Iammarino and Pitelis (2000), who focus their study on Greek outward FDI in Bulgaria and Romania, reporting that the main motives, among others, for business establishment were the geographical position, the investment incentives, the low labour costs and the increase in domestic and regional market share. Less important factors were the proximity of EU markets, transportation costs, the political and economic climate and domestic resources of raw materials. Finally, a very recent study of 64 foreign companies was conducted by Bitzenis (2007), and regarded the determinants of FDI in Bulgaria during the post-communist 1990s. Among other findings, the study showed the significance of geographical proximity as well as the importance of low labour costs for export-oriented companies. Similar results were reported by Iammarino and Pitelis (2000). Furthermore, the findings indicate the importance of cultural closeness and strong historical links (Bitzenis, 2007)[1]. Table 1 shows the investment inflows at the top 10 Bulgarian destinations, measured in USD$ for the period 1992-2003

No	THE TOP 10 REGIONS	SOFIA CITY	VARNA	SOFIA	BOURGAS	PLOVDIV	GARBROVO	LOVECH	PLEVEN	SLIVEN	BLAGOEVGRAD	TOTAL
	COUNTRY OF INVESTOR											
1	TURKEY	1203	205	12	400	1153	61	55	18	149	20	3276
2	RUSSIAN FEDERATION	1225	743	53	350	302	67	57	57	57	62	2973
3	GREECE	1575	52	56	60	547	38	18	35	62	745	3188
4	CHINA	2733	12	5	4	51	2	1	1		7	2816
5	SYRIA	1747	136	5	43	216	2	2	33	3	7	2194
6	ARMENIA	356	323	12	378	564	7	4	28	39	35	1746
7	ITALY	895	69	46	56	360	10	39	21	2	64	1562
8	FYROM	232	9	9	6	38	5	3	9	1	830	1142
9	UKRAINA	490	255	15	163	123	33	6	32	7	36	1160
10	GERMANY	757	146	33	89	115	30	29	13	5	29	1246
	TOTAL	11213	1950	246	1549	3469	255	214	247	325	1835	

Table 1 Distribution of the top 10 foreign investors (countries, by number of projects) in the top 10 Bulgarian destinations in USD$

2 For further information see Bitzenis (2007) Determinants of Foreign Direct Investment: Evidence from Multinationals in the Post-crisis Era of Bulgaria in the late 1990s. Southeast European and Black Sea Studies, 7(1): 83-111

ADVANTAGES	Studies	DISADVANTAGES	Studies
The geographical position	KPMG, 2000; Jordanova, 1999; Iankova & Katz, 2003; Kolarova,2003; Iammarino & Pitelis, 2000; Greek Embassy in Sofia, 2007	Access to EU markets	Iammarino & Pitelis, 2000
		Urban transport facilities Quality of Urban Environment Limited and underdeveloped business infrastructure	Regional Development Plan, 2007-2013
Low labour costs	Greek Embassy in Sofia, 2007; Totev, 2005; Bitzenis, 2007	Low capabilities of educated labour force	Spiridonova et al, 2000
Access to national markets and establish relations with customers	Totev, 2005; KMPG, 2000	Business climate	Iammarino & Pitelis, 2000; Spiridonova et al, 2000
		High risk of investment and trade development	Totev, 2005; KPMG, 2000
Skilled labour force	KPMG, 2000; Jordanova, 1999; Regional Development Plan, 2007-2013	Bureaucracy and corruption	Totev, 2005; KPMG, 2000; Bitzenis, 2007
Telecommunications and services facilities	Totev, 2005	State authorities and business organisations attitude towards businesses	Totev, 2005
The market potentialand the emerging Bulgarian market	Iammarino & Pitelis, 2000; KPMG, 2000; Bitzenis, 2007	Lack of experienced managerial human staff	KPMG, 2000
Cultural and Historical Heritage	Regional Development Plan 2007-2013	Low financial investment incentives	Bitzenis, 2007
Stable country political environment	KPMG, 2000		

Table 2 Advantages and disadvantages of FDI attraction on national level

Grouping most of the findings of the empirical researches mentioned above, Table 2 presents an analysis of the advantages and disadvantages of Bulgaria as a foreign investment destination. The main aim of this analysis is to award those factors that are the main assets on a national scale and to provide some comparative conclusions (at the end of the paper) in relation to an evaluation of the relevant factors in the case of Varna.

4. Research Profile and Methodology

This study collected primary data from 90 firms from all production sectors (industrial/ manufacture, commerce, services and tourism). It took place from May 2003 to June 2005 and used questionnaires and personal interviews. The questionnaire includes open-closed questions in five groups of questions; for the answers a Likert scale was used (1-10)

Production Activity	n	%	Type of ownership	n	%
Industrial/ Manufacture	35	40,2	Local	70	80,5
Commerce	28	32,1	Local with foreign participation	11	12,6
Services	10	11,5	Foreign*	6	6,9
Tourism	14	16,0			
Total	**87**	**100,0**	**Total**	**87**	**100,0**

Table 3 Firms included in the study by production activity and character

[Likert, 1932; Stathakopoulos, 2005:134]. Each interview lasted 25 to 45 minutes. All the firms had over 20 employees, and 80% were local. Research took place within 50 km of the city center. Interviews were made with high level managers and also business-owners. Each interview was certified with the signature of the responder, who filled in the questionnaire and the business stamp.

Table 3 presents profiles of the firms included in the study according to their production activity and character. As we can see, 72.3% of the firms are industrial and commercial enterprises, while the rest belong to the service and tourism sectors. All firms have over 20 employees, with an average of 87 employees. This study then concerns Small-Medium Enterprises. In addition, the majority of the firms are local (80.5%), while a small percentage include foreign participation or are exclusively foreign investors. This means that the evaluations of the specific firms are greatly important both for local development and the planning and implementation of solid development policies.

At this point we have to make clear something very important. In order for a more comprehensive analysis to be made and to reach final conclusions, the analysis includes both the evaluations of local firms, which are the majority, and the evaluations of foreign (or with foreign participation >30%) firms, which make up only a small percentage of the respondents. The main objective of this analysis is to determine, according to estimations made by firms, if and to what extent Varna can become an attractive investment destination. Of course, there are differences between estimations made by local and foreign firms, mainly concerning the importance of factors they evaluate, and for this reason it is interesting to report both sides. As far as the reliability of the conclusions is concerned, based on the small percentage of foreign firms, we cannot claim to derive general conclusions as to what is considered important by foreign firms in general. In the present analysis, however, we can observe an intense tendency of these firms in relation to their evaluations of Varna's characteristics and the extent of their differences from the evaluations made by local firms. Moreover, the conclusions of the analysis will be evaluated according to their advantages/disadvantages analysis mentioned above in order to see whether there is any coincidence of views concerning the advantages and disadvantages in terms of the attraction of FDI on a national level.

5. The Region of Varna: Profile

Varna occupies an area of 205 km^2 on verdant terraces descending from the calcareous Frangen Plateau (height 350 m) along the horseshoe-shaped Varna Bay of the Black Sea, the elongated Lake Varna, and two waterways bridged by the Asparuhov most. The region of Varna has a population of 490.000 people, 70% of whom live in the city of Varna, the third largest city in Bulgaria. The city is becoming the centre of a growing conurbation stretching along the seaboard to the north and south (mostly residential and recreation sprawl) and the lake valley to the west (mostly transportation and industrial facilities). The city lies 470 km north-east of Sofia; the nearest major cities are Dobrich (45 km to the north), Shumen (80 km to the west), and Burgas (130 km to the south-west). Varna is accessible by air (Varna International Airport), sea (Port of Varna Cruise Terminal), railroad (Central Train Station), and automobile. Major roads include European routes E70 and E87 and national motorways A-2 and A-5; there are bus lines to many Bulgarian and European cities from two bus terminals (Municipality of Varna, 2007).

Map of Bulgaria and the position of Varna
Source: www.infohub.com

The production profile of Varna region is predominantly determined by metal and mechanical engineering and machine building, including shipbuilding and ship repairing, chemical industry, transportation by sea, as well as light and food industry, textile industry, and construction. Numerous companies are working in the fields of shipbuilding, ship repair, production of diesel engines, radar technology, medical technology, production of household appliances, building material and building, furniture production, textile production, canning of fruits and vegetables, alcoholic and alcohol-free beverages, meat products and dairy products (Varna Chamber of Commerce and Industry, 2007). Varna and the surrounding area attracted $418m between 1992 and 2001, accounting for 10% of the total inward foreign investments in Bulgaria. The city's port forms a part of one of the major logistics routes between Europe, Russia, Ukraine, Caucasus and Asia. Varna's international airport is the country's second largest airport after Sofia with connections to 35 countries and 101 cities around the world. In September 2004, *FDI*

Magazine (a *Financial Times* Business Ltd publication) proclaimed Varna *South-eastern Europe City of the Future*, citing its strategic location, fast-growing economy, rich cultural heritage and higher education (FDI magazine, 2004).With the nearby towns of Beloslav and Devnya, Varna forms the Varna-Devnya Industrial Complex, home to some of the largest chemical, power generating and manufacturing plants in Bulgaria, including the sites of the two largest cash privatization deals in recent history.

6. Definitions of Varna's Advantages and Disadvantages

The first group of factors that is examined concerns the existence of *agglomeration economies and access to European markets*. More specifically, this group includes six variables (factors) regarding the accessibility to customers and suppliers, the existence of foreign firms and supporting services, as well as the accessibility to national and European markets. Previous studies have shown that all the factors above are of major interest for foreign investors in expanding their activities in potential locations. Several studies (Waits *et al*, 1997; Nachum, 2000; Nachum and Keeble, 2003) support that firms tend to locate close to large customers and suppliers, important competitors, aiming for direct access to the final sales points and consequently the minimization of product distribution costs and to exploit the benefits of agglomeration economies that exist in the areas of interest (technology, innovation, etc.) In addition, the easy access to the new market's means, direct satisfaction of customers' needs and increase of firms' competitiveness against other competitors are all considered factors (Blakely, 1994:148; Doeringer *et al.,* 2004; Papadskalopoulos *et al*., 2005).

Regarding the case of Varna, the research shows that both local and foreign firms that were asked in this research evaluate the city of Varna as a destination with an attractive geographical position (figure 2). The direct access to suppliers and customers, as well as the accessibility to other national markets are the two main advantages cited. At the same time –and because there is a major concentration of mean values – a score slightly over the average (5.5), i.e., between 6.0 and 7.0, supports that Varna combines all the characteristics of a good geographical position, which derives from it being a harbor and the gate of Bulgaria to the Black Sea. Therefore, because of the medium mean values and the high standard deviations that the examined factors received, the geographical position of Varna is distinguished among the firms' appreciations. More specifically, the firms overall estimate that all the factors that are examined constitute advantages, but they differ in whether they are especially strong advantages. The main differences arise in their evaluations of the

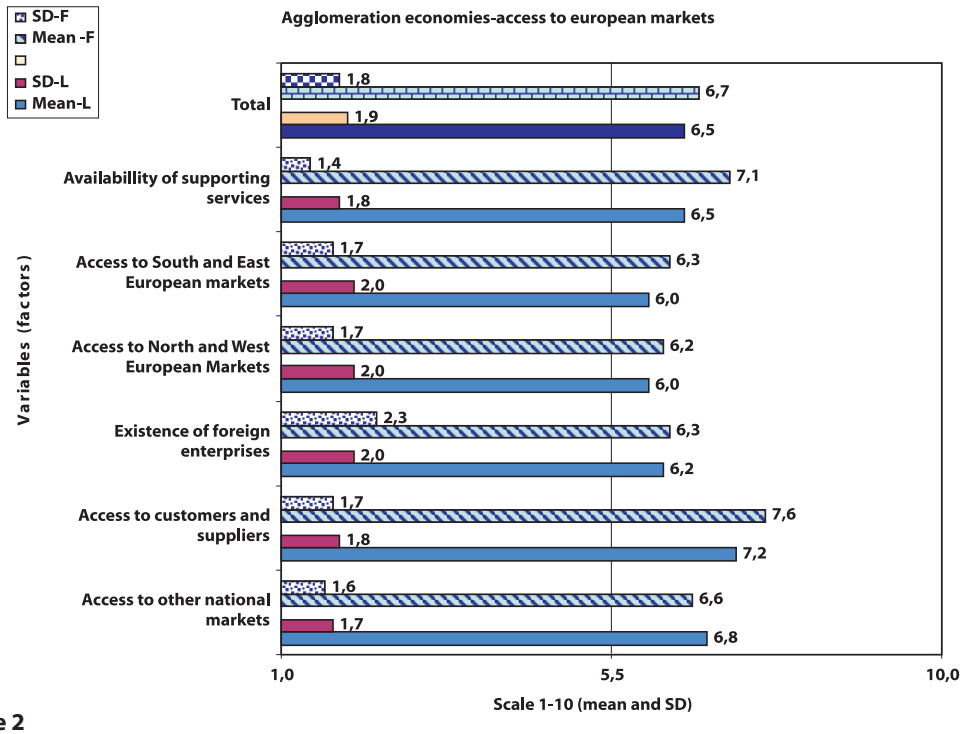


Figure 2
Agglomeration economies – access to European markets (mean, SD) [1= the least important, 10= the most important]

'availability of supporting services,' where foreign firms give a quite high mean value (7.1) and also a low standard deviation in relation both to the local firms and to all the factors examined. Generally, the total evaluation indicates that agglomeration economies and access to national and European markets formulate an attractive position for the city, one capable of attracting foreign investment.

The second group of factors that is examined concerns the existence of some very important *characteristics* and *policies* on a regional level and, more specifically, the availability of strongly attractive investment motives, the existence of low local taxes and finally, and most crucially, the local authorities' attitude towards businesses (figure 3). Previous studies have defined that the role of local authorities is important, since they contribute to the creation of a dynamic business climate, supporting the competitiveness of the existing firms but also the attractiveness of new ones (Fuller *et al.,* 2003; Leeming, 2002; Bennett and Krebs, 1991; Syrett, 1994, etc.). Furthermore, local taxes, as well as a well balanced tax system on a national scale play a crucial role in attracting foreign investment (Budryte, 2005; Desai *et al.,* 2004; Leibfritz *et al.*, 1997). Of course this is not entirely correct, since that econometric analysis and other surveys of international investors showed that tax factors are not the most important for multinationals in deciding on the location of their investment (Shah, 1995; Morisset, 2003; Morisset and Pirnia, 2001). Furthermore, FDI in SEE countries has been primarily privatisation-led and, in most cases, market-oriented (horizontal) as opposed to export-oriented. This type of investment is less likely to be influenced by corporate income tax incentives (OECD, 2003).

Regarding the case of Varna, the whole view presented is quite troubling. Both local and foreign firms regard all the factors of this group as disadvantages, since all mean values are under the average (5.5). At the same time, without the values of standard deviations being low, they present a relevant homogeneity regarding their value, with the exception of the standard deviations (1.8 and 1.7) of the factor 'availability of strong investment incentives.' This fact leads to the conclusion that the factors related to the creation of an attractive business climate in the area are evaluated as disadvantages, something on which all the sample firms agreed. These appreciations are acceptable, if we take into consideration that, since 1992, all Bulgarian cities have faced a new period of challenges and changes that influence the operation and the whole profile of the municipalities. Since 1999, Bulgarian cities are obligated to adopt a city development strategy – CDS – which constitutes the base for a long-term development strategy (Tsenkova, 2004; Driscoll, 2002). For the first time, the Municipal Government has become the main administrative unit. Hence, local authorities should reconstruct themselves and become oriented towards important changes such as the acquisition of know-how and experiences, the development of partnerships with the private sector, the increasing demand for education and continuing training, the need for specialized staff with skills and knowledge in the fields of management and legal affairs (Kapitanova and Minis, 2003).

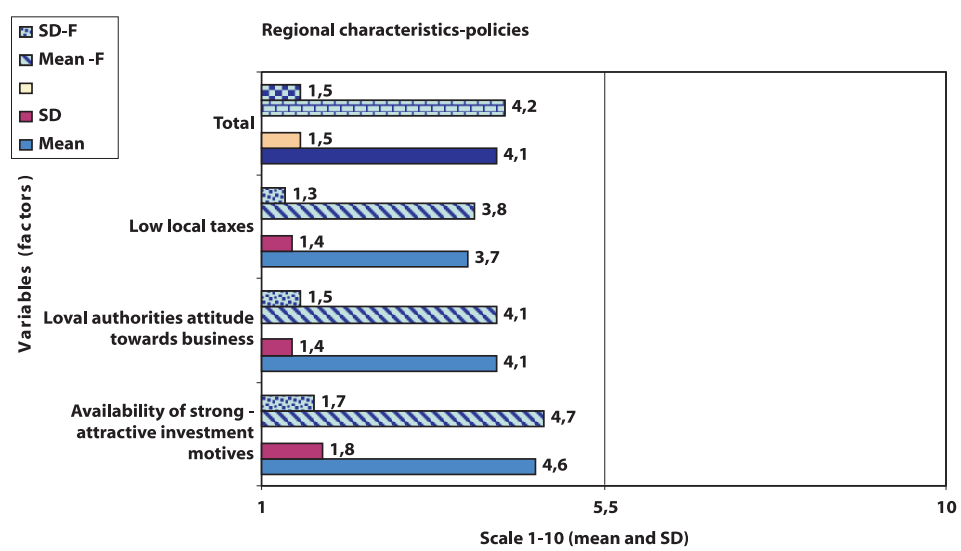


Figure 3
Regional characteristics - policies (mean, SD)
[1= the least important, 10= the most important]

The next group of factors that is examined concerns *labour* factors, focusing especially on the availability, the quality and the specialization of human resources. Particular attention has been paid to the existence of good labour relationships and labour ethics on a local level. The significance of these factors in firms' competitiveness has received great attention since the decade of the 60s, notably in the older studies Herzberg *et al*., (1959) and Locke (1976), as well as in more recent studies (Tietjen and Myers, 1998; Parsons and Broadbridge, 2006).

In the case of Varna (figure 4), the research shows that local firms regard all labor factors as disadvantages, since the mean values are below the average (5.5). The important point is that there exists differentiation among firms' opinions regarding the significance of these factors and how they contribute to the creation of a city's competitive image, since standard deviation values are very high (1.8 to 2.4). This fact is obvious in all the factors, especially in the 'availability of human resources.' Local firms perceive that the city lacks human resources, since the region of Varna holds the highest percentage of employment (46%), vis-a-vis 42.4% on a national level and the rest of the cities in the Northeastern Region whose unemployment rate is below the mean national rate (Regional Development Plan, *2007-2013*, 2007:5). Despite the fact that many higher education establishments are gathered in the city of Varna (5 universities and 5 colleges) in relation to the rest of the cities of the Northeastern Region (Regional Development Plan, *2007-2013*, 2007:5), the local firms named this factor a disadvantage, something that is also supported by the Regional Development Plan, in which a number of professional fields are not incorporated in the curricula of the secondary and higher educational establishments in the region. At the same time, the level of professional qualification of the workforce, especially of the unemployed, is not fully adequate to the requirements of the market and the infrastructure of professional training and re-training in the region is still underdeveloped (Regional Development Plan, *2007-2013*, 2007:6). However, a clear differentiation is observed in the estimations of foreign firms. These firms estimate that labor force availability, much more its quality and specialization, are advantages for Varna, which is something that opposes the views of the local firms. The next two factors, good working relations and morality in work, are given mean values very close to the average (5.5), showing that these factors are neutral; that is, they are considered neither an advantage nor disadvantage for the city.

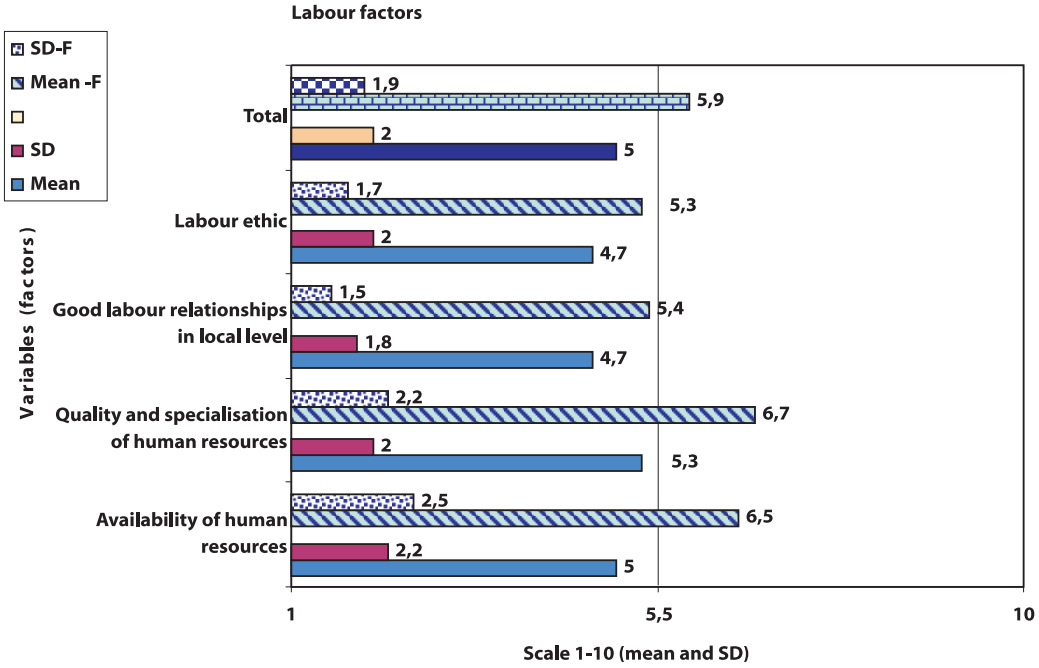


Figure 4
Labour factors (mean, SD)
[1= the least important, 10= the most important]

The next group of factors considered concerned cost. We examine the cost of labor and the cost of land use. Recent studies, especially in the models of New Economic Geography, show that firms avoid locations in regions with high production cost (land use, labor and transport costs) [Fujita et al., 1999; Love et al., 1999; Disdier and Mayer, 2004, etc.].

Regarding the case of Varna (figure 5), the research shows that all firms evaluate cost factors as strong disadvantages for the city. It is important that the foreign firms regard the low costs in labor and land as disadvantages, which is a fact that contrasts with most of the empirical studies mentioned above. We will assert that there is a logical explanation for this, which is that the low labor cost is related with the low quality and efficiency on the work that takes place, something possibly influences both the final product and the total competitiveness of firms against other firms with more qualitative products. This hypothesis is endorsed, up to a point, by the estimations made by foreign firms on labor factors in figure 4. On the other hand, the low cost of land use could lead to the spatial concentration of some declining industrial forms of business that negatively influence the effectiveness of the local economy's development.

The fifth group of factors examined concerns Varna's urban infrastructure. More specifically, these include all the types of the city's connections – forms of transportation as well as the existence of telecommunications and networks that operate effectively. These are related to the direct products' distribution, easier access to markets, the minimization of products' cost, as well as the final products' price (EU, 2002; European Communities, 2003:14). On this point, the new economic geography studies support that the minimization of transportation costs, and through the improvement of transportation facilities, enforce the concentration of economic activities, especially in big urban centers, where firms enjoy all the benefits of co-existence and the development of relationships with other businesses (Gao, 2004).

In the case of Varna (figure 6), the research shows that both local and foreign firms believe the current urban infrastructure constitutes an advantage for the city. All factors receive mean values much higher than the average (5.5), with the dominant factor being 'telecommunications' which, besides the high mean values that it receives (8.0 and 8.2), presents the lowest standard deviations as well (1.8 and 1.2). This fact means that there is strong consent on the significance of this factor among all the sample

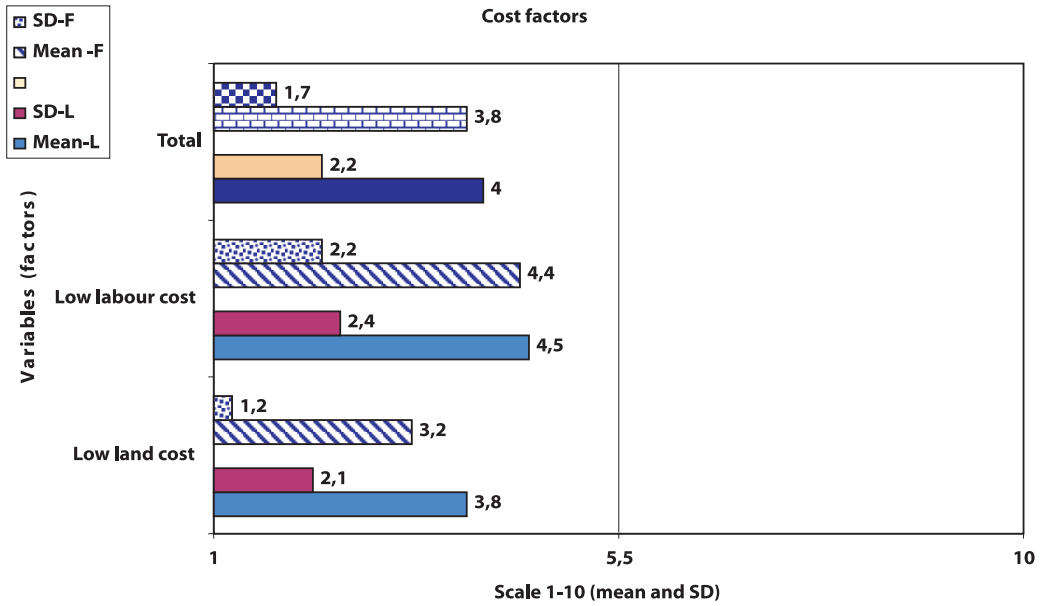


Figure 5
Cost factors (mean, SD)
[1= the least important, 10= the most important]

firms. Air and sea connections were also evaluated as very important, proving the important role of the Varna port and airport. Land infrastructure is considered less important, a factor which also presents strong variations among firms with regard to its importance. Foreign firms evaluate non-land transportations as very important advantages for Varna for the attraction of FDI, highlighting the importance of the city as a port in the greater region of Black Sea and the Balkans. Another important fact is that all the firms recognize the importance of urban infrastructure for the city, while the rather high values of typical deviations show differences on the part of firms with regard to the characterization of these factors as advantages or sound advantages. Combining the factors of urban infrastructure with those of agglomeration economies and those of access to European markets, we assert that the geographical position of Varna is awarded the role of the main advantage of the city and constitutes the axis of its competitive image.

The next group of factors concern 'soft factors' and, especially in the current analysis, those related with urban aesthetic and the attractiveness of the natural environment. These factors have received great attention, especially in the last two decades, proving their high importance for cities and also firms' competitiveness (Hall, 1998:115; Jansen-Verbeke and van Recom, 1996; Jensen and Leven, 1997; Craglia et al., 1999). In addition, according to studies of the 80s (Boyer and Savageau, 1981), it constitutes a significant factor of firms' competitiveness, but received more value and attention in the 90s (CEC, 1993).

In the case of Varna (figure 7), the research shows all the firms consider soft-qualitative factors advantages for the city of Varna. Means receive high values (≥ 6.8), while standard deviations are not particularly high. Firms understand that the current aesthetic image of the city, but also the natural environment, combine to form a powerful city profile, capable of attracting new businesses and investments. Especially in the case of foreign firms, the combination of these factors constitutes a significant parameter for their development, something that certifies the great attention that these factors have received as basic criteria for foreign firms' establishment in an area.

The last group of factors that is examined is related to the trio of 'research – development –education'. Several studies have shown that the availability and the quality of Universities and research centers constitute a factor in firms' competitiveness, especially in the fields of

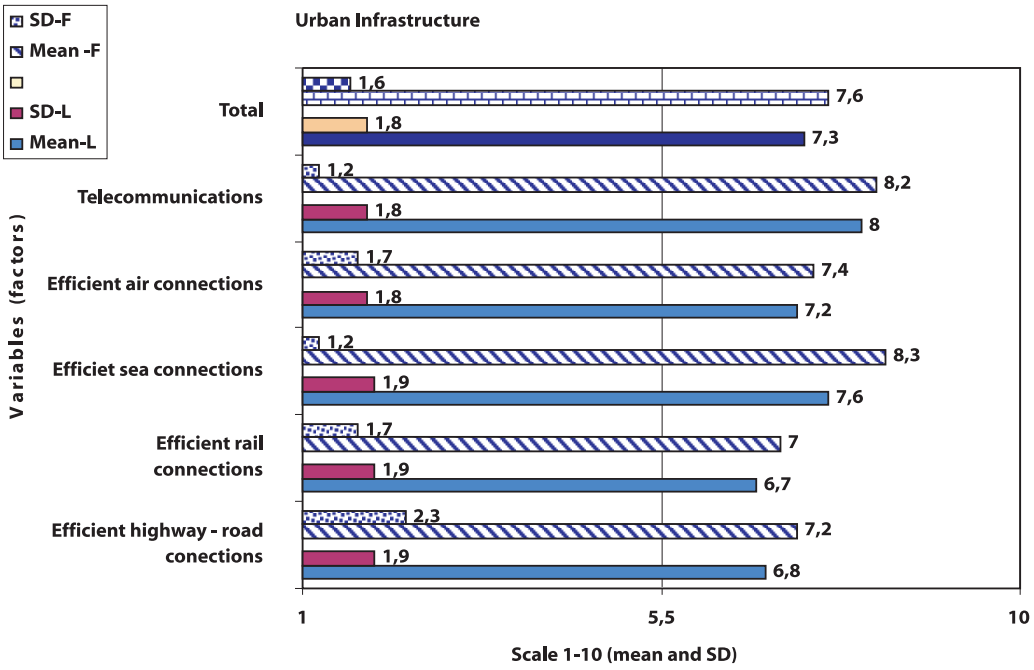


Figure 6
Urban infrastructure (mean, SD)
[1= the least important, 10= the most important]

technology and innovation (Doutriaux, 2003; Doutriaux and Barker, 1995). Consequently, firms preferred to be located in areas that provide high levels of specialization, research and education. In addition, most firms, through the development of partnerships with universities and research centers, were able to become fields of research and work on a local level (Shane, 2002).

In the case of Varna (figure 8), the research shows that generally both local and foreign firms evaluate the factors of research, development and education as advantages but not strong ones. Mean values are between 5.5 and 7.0, while they enjoyed high standard deviations. This fact points out the problem of specialization and the quality of human resources, something that has been noticed also in the analysis of labor factors above. A significant exception is the high mean of 'quality of continuing training and education' that foreign firms give to this factor. The results show that foreign firms evaluate with higher values and lower standard deviations two of the three factors of this group, but the total mean for all firms is between 6.0 and 7.0 (not strong advantages). The combination of the outcomes of these two groups of factors (labor and research-development-education) leads to the conclusion that Varna does not lack so much in universities and research institute facilities, but it lacks actually in the quality of the fields of specialization, research and know-how. Consequently, we can assert that these factors, working together, constitute an important disadvantage for the city of Varna, something that influences the whole image of the city as an 'attractive investment destination' negatively.

7. A Proposed Image for Varna as an Investment Destination

The configuration, or differentiation of city image, has attracted the attention of many specialists in the last 20 years (Lamboy and Moulaert, 1996; Hope and Klemm, 2001; Hall and Hubbard, 1998:12). The creation of a city image as a 'final productive good' is not random, since it is directly related with the nature (character) of its identity (strong or weak), and also with the distinctive characteristics that constitute the main components of each city's 'uniqueness' (Jenkins, 1999; Metaxas, 2003). Following the definition of Kotler *et al* (1999: 160), the image is the sum of beliefs, ideas and impressions that people have about a place. The images represent a simplification of a large number

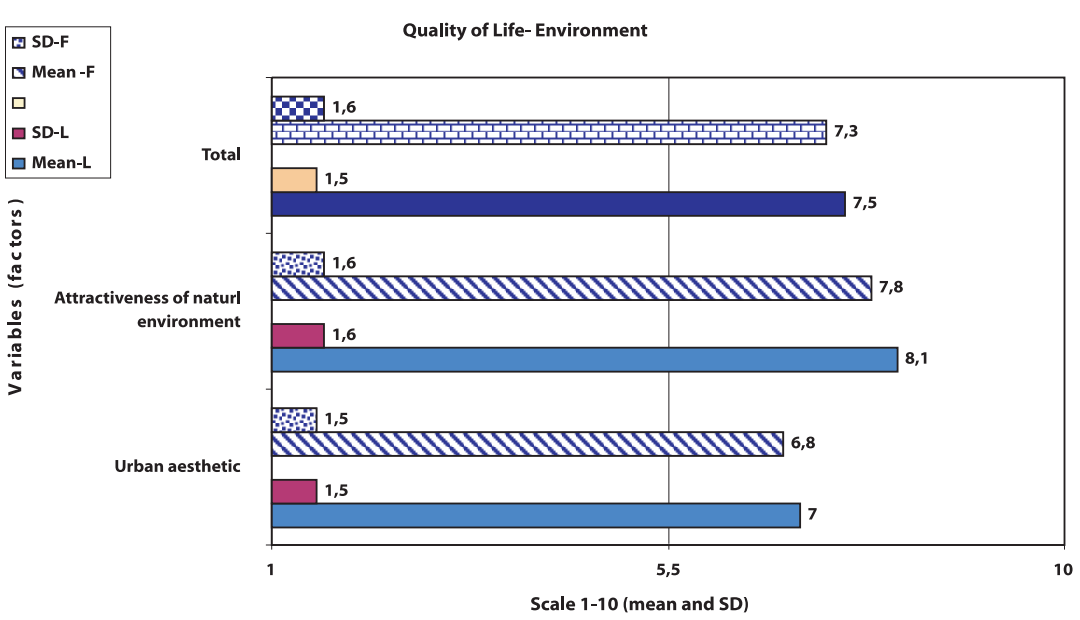


Figure 7
Quality of life - environment (mean, SD)
[1= the least important, 10= the most important]

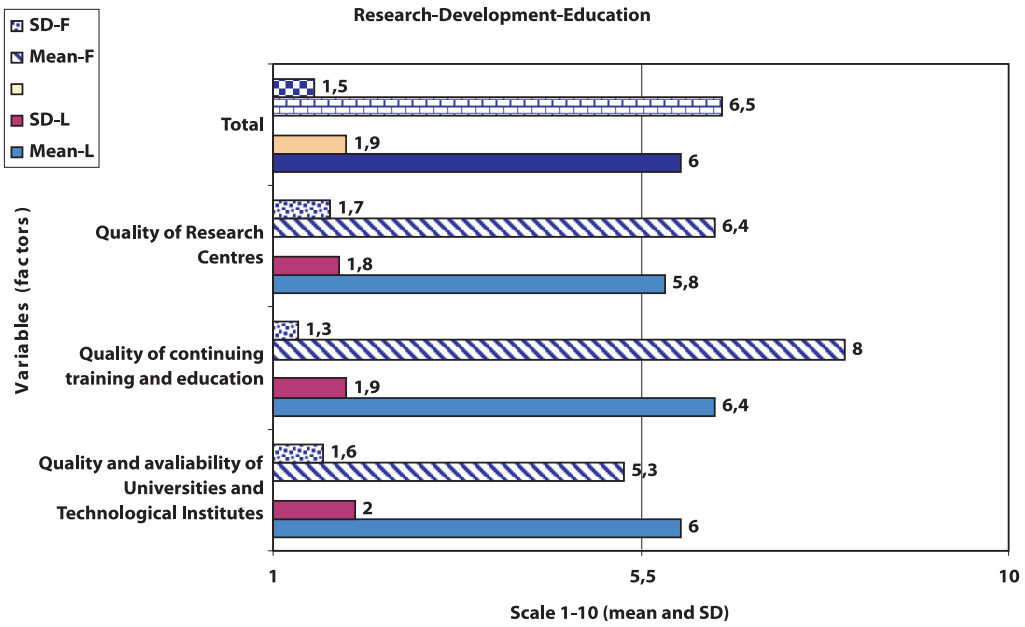


Figure 8
Research – Development – Education (mean, SD)
[1= the least important, 10= the most important]

of associations and pieces of information connected with that place.

In the case of Varna, the creation of this city's image as an investment destination starts with the city's attempt to attract investment activities based on its distinctive characteristics and the advantages of its environment. The positive aspects in Varna's internal environment include its high accessibility (by air, sea, rail and road) and the large size of the local market – an urban agglomeration with supranational significance. Considering these characteristics as the core of Varna's image as an investment destination, a proposed image is presented in figure 9. Furthermore, two more advantages of Varna are presented, that is, the factors of research – development – education (as availability of infrastructure), along with the factors of quality of life and environment. These factors work as satellites of the total investment image of the city, supporting the factor of 'geographical position.' Based on this model, we will assert that the city of Varna and the wider area are likely to attract foreign investments, mainly in the industrial/manufacturing and service sectors. The two main poles (agglomeration economies and access to markets along with urban infrastructure) are interrelated, the one complementary to the other's usefulness.

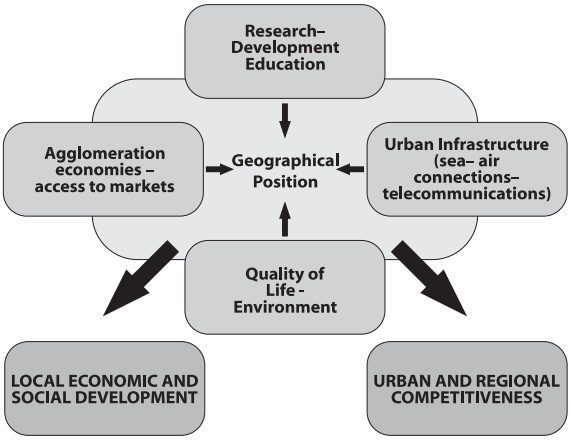


Figure 9
A proposed image of Varna as investment destination

We can support, to a certain extent, that the suggested city image is further supported by the results of the analysis of advantages/disadvantages of Bulgaria as an investment destination (table 2). Factors such as geographical position, which has to do with agglomeration economies and accessibility to national and foreign markets, are taken into

serious consideration. There are differences, of course, such as in urban infrastructure, and this is logical since cities like Varna and Burgas have a quite satisfactory infrastructure in comparison with other cities in Bulgaria, mainly because of their geographical position and their population size.

Of course, the scenario presented according to this model generates a series of questions which have to be investigated and answered. For example, a) What kind of investments and from where should the city of Varna pursue? b) Does the city of Varna have the capacity and the proper favorable political and economical environment to attract and sustain the creation of new investments? c) Do the local authorities have the required know-how and specialization in order to support the image of Varna through specific policies such as place marketing and place branding? d) Is there common representation of development interests among all the city's actors (local authorities, firms, development organizations, decision makers, residents, etc.)? e) since the factors of cost and labor, as well as factors that concern mainly the role of local authorities towards firms, emerge as major disadvantages for Varna in the analysis above, How can the local authorities and decision makers of the city proceed to the adoption of the proposed model of Varna's image and its overall support in the potential target markets?

The above questions are only a few of the many that concern a destination that is trying to build a dynamic, competitive and attractive investment image in the context of new competitive European and International markets.

Conclusions and Suggestions

The aim of the article was to outline the potential for a medium size city of southeastern Europe to become an attractive investment destination. To satisfy this aim, using the HERAKLITOS programme, the study attempted to record and analyse Varna's potential. Through primary research, the advantages and disadvantages of Varna were evaluated by local and foreign small-medium firms of all the production sectors that are located in greater Varna. Based on the research findings, the study made the following important conclusions.

First, both local and foreign firms participating in the research estimate that the main advantage of Varna is its geographical position, as the city has a port and is the main entrance to the Black Sea. This fact is able to allow the concentration of firms, mainly industrial and commercial ones, in the area. In the firms' evaluations one can notice some differences in opinion as to how strong the advantages are of the factors of this group. A second advantage for Varna, which is directly linked to its geographical position, is urban infrastructure. More specifically, all firms stress the importance of communications and air and sea infrastructure, while for land facilities a difference in opinions is noticed with regard to their importance. The combination of the factors that compose the groups 'agglomeration economies – networks' and 'urban infrastructure' – renders Varna's geographical position its main advantage for the attraction of foreign investments. Finally, a third group of factors that are estimated as advantages are those of the aesthetic image of the city and its natural environment, which are likely to supplement the city's benefits, since they are seriously taken into consideration by foreign firms that are considering establishing themselves in the area.

Second, all the firms deem the rest of the groups of factors as disadvantages. There are two points here that need more analysis. First of all, the factors 'research – development – education' are regarded by the firms of Varna as advantages. However, in direct relation with this estimation, we find the negative assessment of the group 'labor factors' and especially those concerning the existence of qualitative and specialized human resources. The combination of these two estimations leads to the conclusion that Varna, on the one hand, is not deprived of infrastructure in research, development and education, but lags behind in issues concerning quality, specialization and know-how. The co-existence of these factors constitutes a quite strong disadvantage for the city, affecting the dynamic of its investment profile. Also, as a result of this analysis, there is an appreciable difference among the foreign firms concerning the importance of 'labor factors' which, however, we cannot consider a given fact for all foreign firms, first because the mean values received for the factors of this cluster is just over the average (5.5) and second because the sample of the foreign firms is rather small and not as representative as we would like it to be. A further disadvantage is the absence of sound investment incentives. All firms in the research estimate that the total current business environment is not a factor for the attraction of new investments, a fact that is linked to the lack of experience and absence of know-how on the part of local authorities to plan and implement competitive and developmental policies.

Third, Varna's image as an investment destination involves a limited potential which, however, is likely to work positively for the city. The two main axes of the creation and support of the city image are agglomeration economies – access to European markets and urban infrastructure. The article asserts that, following these two axis, there must be more attention and effort on the part of the city so that the combination of these factors will create added value for the city as well as the firms. Consequently, the city authorities, in co-operation with the private sector, should plan and undertake an initiative for the support and promotion of the city image through strategic planning procedures (i.e., place marketing

strategies), so that the whole effort will create the best possible outcome.

Fourth, one can notice a dysfunction in the relations between the public and private sectors. The firms recognize the dynamic of the city, but they also attach great importance to the factors which compose the negative profile of the city. Considering the fact that the current research presents and analyses small-medium local firms' estimations, we will assert that the findings and the conclusions of the research are very significant for both the firms and the city itself. At the same time, they bring to light a more general overview of problems and disadvantages potentially shared among many other cities with the same characteristics as Varna on a national level.

Finally, comparing the region of Varna with the rest of Bulgaria (according to the results of the analysis in table 2), we infer, first of all, that the geographical position of the city is its main advantage, which is something related to both the creation of agglomeration economies and the development of relations and access to markets in the interior. These views are especially important because they reflect the views of foreign firms on a national level, and also a portion of Varna's firms, while at the same time point out the views of the local firms (through the estimations of the firms of Varna) on the importance of geographical factors and networks for all Bulgarian firms. Furthermore, a cheap labor force is proved to be an advantage for the country, contrary to what the firms in Varna believe. On a national level, there is no clear appreciation of the importance of urban infrastructure but both the local and foreign firms of Varna consider it the main advantage of the city. To a certain extent, this points to the better quality of the infrastructure of Varna in comparison to other Bulgarian cities. There is a concurrence of views among foreign firms (including those based in Varna), as to the existence of a specialized labor force, whereas the local firms of Varna do not share this view. Finally, the total entrepreneurial condition and climate throughout the country is regarded as a downside, showing the nature of the role that authority centers play in reference to the quality and availability of investment incentives, the legal framework and the high risk rate created for investments by all of the above factors. What is important is the fact that these evaluations are expressed by both foreign and local firms of an important city like Varna, which has participated in studies during the last few years. Consequently, dissatisfaction from national and local authorities is common and is intensely expressed.

In conclusion, we can say that there are some factors that are strong advantages (location and accessibility to markets) or strong disadvantages (local and national authorities attitude towards firms, quality of investment incentives, legal framework) for both foreign and local firms, while there are strong differences in firms' views on factors concerning other factors (urban infrastructure). The essential point, however, is that each city/region has its own potential and characteristics on which to base its future development and competitiveness after clear identification and strategic planning, and Varna is no exception.

References:

Begg, I. 1999. Cities and Competitiveness, Urban Studies, 36 (5-6): 795-809

Bennett, R and Krebs, G. 1991. Local Development Public-Private Partnerships Initiation in Britain and Germany, Belhaven Press, London, NY

Berköz, L. 2001. The Interregional Location of Foreign Investors in Turkey, European Planning Studies, 9 (8): 979-994.

Blakely, J.E., 1994. Planning Local Economic Development: Theory and Practice, Sage publications, 2nd edition

Bitzenis, A. 2007. Determinants of Foreign Direct Investment: Evidence from Multinationals in the Post-crisis Era of Bulgaria in the late 1990s. Southeast European and Black Sea Studies, 7(1): 83- 111

Bitzenis, A. 2006. Causes Behind the Great Accumulation of Greek Investors in the Balkan Region: Registered and Active companies, Proceedings of the 9th International Congress 'Entrepreneurship, Competitiveness and Growth in South-Eastern Europe, University of Macedonia, Thessaloniki, 23-25 September, 2006, pp. 217-246

Boyer, R and Savageau, D., 1981. Places Rated Almanac: Your guide to finding the best places to live in America, Chicago :Rand McNally

Budryte, A., 2005. Corporate income taxation in Lithuanian in the context of the EU, Research in International Business and Finance, 19, 200-228

Bulgarian Foreign Investment Agency, (BFIA), 2003. *www.investbg.government.bg/*, Sofia, Bulgaria Bulgaria Investment Guide, 2006. Business Environment and Key Sectors, Invest Bulgaria Agency

Bulgaria Investment Profile, 2001. Business Forum, London 22-24 April

Castells, M., 1992. European Cities, the Informational Society and the Global Economy. Centrum voor Grootstedelijk, Amsterdam

Chakrabarti, A., 2003. A theory of the spatial distribution of foreign direct investment, International Review of Economics and Finance, 12, 149-169

Chen J., and Williams M., 1999). The determinants of business failure in the U.S Low-Technology and High-Technology Industries, Applied Economics, 31(12): 1551-1562

Commission of European Communities, Directorate General for Regional Policies, 1993. New location factors for mobile investment in Europe, final report in cooperation with Ernst-Young, Brussels, Luxembourg

Craglia, M., Leontidou, L., Nuvolati, G., and Schweikart J., 1999. Evaluation of the quality of life in European regions and cities, European Communities, Belgium.

D'Arcy, E., and Keogh, G. 1998. Territorial Competition and Property Market Process: An Exploratory analysis, Urban Studies, 35 (8): 1215-1230

D'Arcy, E., and Keogh, G. 1999. The property market and urban competitiveness: a review, Urban Studies, 36 (5-6): 917-928

Deas, I., and Giordano, B., 2001. Conceptualising and measuring urban competitiveness in major English cities: an exploratory approach, Environment and Planning A, 33, 1411-1429

Deffner A., and Metaxas T., 2005. Shaping the vision, the identity and the cultural image of European places, 45TH Ccongress of the European Regional Science Association 23 – 27 August 2005, Vrije Universiteit Amsterdam "Land Use and Water Management in a Sustainable Network Society

Desai, M., Foley, C.F and Hitnes, J.R 2004. Economic effect of regional taxes Havens, NBER Working Paper 10806

Disdier, A.C and Mayer, T., 2004. How different is Eastern Europe? Structure and determinants of location choices by French firms in Eastern and Western Europe, Journal of Comparative Economics, 32, 280-296

Doeringer, P., Evans-Klock, C., and Terkla, D., 2004. What attracts high performance factories? Management culture and regional advantage, Regional Science and Urban Economics, 34, 591-618

Donald, B., 2001. Economic Competitiveness and Quality of life in City Regions: A review of the literature, Williams Research. Com. Inc, Canada

Doutriaux, J., 2003. University-Industry linkages and the development of knowledge clusters in Canada, Local Economy, 18(1): 63-79

Doutriaux, J., and Barker, M., 1995. The university-industry relationship in science and technology, Occasional Paper, 11, Industry Canada, August, 24-31

Driscoll J., 2002. Introducing Community Based Capital Investment Planning in Bulgaria, LGI, December 2002, Sofia

Dziembowska-Kowalska J. and Funck H.R. 2000. Cultural activities as a location factor in European competition between regions: concepts and some evidence, Ann Reg Sci, 34, 1-12

European Commission, 2003. Structural policies and European territories: Competitiveness, sustainable development and cohesion in Europe. From Lisbon to Gothenburg, Luxembourg: Office for Official Publications of the European Communities

E.U. 2000. 6th Periodic Report, Official Publications of the European Communities

FDI Magazine (2006)

FDI Magazine (2004)

Fest, H., 2000. The EURO and the Competitiveness of Agglomerations: What does the Single Currency Add?' in Batey, P., and Friedrich, P., (eds), Regional Competition, Springer-Verlag Berlin, Germany

Filipovic, S. and Petrakovic, D., 2005. SME Sector development by Improving Financial Support: Serbia compares to other SEE Countries. South-Eastern Europe Journal of Economics, 2, 273-293

Florek, M., 2006. The country brand as a new challenge for Poland, Place Branding and Public Diplomacy, 1 (2): 187-204

Fuller, C, Bennett, J.R and Ramsden, M. 2003. Organising for inward investments? Development agencies, local government and firms in the inward investment process, Environment and Planning A, 35, 2025-2051

Fujita, M., Krugman, P., and Venables, J.A 1999. The Spatial Economy: Cities, regions and international trade, MIT Press (eds), Cambridge, Massachusetts, London England

Funck, H. R., 2000. Hard and Soft Determinates in Interregional Competition, in Batey, P., and Friedrich P., (eds), Regional Competition, Springer-Verlag Berlin, Germany

Gao, T., 2004). Regional industrial growth: evidence from Chinese Industries, Regional Science and Urban Economics, 34, 101-124

Gaskill, L., van Auken H., and Manning R., 1993. A Factor Analytic Study of the Perceived Causes of Small Business Failure, Journal of Small Business Management, 31(4): 334-341

Hall T., 1998. Urban Geography, eds. Routledge, N.Y

Hall, T., and Hubbard, P. 1998. The Entrepreneurial city. J. Wiley and Sons, eds.

Harrighton, J.W and Warf, B., 1995: Industrial Location, Principles, Practice and Policies, Routledge, London

Harvey D., 1989. The Condition of Postmodernity', eds Blackwell, Oxford

Head, K.C., Ries C.J., and SWENSON, L.D. 1995. Agglomeration benefits and location choices: evidence from Japanese manufacturing investments in the United States, Journal of International Economy, 38, 223-247

Herzberg, F., Maunser, B and Snyderman, B., 1959. The motivation to work, Wiley, New York

Hinderink, J., and Titus, M., 2002. Small towns and Regional Development: Major findings and policy implications from comparative research, Urban Studies, 39 (3): 379-391

Hope C.A, and Klemm M.S., 2001: Tourism in difficult areas revisited: the case of Bradford, Tourism Management, 22, 629-635

Iammarino S., and Pitelis, C. 2000. Foreign direct investment and less favoured regions: Greek FDI in Bulgaria and Romania. Global Business Review, 1(2): 155-170

Iammarino S., and Santagelo D. G., 2000. Foreign direct investment and regional attractiveness in the EU integration process, European Urban and Regional Studies, 7(1): 5-18

Iankova, E., and Katz, J. 2003. Strategies for political risk mediation by international firms in transition economies: the case of Bulgaria, Journal of World Business, 38, 182-203

Ioannides Y., and Petrakos G., 2000. Regional disparities in Greece – the performance of Crete, Peloponnese and Thessaly, E.I.B. Papers, 5 (1): 31 – 60

Jansen-Verbeke M, and van Rekom J. 1996. Scanning Museum Visitors' Urban Tourism Marketing, Annals of Tourism Research, 23 (2): 364-375

Johnson, M., 1995. Czech and Slovak tourism: Patterns, problems and prospects, Tourism Management, 16 (1): 21-28

Jordanova, Z.T. 1999. Foreign Direct Investments (FDI) in Bulgaria: The basis for the formation of Strategic Alliances of the type "East-West" in the process of preparation the joining the EU. Facta Universitatis, Series: Economics and Organisation, 1 (7): 57-62

Kapitanova G. and Minis P.H., 2003. Case study of Bulgaria: From Totalitarianism to Democratic Local Governance, Local Government Initiative

Kolarova, D. 2003. Development of the Business Services on Black Sea Coast: A case study of Bulgaria. XIIIth International Conference of RESER 'Services and Regional Development', Mons, 9-10 October

Kotler, P., Asplund, C., Rein, I., and Haider, H.D. 1999: Marketing Places Europe: Prentice Hall (eds).

Kotler, P., Rein, I., and Haider, H.D. 1993. Marketing Places: Attracting Investment, Industry, and Tourism to Cities, Regions and Nations: Free Press N.Y

KPMG. 2000. Foreign Investors in Bulgaria: Survey 2000. Sofia: KPMG

Lampooy, G.L and Moulaert, F., 1996. The economic organization of cities: An institutional approach, International Journal of Urban and Regional Research, 20, 217-237

Lankes, H.P and Venables, A.J., 1996. Foreign direct investment in economic transition: the changing pattern of investments, Economics of Transition, 4(2), 331-347

Leeming, K., 2002. Community businesses-lessons from Liverpool, UK, Community Development Journal, 37 (3): 260-267

Leibfritz, W., Thorton, J and Bibbee, A., 1997. Taxation and economic performance, OECD, Economic Department Working Paper, No. 176/GD (97) 107

Likert, R., 1932. A Technique for the measurement of Attitudes, Archives of Psychology, 140

Locke, F.A 1976. The nature and causes of job satisfaction, in Dunnette, M.D (eds) Handbook of Industrial and Organisation Psychology, Rand McNally, Chicago, pp. 1297-1349

Louri, H., Papanastassiou, M. Lantouris, J., 2000. FDI in EU periphery: a multinomial analysis of Greek firm strategies, Regional Studies, 34, 419-427

Love, L.L, and Crompton, L.J., 1999. The role of quality of life in business (re)location decisions, Journal of Business Research, 44 (3): 211-222

MacKinnon, D., Phelps, N.A., 2001. Devolution and the territorial politics of foreign direct investment, Political Geography, 20, 353-379

Metaxas, T., 2006. Implementing Place Marketing Policies In Europe: A Comparative Evaluation Between Glasgow, Lisbon and Prague. International Journal of Sustainable Development and Planning, 1 (4): 399-418

Metaxas T., 2003. The image of the city as a 'good': The creation of a city's promotional package through a strategic framework analysis of City Marketing procedure, in Beriatos E. et al (eds) *Sustainable Planning and Development'*, Wessex Institute of Technology and Dept. of Planning and Regional Development (Univ. of Thessaly), pp. 427-438

Meyer, E.K., 1996. Foreign direct investment in the early years of economic transition: a survey, Economics of Transition, 3(3), 301-320

Miller, E.W., 1977. Manufacturing: a study of industrial location, Pennsylvania State University Press, University Park, USA

Ministry of Regional Development and Public Works, 2006. Operational Programme 'Regional Development 2007-2013', Draft version 9, Sofia, October

Morisset, J., 2003, 'Using Tax Incentives to Attract Foreign Direct Investments, Public Policy for the Private Sector, World Bank, Note 253

Morisset, J., Pirnia, N., 2001, How Tax Policy and Incentives Affect Foreign Direct Investment: A Review, Foreign Investment Advisory Service, International Finance Corporation and World Bank.

Nachum, L., (2000), 'Economic geography and the location of MNEs: financial and professional service FDI to the US', Journal of International Business Studies, 31(3): 367-386

Nachum, L. and Keeble, D., 2003. MNE linkages and localized clusters: foreign and indigenous firms in the media cluster of Central London, Journal of International Management, 9, 171-192

Papadaskalopoulos, A., Karaganis, A, and Christofakis, M., 2005. The spatial impact of EU Pan- European transport axes: City clusters formation in the Balkan Area and development perspectives, Transport Policy, 12, 488-499

Parkinson, M., 1991. The rise of entrepreneurial European city: Strategic Response to economic changes in the 80's, Ekistics pp. 350- 351

Parsons, E and Broadbridge, A., 2006. Job motivation and satisfaction: Unpacking the factors for charity shop managers, Journal of Retailing and Consumer Services, 13, 121-131

Rogerson, J. R, 1999. Quality of Life and city competitiveness, Urban Studies, 36 (5-6): 969-985

Rogoff, G.E, Lee, M-S., and Sub, D-C., 2004. Who Done it? Attributions by Entrepreneurs and Experts of the factors that cause and impede Small Business Success, Journal of Small Business Management, 42(4): 364-376

Sapienza, H.J., 1991. Comets and Duds: Characteristics Distinguishing High and Low Performing Ventures, Frontiers of Entrepreneurial Research, 6, 124-138

Scott, A. 1995: The geographic foundations of industrial performance, Competition and Change: The Journal of Global Business and Political Economy, 1(1), Harwood Academic Publishers

Shah, A., 1995 'Fiscal Incentives for Investment and Innovation, Oxford University Press, New York.

Shane, S. 2002. University technology transfer to entrepreneurial companies, Journal of Business Venturing, 17(6): 537-552

Southeast Europe Investment Guide 2006: Bulgaria

Southeast Europe Investment Guide 2007: Bulgaria

Spiridonova J., Novakova M., and Guenchev R., 2000. 'The future of idustrialised cities and regions undergone structural changes: Bulgaria – Country profile, Sofia

Stathakopoulos, V., 2005. Market Research Methods, Stamoulis, eds., Athens

Syrett, S., 1994. Local Power and Economic Policy: Local Authority Economic Initiatives in Portugal, Regional Studies, 28(1):53-67

Tietjen, M and Myers, R.M., 1998. Motivation and job satisfaction, Management Decision, 36(4): 226-231

Timmons, J. A., 1994. New Venture Creation, 4th ed., Chicago, IL: Irwin

Tøndel, L., 2001. Foreign Direct Investments during transition: Determinants and Patterns in Central and Eastern Europe and the former Soviet. Working Paper, 9, Chr. Michelsen Institute, Bergen, Norway

Totev, S., 2005. Foreign Direct Investments in Bulgaria. South-East Europe Review, 4, 91- 104

Tsenkova, S. and Nedovic-Budic, Z. 2006. The post-socialist

urban world in Tsenkova, S. and Nedovic-Budic, Z. (eds) The Urban Mosaic of Post-Socialist Europe, Phychica-Verlag, 2006, 18: 349-366

Varna Chamber of Commerce and Industry, 2007. Profile of Varna Region. *www.vcci.bg*

Waits J. M, Rex, T. and Melnick, R., 1997. Cluster analysis: a new tool for understanding the role of the inner city in a regional economy' Morrison Institute for Public Policy, School of Public Affairs, Arizona State University, USA

Williams, M.P., 2002. Community Strategies: Mainstreaming Sustainable Development and Strategic Planning? Sustainable Development, 10, 197-205

Zhu, J., 2000. The impact of industrial land use policy on industrial change, Land Use Policy, 17, 21- 28

Innovation Propensity in Croatian Enterprises: Results of a Community Innovation Survey

Zoran Aralica, Domagoj Račić, Dubravko Radić*

Abstract

This paper assesses the determinants of innovation activities in Croatian enterprises and their implications for innovation policy. A Type-2 Tobit model is used for modelling the innovation behaviour of Croatian companies, based on the results of a Community Innovation Survey conducted for the period 2001-2003. This model identified the positive effects of conditions for enterprise growth (enterprise size and demand pull variable) and the integration of enterprises into international flows of capital and goods (through foreign direct investments) as well as R&D activities. These variables can be tackled through a more effective policy framework that should increase competitiveness within industries in order to stimulate the demand for innovation. The focus should be on fostering enterprise growth, attraction of FDI with strong spillover effects, and stimulating the export capability of enterprises. Only in such a context can the positive effects of engagement in R&D be maximised.

Key words: Innovation activities, Community Innovation Survey, Croatia

JEL: O31 **DOI: 10.2478/v10033-008-0008-6**

1. Introduction

Innovation tends to be considered a major driver of both economic growth and the competitiveness of companies and industries. However, measurement and analysis of innovative activities and their impacts at the micro-, meso-, and macro-levels have often been burdened with conceptual and applicative difficulties. Following the Oslo Manual (cf. OECD 1997), a methodology for collecting and interpreting enterprise-level data on technological and organisational innovation has been developed and applied to the countries of the European Union and its new member states. In addition to economic imperatives, the transition economies of Central and Eastern Europe have tended to embrace innovation-related issues within their accession into the European Union, which defines the development of a knowledge-based economy as a crucial policy goal (CEU 2000).

*Aralica:
Institute of Economics, Zagreb
Trg J. F. Kennedy 7, HR-10000 Zagreb, Croatia
e-mail: zaralica@eizg.hr

*Račić:
Centre for Strategy and Development
Kranjčevićeva 27a, HR – 10000 Zagreb
e-mail: domagoj.racic@mrezaznanja.hr

*Radić:
University of Wuppertal
Gaußstraße 20, 42097 Wuppertal
e-mail: radic@wiwi.uni-wuppertal.de

* The authors would like to thank Slavo Radošević, Krešimir Žigić and Vladimir Cvijanović for valuable comments.

The existing research into innovation (cf. Božić and Radas 2005; Račić et al. 2005), innovation policy (cf. Andrijević-Matovac 2003; Aralica and Bačić 2005; Švarc 2006) and competitiveness (cf. NCC 2006) indicates the inadequate innovation performance of the Croatian economy and deficiencies in the processes supporting the development and commercialisation of new knowledge. However, these findings have not so far been supported by a comprehensive firm-level innovation survey.

The aim of the paper is to explore the determinants of innovation propensity in Croatia, which should help elucidate some of the key factors of the economic transformation required to fulfil the requirements of its expected EU accession and advancement of the Lisbon agenda in general. The paper aims to address the absence of a firm-level survey and transcend descriptive analysis by econometric modelling, providing a useful input into the formulation of a more effective innovation policy. This analysis of innovation activities is based on the first Community Innovation Survey (CIS) conducted in Croatia for the years 2001-2003.

The rest of the paper is organized as follows: We start with a brief literature review of the determinants of innovation activities. Section three introduces the dataset and offers some descriptive results that will form the basis for the econometric modelling. In section four, we will estimate a Tobit model which explicitly takes the peculiarities of CIS type data into account. Most of the variables that might explain the innovation behaviour of firms are available for innovative firms, but not for their non-innovative counterparts. A Tobit model addresses this data problem by assuming a two step model for innovations. In the first phase, the decision of the firm to introduce a new product/service is modelled. Given a positive decision at the first step, the share of innovative sales is measured in a second phase using a simple regression model. The final section consists of concluding remarks..

2. Literature Review

The influence of innovation activities on firm performance has been widely acknowledged (Griffith et al. 2006). Innovation activities affect firm performance in terms of value added, sales, employment and profitability (cf. Lööf and Heshmati (2006), Crepon, Duguet, and Mairesse (1988)).

However, when it comes to innovation activity determinants, there is a much greater diversity of views and approaches. The results of various studies demonstrate that innovation is a complex phenomenon influenced by a large number of factors (cf. Crespi 2004, p. 21). Given the variety of potential causal relationships within which innovation activities can be placed, the literature dealing with innovation activity determinants is extremely extensive. It links innovation with diverse topics and places it within different contexts. Empirical evidence about innovation activities determinants has been flourishing in the last twenty years and has shown a variety of results in different national contexts (cf. a broad literature survey by Cohen (2005).

Given the variety of the possible explanatory variables used in the literature, empirical analysis inevitably needs to focus on the variables that are deemed more relevant and/or the variables for which reliable data are available. Since this paper is based on Community Innovation Survey firm-level data, it deals with the characteristics of innovation activities and connects innovation and other firm activities (cf. Dosi 1988), pointing to the context and/or content of innovation-related processes.

Firm specific capabilities have become important recently in the analysis of firm innovation activity determinants and their relation to firm performance (cf. Cohen 2005, p. 201). The focus of this analysis has been on research and development (R&D) activities and their relation to innovation activities. Various qualitative analyses show the importance of R&D-related capabilities for the process and commercial outcomes of a firm's innovative activities (Teece 1986, 1977; Mowery and Rosenberg 1989). An important issue is whether innovation activities are based on and related to R&D. R&D activity is an indispensable part of more complex innovation activities with longer-term effects on companies and markets, but innovation is by no means restricted to R&D. A significant amount of innovation and improvements originates from design improvements, 'learning by doing' and 'learning by using' (Arrow 1962; Rosenberg 1982; Mowery and Rosenberg 1989) and such informal efforts are generally embodied in people and organisations (Teece 1977, 1986; Pavitt 1986). In the analysis of innovation patterns in Central and Eastern European countries (CEEC), Radosevic (1999) found that the companies from CEECs purchase relatively more embodied technology than companies from the EU; they also have a lower share of R&D expenditures in total innovation expenditures. Non-R&D sources of innovation also mean that the forms of protection of innovation are diverse and include formal (patents, copyright and trade marks) and informal (e.g. design complexity, trade secrets, faster market entry) means (cf. Crespi 2004). Cohen, Nelson and Walsh (2000) found that the other ways of protecting intellectual property - such as being first in the market, using trade secrets and developing complex designs - are more effective

than patents. Baldwin, Hanel, and Sabourin (2000) found that the causal relationship is much stronger going from innovation to the decision to use patents than from the use of patents to innovation. However, innovation incentives are not entirely exogenous, as innovation capability further stimulates companies to protect their innovation results by patents.

High risks and costs and the lack of available knowledge induce firms to seek external partners, thereby developing innovations in collaboration with suppliers, customers, competitors and academic institutions. The importance of cooperation has risen steadily alongside the complexity, risk and cost of innovation activities. Innovation cooperation influences innovation activities through the pattern of collaborative relationships and partner type involved (Vinding 2002). This relationship is mutually reinforcing - external linkages facilitate innovation, and at the same time innovative outputs attract further collaborative ties (Powell and Grodal 2005, p. 67-68).

Competition increases the interaction and dynamism of market processes; consequently, it usually facilitates demand for innovative products and/or services. The competitiveness and innovation activities are primarily linked via the national innovation capacity, which involves R&D supply, absorption capacity, the diffusion of knowledge and market demand (cf. Radošević, 2004). However, in a particular industry, competition incurs specific innovative expenditures on firms; for example, in high-tech industry it leads to the internalization of innovative activities, where the majority of innovative products are a result of firms' own R&D investments (cf. Baumol 2004).

An educated workforce tends to be a prerequisite for undertaking innovation. The presence of employees engaged in R&D activities can facilitate successful innovation activities. More specifically, the number of employees engaged in R&D favours the generation of innovations; this effect increases with the special skills of the personnel charged with these activities (cf. Leiponen 2005).

The recent stream of literature exploring innovation activities within SMEs has been growing. SMEs' innovativeness is the result of various factors, such as industry-specific factors, firm-specific factors and innovation-specific factors (cf. Hausman 2005). Within SMEs it seems that the capability of entrepreneurial behaviour is the crucial factor behind innovation activities (e.g. Caird 1994, Lipparini and Sobrero 1994, Kickul and Gundry 2002).

In the last twenty years, innovation has become closely linked to the internationalisation of business activities. Two groups of literature have appeared that examine the determinants of innovation activities in international business activities. The first group examines the distinction between foreign and domestic ownership with regard to innovation performance. A standard argument in this context is that increasing FDI also increases the inflow of external knowledge and technology. Račić et al. (2005) found that foreign-owned firms were more innovative than domestic firms and that this relation was affected by the characteristics of foreign direct investment in Croatia. However, Jaklič, Rojec, and Damijan (2006) found that innovation cooperation influences innovation activities for the domestic partner only (and not for the international ones) and claimed that foreign ownership was not in fact a significant determinant of innovation activity. The second stream of literature analyses the impact of multinational enterprises (MNE) and their subsidiaries created through FDI on internationalisation of innovation activities. The results of empirical studies confirm that multinational companies have a positive influence on local subsidiaries and their innovation activities through knowledge transfer (e.g. Aitken and Harrison 1999, Girma, Greenaway, and Wakelin 2001, Damijan et. al. 2003). It seems that the relation between parent companies and subsidiary is a major challenge for MNEs, specifically the issue of devising an organisational system capable of transferring know-how across units and locations, and allowing locally generated know-how to be used throughout the multinational organisation (Sanna-Randaccio and Veugelers 2003).

3. Dataset and Descriptive Results

In this section the dataset is briefly introduced and some descriptive results are presented. The data have been obtained through the first firm-level innovation survey in Croatia, in which data was collected in accordance with the Oslo Manual (cf. OECD, 1997). The survey covers the period from 2001 to 2003. This postal survey was commissioned by the Ministry of Science, Education and Sports. It was undertaken in autumn 2004 by the Institute of Economics. The available literature on the implementation of CIS III was also consulted (e.g. Kurik et al., 2002; Boia et al., 2003). In addition to general information about the enterprise, the survey covered the following aspects of innovation activities: product and process innovation, expenditures on innovation activities, intramural research and experimental development, innovation cooperation, sources for innovation, factors hampering innovation activities, innovation protection, and important strategic and organisational changes in the enterprises. The survey was based on a stratified representative sample of all Croatian enterprises in relevant manufacturing and service sectors. The sample consists of 1272 firms. The following table

Number of employees	Number of firms	Share of firms	Share of firms with product innovation	Share of firms with process innovation
< 10	540	0.42	0.27	0.19
[10 – 50)	253	0.20	0.32	0.28
[50 – 250)	145	0.11	0.37	0.27
≥ 250	334	0.26	0.12	0.10

Table 1:
Size, distribution and innovation propensity of Croatian firms[12]

shows the distribution of the firms according to the number of employees.

There seems to be an inverted U-shape relation between the size of the firms and their innovation propensity. The share of micro firms with less than 10 employees that have introduced product or process innovations amounts to 27% and 19%, respectively. These shares increase with firm size. Consequently, firms with 50-250 employees are the most innovative ones regarding product innovations (37%). However, in the case of firms with more than 250 employees, the share of firms with product innovations drops again markedly to 12%. The low innovativeness of the largest enterprise may reflect temporary restructuring difficulties at several large enterprises, rather than a systemic feature of the economy. The relation between firm size and process innovations varies less, but, again, drops in the case of the largest enterprises.

The following table shows the industrial affiliation of Croatian firms. Columns two and three contain the share of innovative firms in the different industry sectors. We have considered two different innovation indicators, namely product and process innovations.

Industry Sector	Share of firms	Share of firms with product Innovation	Share of firms with process innovation
Mining	0.01	0.13	0.25
Food	0.06	0.47	0.36
Textile	0.07	0.22	0.16
Wood	0.09	0.27	0.19
Chemicals	0.03	0.39	0.23
Plastic	0.04	0.36	0.38
Glass	0.04	0.34	0.31
Metals	0.06	0.34	0.34
Machinery	0.04	0.51	0.28
Electrical equipment	0.10	0.34	0.28
Vehicle	0.02	0.33	0.17
NEC	0.05	0.28	0.24
Wholesale trade	0.06	0.04	0.11
Retail	0.12	0.10	0.08
Transport	0.08	0.16	0.12
Finance	0.05	0.19	0.15
Other services	0.10	0.38	0.20

Table 2:
Industrial affiliation and innovation propensity of Croatian firms

The figures in Table 2 reveal that the machinery (0.51) and food industries (0.47) contain the highest share of firms that have introduced new products, whereas the plastic (0.38) and food industries (0.36) lead when it comes to the introduction of process innovations. Moreover, there is no clear relationship between the level of complexity of products and technologies of particular industries and their level of innovativeness. That could be due to the role of other factors at the micro level that may influence innovation processes such as product diversification, firm-specific capabilities[1] as well as the level of competition in a given industry[2].

4. Econometric Modelling

In the following section we will model the innovation behaviour of Croatian firms using a Type-2 Tobit model. Such a procedure has become common for CIS-type data since most of the variables that might explain the innovation behaviour of firms are only available for innovative firms but not for their non-innovative parts (cf. Raymond et al. 2006). As has been noted by Mohnen and Dagenais, (2000, p. 10), 'there is little information in the CIS dataset regarding non-innovators'. We thus have very little information in the CIS database to discriminate between innovators and non-innovators. As a consequence, only a censored regression approach can be estimated which explicitly takes account of this data structure, as will be explained in more detail below.

Regarding possible dependent variables, the CIS dataset contains a number of indicators that can be classified into input and output side oriented variables. Input oriented indicators of innovation activities included in the questionnaire are R&D expenditures and variables indicating whether firms are engaged in R&D co-operation or not. Although widely used, indicators based on R&D bear several limitations as a measure of technological change. First, they underestimate technological activities in manufacturing and service industries where much of the technical change takes place around design and manufacturing that is not captured by the concept of R&D (Patel and Pavitt, 2005, p.21). Second, small and medium sized firms often do not possess a separate business unit devoted to R&D. Using R&D expenditure or R&D personnel as a measure will therefore underestimate their innovation activities. Finally, as an input measure, R&D expenditures are only loosely connected with the output of technological change.

On the output side, the CIS questionnaire contains information on patents granted to firms, which are another frequently used measure of technological activity. However, several drawbacks have to be taken into account when considering patents as a measure of technological change. First, not every innovation is based on a patentable invention, and not every patent results in a marketable product. Second, in certain industries - like the automotive industry - patents play only a minor role as a barrier to imitation and hence differences in patent activities across industries will not always reflect differences in innovation activities. Third, institutional, legal and economic factors related to the process of obtaining a patent will also have an impact on patent intensities (for a discussion on patents, cf. Griliches 1990). Finally, simply looking at patents says nothing about the economic value of the innovation (cf. Patel and Pavitt 2005).

We therefore decided to use an output-oriented measure, namely the declaration of whether a firm has introduced a new product/service and the percentage of sales due to this new product/service.[3] The advantage of such an approach is the ability to directly measure the economic outcomes of innovation activities. There are, however, also some disadvantages that should be mentioned. Although the questionnaire contains a detailed description of the notion of a new product/service, CIS surveys reflect the subjective view of firms, which have to decide what they regard as a product/service innovation. This is especially pronounced in the first applications of such surveys in a new environment.[4]

A Type-2 Tobit model consists of two steps. In the first step, the decision of a firm to introduce a new product/service is modelled using a simple Probit model. Given a positive decision at the first stage, the share of innovative sales, y_i, follows a simple censored regression model at the second stage. Formally:[5]

$$y_i = \begin{cases} 0, \text{iff } y_i^* = x_i'\beta + \varepsilon_i < 0 \\ z_i'\gamma + \upsilon_i, \text{iff } y_i^* = x_i'\beta + \varepsilon_i \geq 0 \end{cases} \quad (1)$$

The latent variable, y^*_i, can be interpreted as the propensity to innovate.[6] In the first stage we use data on innovators and non-innovators: If y^*_i exceeds the threshold level, which is set to zero for identification, the firm decides to innovate. If, on the other hand, y^*_i is below zero, the firm decides not to innovate and what we observe in the dataset is thus $y_i = 0$. In the second step innovative sales as measured by y_i are modelled by the regression part of the Tobit model. It should be noted that for a type-2 Tobit model the first stage decision whether to be innovative or not depends on a set of explanatory variables x, whereas the decision about the amount of innovative sales is assumed to depend on another set of exogenous variables z. The set of these variables may not be identical. We further assume that the two error terms ε and υ follow a standard normal distribution.

As already stated, due to the construction of the CIS questionnaire, the set of variables for the first stage decision is rather limited. We considered the following:

- Size dummies: establishments with 11-50 employees, establishments with 51-250 employees and establishments with more than 250 employees.
- 16 industry sector dummies.[7]

Size is a traditional explanation for innovative behaviour.[8] Larger firms have better access to capital markets or more internal funds to finance uncertain and risky innovation projects. They have better access to competent and specialised staff, which can foster the development of specific competences. R&D activities exhibit economies of scale and scope, i.e. larger firms have better opportunities to diversify the risks associated with innovation activities. Fixed costs associated with R&D investments can be distributed over a larger volume of sales. Finally, there might be complementarities between innovation and certain activities, e.g. marketing or planning, which are more pronounced among larger firms. There are, however, also counteracting effects. Larger firms tend to be more bureaucratic and hierarchical, which can hinder innovation activities. Also associated with an increasing size is a loss of managerial control of innovation activities. Hence, the impact of firm size on innovations is not clear-cut. For transition economies another point becomes important in this context. During the transition period in Croatia a lot of formerly state-owned enterprises were reduced through restructuring or split up into smaller units (cf. Račić and Cvijanović 2005) Moreover, new small and medium sized companies were founded, but their innovation capability tends to be limited.

Due to missing data, industrial affiliation has to measure a set of different effects. First of all, different industries are characterized by different technological conditions and opportunities. Examples include the maturity of the technology used, the rate of technological advance, and the 'closeness' to science and externally generated knowledge through R&D co-operation. If internal 'absorptive' capabilities are available, as measured, for example, by the number of R&D personnel, such external technological opportunities can be exploited for innovations. Including industry dummies will also control for market characteristics in such industries, e.g. market concentration and differing demand conditions.

For the second stage, i.e. the amount of innovative sales, the following variables were included in the regression:

- Size of the firm measured by the following dummies: establishments with 11-50 employees, establishments with 51-250 employees and establishments with more than 250 employees.
- Share of employees with a university degree
- Share of capital foreign investors hold
- Dummy variable indicating whether the international market is the most important
- Dummy variable indicating whether the firm is continuously engaging in R&D or not
- Dummy variable indicating R&D cooperation with other firms or institutions such as universities
- Demand pull indicator, which equals one if the aim of the product innovation was to extend the product range or to open up new markets.[9]

The economic reasons for the inclusion of the size variable are the same as those for the first step. However, firms differ also in their specific technology capabilities. These capabilities are reflected in differences in the qualification structure of the employees, in the internal organization of R&D, manufacturing and marketing and the ways of information processing. Firms with better in-house R&D capabilities will more successfully pursue innovations and also have better absorptive capacities to gain from outside technological opportunities. Therefore we also include the share of highly qualified employees, i.e. employees with a university degree, and continuous engagement in R&D as a proxy for the internal technological capabilities of a firm.

Better in-house technology capabilities are especially necessary when cooperating with other institutions in R&D since these firms have better absorptive capacities to gain from such outside technological opportunities. We therefore also include a corresponding dummy variable which equals one if a firm engages in such R&D co-operation.

Since firms' innovation activities respond to economic incentives, especially to changing demand conditions, large and fast growing markets will increase the return on investment in innovations. We control for this by including a demand pull indicator which equals one if the aim of the product innovation was to extend the product range or to open up new markets. Another factor that might spur innovation activities is competition. Therefore, it might be expected that internationally oriented firms are the more innovative ones.

The estimation of the Tobit model was done using a simple two-step procedure. In the first step the parameters for the Probit model were obtained. Given these parameters, a Mills ratio, $\varphi(x_i'\beta)/\Phi(x_i'\beta)$, was calculated and plugged into the second stage regression conditional on positive shares of innovative sales.[10]

$$y_i | y0 z_i^* > \quad = \quad \gamma_i' + \sigma \frac{\phi(x_i'\beta)}{\Phi(x_i'\beta)} + \upsilon_i \qquad (2)$$

where $\varphi(.)$ is the standard normal density and $\Phi(.)$ the standard normal cumulative density function.

	Parameter	SE	t-Value	p-Value
Constant	-0.75	0.08	-9.34	0.00
No. of employees [10 - 50)	0.18	0.11	1.68	0.09
No. of employees [50 - 250)	0.31	0.13	2.38	0.02
No. of employees ≥ 250	-0.64	0.11	-5.61	0.00
MFX employees [10 - 50)	0.05	0.03	1.62	0.11
MFX employees [50– 250)	0.10	0.05	2.22	0.03
MFX employees ≥ 250	-0.17	0.03	-6. 64	0.00
	χ^2-Value		p-Value	
Industry dummies	159.88		0.00	
Overall	143.10		0.00	
Number of observations	992			
Pseudo R^2	0.10			

Table 3:
Probit regression results: Product innovation yes/no

The figures in Table 3 refer to the Probit equation, i.e. the decision whether to introduce an innovation or not, and indicate that – according to the previous reasoning – the number of employees has an inverted U-shape impact on the marginal likelihood of introducing a new product or service.[11] Compared to micro-establishments with less than 10 employees, establishments with 11-50 employees have a 5%-points higher probability to introduce an innovation. Establishments with 51-250 employees have an ever higher probability (by 10%-points), whereas large companies have a lower innovation probability than micro-establishments (by 17%-points).

Now we turn to the estimation results for the censored regression equation. Contrary to the previous inverted U-shape results, the size of firms now has a negative marginal impact on the share of innovative sales (Table 4). Or to put it simply: size has an inverted U-shape effect on

	Parameter	SE	t-Value	p-Value	VIF
Constant	26.01	7.76	3.35	0.00	-
No. of employees [10 - 50)	-13.28	4.20	-3.16	0.00	1.48
No. of employees [50 - 250)	-23.94	5.25	-4.56	0.00	1.74
No. of employees ≥ 250	-23.51	6.55	-3.59	0.00	1.82
Share of highly qualified employees	-7.97	5.75	-1.39	0.17	1.56
Share of capital of foreign investors	0.27	0.09	2.92	0.00	1.10
International market most important	6.54	3.76	1.74	0.08	1.09
Continuous engagement in R&D	8.60	3.28	2.62	0.01	1.18
R&D cooperation	7.90	3.43	2.30	0.02	1.12
Demand pull	7.09	3.31	2.15	0.03	1.16
Mills ratio	-6.43	5.47	-1.18	0.24	-
	F-Value		p-Value		
Overall	6.04		0.00		
Number of observations	149				
Adjusted R^2	0.22				

Table 4:
Censored regression results:
Share of positive innovative sales

the marginal probability to introduce an innovation, i.e. micro establishments (less than 10 employees) and large establishments are less innovative than SMEs. On the other hand, the impact on innovative sales is larger for smaller firms.

Except for the qualification structure of firms, which turns out to be insignificant, all other variables have the a-priori expected sign. Continuous engagement in R&D and R&D cooperation, turn out to be positive and significant. Since R&D activities have been recognised as a crucial factor of innovation activity and/or innovation capacity (Cohen and Levinthal, 1989) this result is not surprising, despite the fact that overall R&D expenditures of analysed firms tend to be relatively low (cf. Račić et al., 2005). Increasing the participation of foreign investors by 1% of the capital they hold increases innovative sales by 0.27%. Demand pull is statistically significant at the 8-% level, indicating that the share of innovative sales is higher if the innovation aims at extending the product range. On the other hand, the insignificance of employee education levels seems to indicate the low capability of companies to upgrade and utilise the acquired knowledge of their employees in order to develop and launch new economically viable products.

The statistical significance of the share of capital of foreign investors can be explained by the introduction or strengthening of innovative culture and competent management, as well as by the introduction of products and processes into local subsidiaries that are already known within the parent company. Such findings are in line with assumptions that firms with a higher share of capital held by foreign investors are more innovative - both because the inflow of foreign direct investments can provide an external source of knowledge and skills, as well as because foreign investors may actually prefer to invest in firms with stronger capabilities for innovation. Statistical significance of the demand pull variable can be explained by increasing competitiveness, which forces the Croatian companies to involve new innovative elements in their business strategies such as introducing new products or increasing capacity. The statistical significance of the variable 'the international market being most important' can be explained by the more intense competition in foreign markets, which increases the incentives of export-oriented firms to innovate.

To check for multi-collinearity, we also report the variance inflation factor (VIF) in the last column of Table 4. The VIF is defined as $(1 - R_i^2)^{-1}$ where R_i^2 is the R^2 obtained from regressing the i-th exogenous variable on all other independent variables. Consequently, a high VIF indicates multi-collinearity. However, the VIF values are all below 2, showing that there is no serious multi-collinearity problem among the independent variables and thus there is no need to compress the variation of the variables by the use of, for example, factor analysis.

5. Concluding Remarks

Although innovation tends to be considered an important driver of economic growth, its dynamics seem only partially understood. In this paper we have attempted to analyse some of the main aspects of innovation activities in Croatian enterprises, based on the results of the first Community Innovation Survey for Croatia. Innovation activities still tend to occupy a peripheral role within competitive strategies of most Croatian companies, which limits the resources and competences devoted to their development, and, correspondingly, their economic effects (cf. Račić et al., 2005). However, several factors that facilitate innovation performance can be identified.

We have observed an inverted U-shape relation between size of the firms and their innovation propensity, whereby innovation propensity (i.e. the likelihood of introducing a new product or service) increases with firm size, measured by the number of employees, but then drops in the case of the largest companies that have not undergone restructuring. However, increases in the size of firms are associated with decreasing shares of innovative sales. Larger companies seem to have greater problems in effectively translating innovation into favourable economic outcomes. On the other hand, there is no clear relationship between the level of complexity of products and technologies of specific industries and their innovation performance. That could be related to other firm-level factors that may influence innovation, including product diversification, firm-specific capabilities and the level of competition in a particular industry.

The qualification structure of firms turned out to be insignificant in relation to the share of sales of innovative products, unlike the participation of foreign investors, continuous engagement in R&D and R&D cooperation and, to a lesser extent, demand pull factors. All of the variables whose significance has been established (i.e. enterprise size, foreign direct investment, export orientation and the demand pull variable) are fairly interconnected. They can be tackled through a more effective policy framework that should increase competitiveness within industries in order to stimulate the demand for innovation. The focus should be on fostering enterprise growth, attraction of FDI with strong spillover effects, and stimulating the export capability of enterprises. Only in such a context can the positive effects of engagement in R&D (including R&D cooperation) be maximised. On the other hand, the insignificance of employee education levels supports the available findings on the insufficient role of knowledge-related factors in building and maintaining competitive advantage. Although the solution to this should primarily be sought within companies themselves – through improved strategies, innovation activities and human resource management practices – a better alignment of the education sector with the needs of the labour market could also be beneficial.

(Endnotes)

1 Cohen and Klepper (1992) assumed firm specific, R&D related capabilities to be determinants of R&D intensity.

2 The results seem to reflect the industry-specific nature of innovation activities (e.g. process and product nature of innovation in food industry and product innovation in machinery industry). See more about the taxonomy of sectors of production/use of innovation in Pavitt (1984).

3 The CIS questionnaire contains also qualitative information whether firms have introduced process innovations or not. We decided, however, not to consider process innovations in the analysis since the questionnaire contains no quantitative measure of effects of process innovations. For an alternative approach, see e.g. Mairesse and Mohnen (2001) who substituted this missing information for process-only innovating firms with the smallest positive value of the share of innovative sales.

4 Problem with innovation output data may come up as a consequence of misperception of innovation within firms, especially in transition countries where the importance of innovation practice has not been embedded in the business practice. Innovation sales, for example, should be accounted separately from the sales of other products, but this is still not common practice.

5 Please note that 'iff' means 'if and only if'.

6 y^*_i is called a latent variable since it is not directly observable in the dataset. Additionally, y^*_i should not be interpreted as a probability. For more details see Maddala (1986). y^*_i is only introduced in the model to link the observable dichotomous variable 'Innovation yes/no' to the exogenous variables.

7 These include: mining, food, textile, wood, chemicals, plastic, glass, metals, machinery, electrical, vehicle, supply, retail, transport, finance and other services (OECD 1997).

8 For a more thorough discussion on this topic see e.g. Radic (2005).

9 In his seminal work, Schmookler (1962) was the first to introduce the demand situation as a potential determinant of innovations. For an empirical verification see e.g. Geroski and Walters (1995). Industry affiliation turned out to be insignificant and was therefore excluded from the estimations.

10 For more details see Maddala (1986). The Mills ratio accounts for the fact that the truncated expected value of given $\varepsilon > -x'_i\beta$ is not zero. In fact, from equation (1.2) one can see that not taking account of the truncation of y leads to biased estimation results as long as σ is not equal to zero.

11 We also included squared numbers of employees. However, we do not find non-linear size effects.

12 We have earlier mentioned the difference between OECD (1997) definitions of innovation activity and innovation propensity. The results presented here thus differ from the results of the overall survey of innovation activities (Račić et al., 2005), with the largest difference in the sample of the large firms.

References:

Aitken, B.J. and A.E. Harrison, 1999. Do Domestic Firms Benefit from Direct Foreign Investments? Evidence from Venezuela. American Economic Review 89: 605-618.

Andrijević–Matovac, V. 2003. Croatian National Innovation System: How to create and transfer knowledge and technology? In Transition Countries in the Knowledge Society, edited by J. Švarc, J. Lažnjak, Ž. Šporer, and D. Polšek, 199-217. The Institute of Social Sciences Ivo Pilar, Zagreb.

Aralica, Z. and Bačić, K. 2005. Evaluation of Croatian innovation capability. In Croatian Accession to the European Union, Facing the Challenges of Negotiations, edited by K. Ott, 129-159. The Institute of Public Finance, Zagreb.

Arrow, K. J. 1962. The economic implications of learning by doing. Review of Economic Studies 29: 155-173.

Arvanitis, S. 1997. The Impact of Firm Size on Innovative Activity - An Empirical

Analysis Based on Swiss Firm Data. Small Business Economics 9: 473 - 490.

Baldwin, J. Hanel, P. and Sabourin, D. 2000. Determinants of Innovative Activity in Canadian Manufacturing Firms: The Role of Intellectual Property Rights. Ottawa, Micro-Economic Analysis Division Statistics Canada. http://www.statcan.ca/english/research/11F0019MIE/11F0019MIE2000122.pdf. (accessed March 15, 2007).

Baumol, J.W. 2004. Entrepreneurial Enterprises, Large Established Firms and Other Components of the Free-Market Growth Machine. Small Business Economics, 23 (1): 9-21.

Boia, M. J. Conceição, P. and Santos, R. 2003. Determinants of Innovation in Portugal: Designing, Implementing and Analyzing Evidence from the Third Community Innovation Survey. Instituto Superior Técnico, Lisbon.

Božić, Lj. Radas, S. 2005. The Effects of Innovation Activities in SME´s in the Republic of Croatia. Privredna kretanja i ekonomska politika 15 (103): 30-50.

Caird, S. 1994. How important is the innovator for the commercial success of innovative products in SMEs. Technovation 14 (2): 71-83.

CEU 2000. Presidency conclusions: Lisbon European Council 2000. Bruxelles, Council of European Union. http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/00100-r1.en0.htm. (accessed May 10, 2007)

Cohen, W. 2005. Empirical Studies of Innovative Activity. In Economics of Innovation and Technological Change Handbook, edited by P. Stoneman, 182-264. Oxford: Blackwell Publishers Ltd.

Cohen, W. M., Nelson, R. R. and Walsh, J. P. 2000. Protecting their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not). NBER Working Paper 7552, MS: Cambridge.

Cohen W. M. Klepper S 1992. The anatomy ofindustry R&D intensity distributions. American Economic Review 82: 777–799.

Cohen, W. and Levinthal, D. 1989. Innovation and learning: The two faces of R&D. Economic Journal 99: 569-596.

Crépon, B., Duguet, E. and Mairesse, J. 1998. Research and Development, Innovation and Productivity: An Econometric Analysis at the Firm Level. Economics of Innovation and New Technology 7: 115-158.

Crespi, M. 2004. Notes on the Determinants of Innovation: A Multi-perspective Analysis. Rome, FEEM Working Paper No. 42/04. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=524503 (accessed June 13, 2007).

Damijan, et al. 2003. Technology Transfer through FDI in Top-10 Transition Countries: How Important are Direct Effects, Horizontal and Vertical Spillovers? MI: Ann Arbor, William Davidson Institute working paper, no.549. http://eres.bus.umich.edu/docs/workpap-dav/wp549.pdf (accessed May 10, 2006).

Dosi. G. 1988. Sources, Procedures, and Microeconomic Effects of Innovation. Journal of Economic Literature 26: 1120-1171.

Geroski, P. A. and Walters, C. F. 1995. Innovative Activities over the Business Cycle. Economic Journal 105: 916-928.

Girma, S., Greenaway, D. and Wakelin, K. 2001. Who Benefits from Foreign Direct Investment in the UK? Scottish Journal of Political Economy 48: 119-133.

Griffith, R., Huergo, E., Mairesse, J., Peters, B. 2006. Innovation and Productivity Across four European Countries. Oxford Review of Economic Policy 22, 4: 483-498.

Griliches, Z. 1990. Patent Statistics as Economic Indicators: A Survey. Journal of Economic Literature 28: 1661-1707.

Hausman, A., 2005. Innovativeness among small businesses: Theory and propositions for future research. Industrial Marketing Management 34 (8): 773-782.

Hujer, R. and Radić, D. 2003. Evaluating the Impacts of Subsidies on Innovation Activities in Germany. Frankfurt, Discussion Paper, Faculty of Economics and Business Administration Johann Wolfgang Goethe-University. http://much-magic.wiwi.unifrankfurt.de/Professoren/hujer/papers/rd_eva.pdf (accessed February 14, 2007).

Jaklič, A., Rojec M. and Damijan, J. 2006. Innovation Cooperation and Innovation Activity of Slovenian Enterprises. Paper presented at 32th Annual Conference of European International Business Association (EIBA): Regional and National Drivers of Business Location and Competitiveness, Fribourg, November.

Kickul, J. and Gundry, L. 2002. Prospecting for strategic advantage: the proactive entrepreneurial personality and small firm innovation. Journal of Small Business Management, 40 (2): 85-97.

Kuhlmann, S. 2001. Governance of Innovation Policy in Europe – Three Scenarios. In Innovation Policy in Europe and the US: New Policies in New Institutions, Research Policy - Special Issue 30 6: 953-976.

Kurik, S. et al. 2002. Innovation in Estonian Enterprises 1998–2000. Estonian Institute for Futures Studies, Talinn.

Leiponen, A., 2005. Skill and innovation. International Journal of Industrial Organization 23: 303–323.

Lipparini, A. and Sobrero, M., 1994. The glue and the pieces: Entrepreneurship and innovation in small-firm networks. Journal of Business Venturing, 9 (2): 125-40.

Lööf, H. Heshmati, A. 2006. On the relationship between innovation and performance: A sensitivity analysis. Economics of Innovation and New Technology 15: 317-344.

Lundwall, B.Ä. 1992. National system of innovations: Towards theory of innovation and interactive learning. Printer Publisher, London.

Maddala, G. S. 1986. Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press, Cambridge.

Mairesse, J. and Mohnen, P. 2001. To Be or Not To Be Innovative: An Exercise in Measurement. Cambridge, MS: National Bureau of Economic Research (NBER), Working Papers 8644. http://edocs.ub.unimaas.nl/loader/file.asp?id=243 (accessed September 9, 2007)

Mohnen, P. and Dagenais, M. 2000. Towards an Innovation Intensity Index: The Case of CIS 1 in Denmark and Ireland. Montreal, CIRANO. http://www.cirano.qc.ca/pdf/publication/2000s-20.pdf (accessed January 22, 2007)

Mowery, D. C. and Rosenberg, N. 1989. Technology and the Pursuit of Economic Growth. Cambridge University Press, Cambridge.

Narula, R. 2003. Understanding the growth of international R&D alliances. In Multinational

Enterprises, Innovative Strategies and Systems of Innovation, edited by J. Cantwell and J. Molero, 129-152. Edward Elgar, Cheltenham.

NCC 2006. Croatia's Competitiveness Challenge: Annual Report on Croatia Competitiveness 2006. National Competitiveness Council, Zagreb.

OECD 1997. The Measurement of Scientific and Technological Activities: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data - Oslo Manual 2nd edition. OECD, Paris.

Patel, P. and Pavitt, K. 2005. Patterns of Technological Activity: their Measurement and Interpretation. In Economics of Innovation and Technological Change Handbook, edited by P. Stoneman, 182-264. Oxford Blackwell Publishers Ltd, Oxford.

Pavitt, K. 1984. Patterns of Technical Change: Towards Taxonomy and a Theory. Research Policy 13(6): 343-73.

Pavitt, K. 1986. Technology, Innovation and Strategic Management. In: Strategic Management Research: A European Perspective, edited by: J. Mc Gee and H. Tomas, 171-190. John Wiley & Sons, New York.

Powell, W.W., Grodal, S. 2005. Networks of Innovators. In The Oxford Handbook of Innovation, edited by J. Fegerberg, D.C. Mowery and R.R. Nelson, 56-85. Oxford University Press, Oxford.

Račić, D. et al. 2005. Innovation in Croatian Enterprises. The Institute of Economics, Zagreb.

Račić, D. and Cvijanović, V. 2005. Privatization, Institution Building and Market Development: The Case of Croatia. In Path-depedent development in the Western Balkans: the impact of privatization, edited by S. Kusic, 43-77. Peter Lang, Frankfurt am Main.

Radić, D. 2005. Econometric Analysis of Innovation Activities. Peter Lang, Frankfurt am Main.

Radošević, S. 2004. A Two-tier or Multi-tier Europe? Assessing the Innovation Capacities of Central and Eastern European Countries in the Enlarged EU. Journal of Common Market Studies 42(3): 641-666.

Radosevic, S. 1999. Patterns of Innovative Activities in

Countries of Central and Eastern Europe: An Analysis Based on Comparison of Innovation Surveys. Sussex, SPRU Electronic Working Paper No 35. http://www.sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp35/sewp35.pdf (accessed February 6, 2007).

Raymond, W. P. et al. 2006. Persistence of innovation in Dutch manufacturing: Is it spurious? Munich, CESifo Working Paper Series No 1681. http://ssrn.com/abstract=894203 (accessed April 14, 2007)

Rosenberg, N. 1982. Inside the Black Box: Technology and Economics. Cambridge University Press, Cambridge.

Sanna-Randaccio, F., R. Veugelers 2003. Global innovation strategies of MNEs: Implications for host economies. In Multinational Enterprises, Innovative Strategies and Systems of Innovation, edited by J. Cantwell and J. Molero, 14-46. Edward Elgar, Cheltenham.

Schmookler, J. 1962. Economic Sources of Inventive Activity. Journal of Economic History XXII (1): 1-20.

Szabo, A. 2002. Internationalisation of SMEs: The UNECE Approach. Geneva, UNECE. http://www.unece.org/indust/sme/internat.htm (accessed August 12, 2007)

Švarc, J. 2006. Socio-political factors and the failure of innovation policy in Croatia as a country in transition. Research Policy 35 (1): 144-159.

Teece, D. J. 1977. Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Know-how. Economic Journal 87 (346): 242-261.

Teece, D. J. 1986. Profiting from Technological Innovation. Research Policy 15 (6): 285-306.

Vinding, A. L. 2002. Absorptive capacity and innovative performance: A human capital approach. In Interorganisational Diffusion and Transformation of Knowledge in the Process of Product Innovation. Ph.D. dissertation, Institut for Erhvervsstudier, Ålborg Universitet.

Work Motivation of Highly-Educated Croatian Employees – What Should Managers and HR Experts Know?

Nina Pološki - Vokić, Maja Klindžić, Martina Đaković*

Abstract

The study dealt with the work motivation of highly-educated Croatian employees, specifically those at the fore of their companies in terms of expertise amid this "Age of Knowledge," in order to provide recommendations for management on how to improve their levels of motivation, and give direction to HR experts on which motivation policies and practices to implement.

According to the findings, highly-educated Croatian employees perceive that many regular motivation strategies are insufficiently present in their companies, are generally not satisfied with the motivation strategies applied, and are significantly less satisfied with motivation strategies because they deem them unimportant. Furthermore, they perceive non-material motivation strategies as more effective, assign these strategies greater importance and find them generally more satisfying than material motivation strategies. Finally, the findings indicate that there are no differences in work motivation between highly-educated Croatian employees with different characteristics.

JEL: M12, M52 **DOI: 10.2478/v10033-008-0009-5**

1. Introduction

Managers of every company need to ensure that their employees are highly productive in areas consistent with the objectives of the organization. This can only be achieved if employees are highly motivated in their work, and managers are able to actively enhance and maintain this motivation.

Motivation at work has been a popular area of research for almost a century, from the 1930s onwards. Contemporary exploratory studies on work motivation have increasingly focused on particular respondent groups (for example Leung and Clegg 2001), industries (for example Jindal-Snape and Snape 2006) or geographic areas (for example Eskildsen, Kristensen, and Westlund 2002; Linz, Good, and Huddleston 2006; Takahashi 2006), as well as on different combinations of those determinants (for example Lee-Ross 2002). Research addressing the issue of motivation factors of Croatian employees has mostly been limited to one company (for example Anđelić 1996), one industry (for example, Klepac 2002 about motivation factors in the Croatian bank industry) or one group of employees (for example Franić 2007 about motivation factors of young Croatian managers). In other words, as work

*Pološki - Vokić: University of Zagreb,
Faculty of Economics and Business
Trg J. F. Kennedya 6, 10 000 Zagreb, Croatia
e-mail: npoloski@efzg.hr

*Klindžić: University of Zagreb,
Faculty of Economics and Business
Trg J. F. Kennedya 6, 10 000 Zagreb, Croatia
e-mail: mklindzic@efzg.hr

*Đaković: RTL Television
Krapinska 45, 10 000 Zagreb, Croatia
e-mail: martina.djakovic@rtl.hr

motivation is not a globally uniform concept, its research is suggested to provide insight into the motivation of diverse and under-researched groups of employees (Jindal-Snape and Snape, 2006) and differences resulting from various cultural settings (Eskildsen, Kristensen, and Westlund 2002), which this paper in particular seeks to investigate.

The study dealt with the work motivation of highly-educated Croatian employees, specifically those at the fore of their companies in terms of expertise amid this "Age of Knowledge." Since knowledgeable workers and their productivity are the most valuable assets of a 21st century institution (Drucker 1999, p. 135), what motivates them should be of primary interest to contemporary organizations and their managers. Therefore, highly-educated Croatian employees were selected as a group to be surveyed.

The study had three main aims. The first aim was to explore the level of highly-educated Croatian employees' satisfaction with various common material and nonmaterial motivation strategies, and the importance they assign to those strategies. In other words, the study sought to explore the perceptions of highly-educated Croatian employees regarding a range of motivation factors.

The second aim was to test assumptions concerning the differences in work motivation among highly-educated employees with diverse characteristics. Namely, studies report different and sometimes contradictory findings with respect to the effect that employee characteristics such as gender, age and educational level have on work motivation (Eskildsen, Kristensen, and Westlund 2002), which was the impetus to explore the issue further. In particular, the relationship between respondents' characteristics (both demographic and those of their companies), and their satisfaction with various motivation strategies and the level of importance they assign to those strategies were analyzed.

Upon the collection of the aforementioned data concerning work motivation, the final aim was to identify practical recommendations for managers and human resource (HR) experts with the purpose of improving the productivity of highly-educated Croatian employees. Simply put, the third aim was to provide recommendations for Croatian management on how to improve (or maintain) levels of motivation among their employees. Specifically, since we are living in the "Age of Knowledge," in which human resources are of crucial importance for achieving organizational success, findings on the work motivation of highly-educated Croatian employees could contribute to and enhance the performance of both Croatian organizations and the country in general. Furthermore, since human resource management (HRM) as a business and managerial function has yet to be developed in Croatia, the findings of this research could give direction to HR departments in terms of further development, and suggest precisely which HR practices and policies to implement.

2. Research Areas and Methodology

Research Areas. In order to help Croatian managers to motivate their employees effectively and HR experts to perform their jobs better, four aspects of highly-educated Croatian employees' motivation were assessed: (1) employees' satisfaction with various common material and nonmaterial motivation strategies, (2) the level of importance employees assign to those strategies, (3) the discrepancy between employees' satisfaction and assigned level of importance to various motivation strategies, and (4) the relationship between satisfaction/importance of various motivation strategies and respondents' characteristics (the analysis focused on the following demographic and other categories: gender, age, hierarchical level, pay level, field of work, size of the company, main company activity, ownership structure, existence of HR department, and existence of performance appraisal).

Research Instrument. The research was conducted by means of a questionnaire consisting of five parts: (1) demographic characteristics of respondents (gender, age, hierarchical level, pay level, and field of work), (2) their companies' characteristics (size of the company measured by number of employees, main company activity, ownership structure, existence of HR department, and existence of performance appraisal), (3) questions concerning the presence of various material and nonmaterial motivation strategies in respondents' companies, (4) questions concerning respondents' satisfaction with various standard motivation strategies, and (5) questions concerning the level of importance respondents assign to those strategies. Altogether seventeen commonly present motivation strategies were assessed by respondents: ten material motivation strategies (salary, innovation and improvement bonuses, other bonuses and incentives, profit-sharing, gain-sharing, ESOP – employee stock ownership plan, additional education, life-insurance, recreation, and company car), and seven nonmaterial motivation strategies (job design, flexible working hours, recognition, feedback, leadership style, corporate culture, and MBO – management by objectives). Respondents were asked to indicate the extent of their satisfaction and the level of importance of various material and nonmaterial motivation strategies by circling a number on a five-point Likert-type numerical scale ranging from 1 (not satisfied/not important) to 5 (extremely satisfied/extremely important).

Sample. The sample consists of 98 highly-educated Croatian employees that enrolled in graduate programs

Structure (% of companies)	
Gender	Male (41.2%), female (58.8%)
Age	Up to 25 years old (9.3%), 25-30 years old (47.4%), 30-40 years old (23.7%), 40-50 years old (16.5%), more than 50 years old (3.1%)
Hierarchical level	Non-managerial (43.3%), low level managers (26.8%), middle managers (16.5%), top managers (13.4%)
Pay level	Up to 4000 HRK (11.5%), 4000-6000 HRK (26.0%), 6000-8000 HRK (24.0%), 8000 10000 HRK (19.8%), 10000-12000HRK (6.3%), more than 12000 HRK (12.5%)
Field of work	R&D (5.2%),procurement (5.2%), production (4.1%), sales (18.6%), finances (16.5%), accounting (5.2%), marketing (14.4%), human resource management (6.2%), general management (11.3%), other (13.4%)
Structure (% of companies)	
Size of the company measured by number of employees	Up to 50 employees (23.7%), 50 to 100 employees (8.2%), 100 to 250 employees (15.5%), 250 to 500 employees (11.3%), more than 500 employees (41.2%)
Ownership structure	State-owned companies (22.7%), private Croatian-owned companies (52.6%), private foreign-owned companies (24.7%)
Main company activity	Manufacturing (22.7%), construction (4.1%), wholesale and retail (17.5%), transport, (2.1%), post and telecommunication services (41.1), financial services, banking and insurance (11.3%), public sector (18.6%), professional services (10.3%), other services (9.3%)
Existence of HR department	HR department exists (54.6%), HR department does not exist (45.4%)
Existence of performance appraisal	Performance appraisal is established (61.9%), performance appraisal is not established (25.8%), no answer (12.4%)

Table 1:
Profile of Respondents and their Companies

at the Faculty of Economics and Business – Zagreb (FEB-ZG). Graduate students from FEB-ZG were selected as respondents as they come from different occupations and different parts of Croatia, and therefore are suitable representatives of highly-educated Croatian employees. The research questionnaires were completed anonymously by those graduate students that were present at lectures in April of 2006. Table 1 depicts their profile for this study,

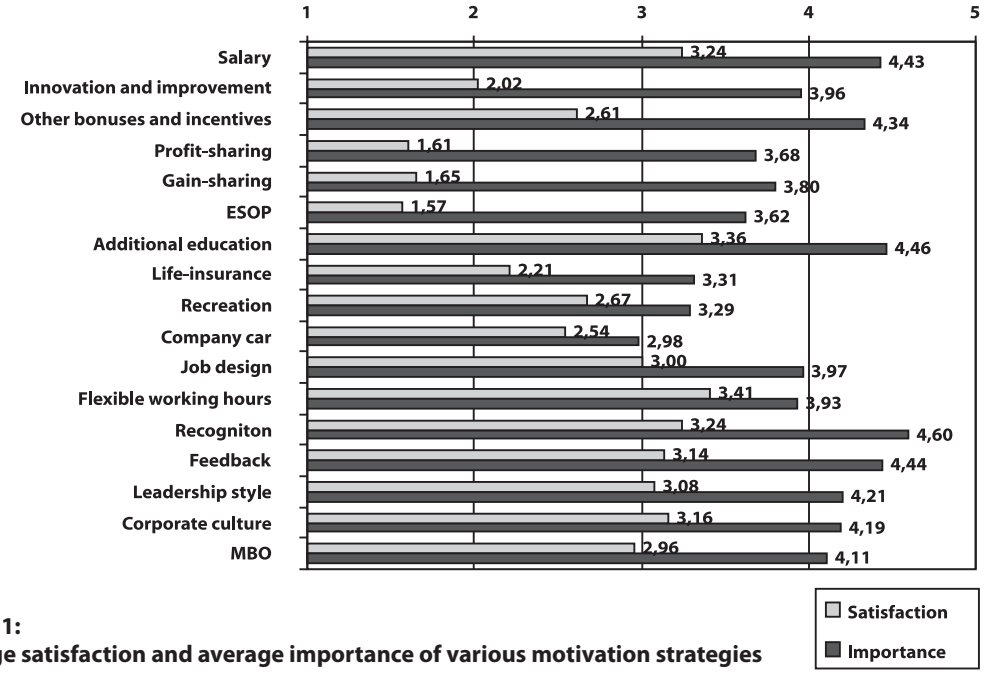


Figure 1:
Average satisfaction and average importance of various motivation strategies

both in terms of their demographic and their companies' characteristics.

The size of the sample is satisfactory when compared with similar studies (see, for example, Jindal-Snape and Snape 2006; Lee-Ross 2002; Leung and Clegg 2001).

Data Processing. Statistical analysis consisted of descriptive statistics calculations, t-tests for two related means, and calculations of Cramer's V. Calculations and tests were conducted using SPSS.

3. Research Results

The research results are presented in two parts. First, highly-educated Croatian employees' satisfaction with numbered material and nonmaterial motivation strategies, the level of importance they assign to those strategies, and the discrepancy between their satisfaction and assigned level of importance are presented. Second, the relationships between satisfaction/importance of various motivation strategies for respondents and their demographic/company characteristics are presented.

3.1. Satisfaction with and Importance of Various Motivation Strategies for Highly-educated Croatian Employees

Figure 1 depicts the average respondents' satisfaction with seventeen standard motivation strategies and the average level of importance they assign to those strategies.

Several main findings stem from Figure 1. First, there is an evident discrepancy between respondents' satisfaction with various motivation strategies and the value they assign to those strategies. Respondents evaluated higher the importance of all seventeen motivation strategies numbered than their satisfaction with those strategies, a result which will be dealt with in more detail later in the article.

Second, respondents are moderately satisfied with the motivation strategies numbered (2.74 on average; nine out of seventeen motivation strategies with an average value less than 3.00). They are especially unsatisfied with the material strategies available in their companies. On average, their satisfaction with those strategies was 2.35; three out of ten of those strategies were evaluated on average less than 2.00 (profit-sharing, gain-sharing, and ESOP); two between 2.00 and 2.50 (innovation and improvement bonuses, and life-insurance); three between 2.50 and 3.00 (other bonuses and incentives, recreation, and company car); only two of those strategies were evaluated on average higher than 3.00 (salary, and additional education). To a higher extent respondents reported satisfaction with nonmaterial strategies. Their average satisfaction with those strategies was 3.14, with none of those strategies evaluated on average higher than 3.50, and with only one evaluated on average lower than 3.00 (MBO).

Third, respondents find all seventeen motivation strategies numbered fairly to extremely important. To be precise, only one motivation strategy had an average importance value less than 3.00 (but not far from that

	Motivation strategy	Paired differences mean	t-value	Sig.
Material	1. salary	-1.196	-9.996	0.000
	2. innovation and improvement bonuses	-2.182	-13.116	0.000
	3. other bonuses and incentives	-1.737	-10.279	0.000
	4. profit-sharing	-2.098	-8.813	0.000
	5. gain-sharing	-2.216	-11.625	0.000
	6. ESOP	-2.063	-10.061	0.000
	7. additional education	-1.112	-7.962	0.000
	8. life-insurance	-1.121	-5.979	0.000
	9. recreation	-0.609	-2.601	0.012
	10. company car	-0.730	-3.416	0.001
Nonmaterial	11. job design	-1.074	-8.172	0.000
	12. flexible working hours	-0.647	-3.548	0.001
	13. recognition	-1.408	-9.456	0.000
	14. feedback	-1.397	-9.427	0.000
	15. leadership style	-1.254	-6.836	0.000
	16. corporate culture	-1.094	-7.892	0.000
	17. MBO	-1.298	-7.822	0.000

Table 2:
Percentage of Companies that Use Various Motivation Strategies and Motivation Strategies Satisfaction/Importance Rankings

	Motivation strategy	Presence (% of companies)	Satisfaction ranking	Importance ranking
Material	1. salary	1000	4	4
	2. innovation and improvement bonuses	5.2	14	10
	3. other bonuses and incentives	44.3	11	5
	4. profit - sharing	2.1	16	13
	5. gain - sharing	3.1	15	12
	6. ESOP	2.1	17	14
	7. additional education	63.9	2	2
	8. life - insurance	13.4	13	15
	9. recreation	24.7	10	16
	10. company car	26.8	12	17
Nonmaterial	11. job design	42.3	8	9
	12. flexible working hours	44.3	1	11
	13. recognition	51.5	3	1
	14. feedback	49.5	6	3
	15. leadership style	20.6	7	6
	16. corporate culture	30.9	5	7
	17. MBO	22.7	9	8

Table 3:
Statistical Differences between Satisfaction and Importance of Various Motivation Strategies

value; company car –> 2.98); two were between 3.00 and 3.50 (life-insurance, and recreation); six between 3.50 and 4.00 (innovation and improvement bonuses, profit-sharing, gain-sharing, ESOP, job design, and flexible working hours); seven between 4.00 and 4.50 (salary, other bonuses and incentives, additional education, feedback, leadership style, corporate culture, and MBO); one strategy was assessed on average as extremely important (recognition –> 4.60). Altogether, the respondents think that motivation strategies numbered are very important (3.96 on average), with nonmaterial strategies graded on average higher (4.21) than material ones (3.79).

Further analysis consisted of observing the presence of various motivation strategies in Croatian companies and associated respondents' satisfaction/importance rankings (table 2).

Table 2 reveals that, when looking at rankings, respondents are more satisfied with those motivation strategies that are more present, which was reasonable to expect. The rankings also confirm previously elaborated findings about nonmaterial motivation strategies being positioned better, since they were ranked higher both in terms of respondents' satisfaction and the importance respondents assign to them.

The third part of the analysis of highly-educated Croatian employees' work motivation consisted of examining significant differences between their satisfaction and the importance they assign to various motivation strategies. Therefore, t-tests for two related means, with pairs being satisfaction and importance of each of the seventeen motivation strategies, were performed (table 3).

As mentioned before, and as is evident from paired differences means signs (all negative), respondents evaluated higher the importance than their satisfaction with all seventeen motivation strategies. Moreover, t-test results revealed that their average importance grades are significantly different (higher) than their average satisfaction grades. To be precise, differences between pair means are all statistically significant, with all but one significant at the 0.01 level.

3.2. Relationship between Satisfaction/ Importance of Motivation Strategies and Respondents' Characteristics

In order to provide a measure of the strength of the relationship between the characteristics of highly-educated Croatian employees (both demographic and those of their companies) and the motivation factors assessed, Cramer's V was used. Table 4 depicts the number and percentage of statistically significant relationships between respondents' demographic characteristics and the satisfaction/importance they attribute to various material and nonmaterial strategies.

Motivation strategies		Percentage of statistically significant relationships				
		Gender	Age	Hierarchical level	Pay level	Field of work
Material	Satisfaction	0/10 (0%)	0/10 (0%)	4/10 (40%)	4/10 (40%)	0/10 (0%)
	Importance	0/10 (0%)	0/10 (0%)	1/10 (10%)	1/10 (10%)	0/10 (0%)
Nonmaterial	Satisfaction	0/7 (0%)	0/7 (0%)	0/7 (0%)	1/7 (14%)	0/7 (0%)
	Importance	0/7 (0%)	0/7 (0%)	0/7 (0%)	0/7 (0%)	0/7 (0%)
Total	Satisfaction	0/17 (0%)	0/17 (0%)	4/17 (24%)	5/17 (29%)	0/17 (0%)
	Importance	0/17 (0%)	0/17 (0%)	1/17 (6%)	1/17 (6%)	0/17 (0%)

Table 4:
Statistically Significant Relationships between Satisfaction/Importance of Various Motivation Strategies and Respondents' Demographic Characteristics

Table 4 implies that none of the respondents' demographic characteristics significantly differentiates their satisfaction with various motivation strategies or the importance they assign to those strategies. Although research gives evidence that demographic differences could be related to motivation factors (Eskildsen, Kristensen, and Westlund 2002; Gurvich 2006 in Hartley 2007), the results of this study reveal that only respondents' hierarchical and pay level could to some extent be aligned with their satisfaction with the material motivation strategies present in their companies.

The relationships between the characteristics of the respondents' companies and the satisfaction/importance they assign to various motivation strategies proved not to be significant (table 5).

Table 5 indicates that although companies' characteristics are generally associated with employees' work motivation (Jindal-Snape and Snape 2006) no company characteristic was found to be significantly related to the motivation issues explored in the research.

4. Discussion and Recommendations

The summary of all obtained results is given separately for material, nonmaterial, and motivation strategies in total. The following findings regarding work motivation in Croatian companies are presented in table 6: (1) average presence of observed motivation strategies in Croatian companies, (2) average satisfaction and average importance respondents assigned to those strategies, (3) average satisfaction and average importance rankings of those strategies, (4) percentage of statistically significant differences between respondents' satisfaction and the importance they assigned to those strategies, and (5) percentage of statistically significant demographic and companies' characteristics related to highly-educated Croatian employees' satisfaction with and the importance they assigned to various motivation strategies.

There are several conclusions that can be drawn from Table 6 and serve as rationale for practical recommendations for managers and HR experts concerning their employees' work motivation:

Motivation strategies		Percentage of statistically significant relationships				
		Size of the company	Ownership structure	Main company activity	Existence of HR department	Existence of performance appraisal
Material	Satisfaction	2/10 (20%)	1/10 (10%)	1/10 (10%)	1/10 (10%)	0/10 (0%)
	Importance	2/10 (20%)	0/10 (0%)	1/10 (10%)	1/10 (10%)	0/10 (0%)
Nonmaterial	Satisfaction	2/7 (29%)	1/7 (14%)	2/7 (29%)	0/7 (0%)	2/7 (29%)
	Importance	0/7 (0%)	0/7 (0%)	0/7 (0%)	1/7 (14%)	2/7 (29%)
Total	Satisfaction	4/17 (24%)	2/17 (12%)	3/17 (18%)	1/17 (6%)	2/17 (12%)
	Importance	2/17 (12%)	0/17 (0%)	1/17 (6%)	2/17 (12%)	2/17 (12%)

Table 5:
Statistically Significant Relationships between Satisfaction/Importance of Various Motivation Strategies and Companies' Characteristics

Motivation strategies	Average presence (%)	Average value		Average ranking		Percentage of statistically significant		
		Satisfaction	Importance	Satisfaction	Importance	differences between satisfaction and importance	respondents' demographic characteristics for satisfaction /importance	respondents' company characteristics for satisfaction importance
Material	28.56	2.35	3.79	11.4	10.8	10/10 (100%)	0/5 (0%)	0/5 (0%)
Nonmaterial	37.40	3.14	4.21	5.57	6.43	7/7 (100%)	0/5 (0%)	0/5 (0%)
Total	32.98	2.74	3.96	-	-	17/17 (100%)	-	-

Table 6:
Summary of Obtained Results

First, highly-educated Croatian employees perceive nonmaterial motivation strategies to be more present in their companies compared to material ones, which is probably the cause of their greater satisfaction with that group of strategies (both in terms of average value and average ranking). For Croatian managers and HR professionals, that implies the need to invest more in material ways of motivating highly-educated employees, especially when keeping in mind that the expected monetary rewards have a large influence on employees' motivation (Linz, Good and Huddleston 2006).

Second, according to both average value and average ranking of motivation strategies, highly-educated Croatian employees find nonmaterial motivation strategies to be more important than material ones. This matches Cohen's (2006) observation that money-based rewards aren't distinctive, individual, or motivational, and that a personal, nonmonetary gift is ultimately more rewarding. Consequently, it is important for Croatian managers and HR experts to consider many different aspects of working conditions beyond financial rewards in order to motivate their employees, as contemporary authors emphasize (for example Strickler 2006; Hartley 2007). Plainly expressed, pay does matter, but convincing people to stay might not cost as much as HR believes (IOMA 2007). The Croatian business environment, just as contemporary business settings all over the world, should thus give relevance to motivation factors such as teamwork, sharing of leadership roles, corporate culture, sincere care and concern, and similar issues (more about the importance and impact of "soft" business practices on employees' motivation see Cohen 2006; Strickler 2006; Zofi and Meltzer 2007). Additionally, highly-educated Croatian employees' perceptions of greater importance of nonmaterial motivation strategies could be the result of their better salaries on average (that match their educational level), and therefore their greater interest in alternative motivation strategies, especially in fulfilling their highest level needs (mostly nonmaterial needs such as self-actualization, recognition, feedback, participative leadership style, etc.).

Third, highly-educated Croatian employees evaluated all seventeen motivation strategies listed in the research as more important than satisfying. This is confirmed by all differences between pairs of values (importance and satisfaction) being statistically significant, and implies that Croatian managers and HR experts should devote considerably more effort, time and money to the development and implementation of a wide range of motivation activities.

Fourth, highly-educated Croatian employees' demographic and company characteristics were not found to be significantly related to either their satisfaction with or the importance they assign to various motivation strategies. The lack of differences in satisfaction between employees with different characteristics could be explained by their overall dissatisfaction with the motivation strategies provided by their companies. The lack of differences in importance they assign to those strategies could be partially explained by the currently popular situational approach to motivating employees, which implies that when it comes to matters of motivation one size does not fit all, and that determining what motivates each and every individual is the only way of managing their performance. Croatian managers and HR experts should therefore not treat Croatian highly-educated employees as a monolithic category. Rather, policies and programs to support them should begin with a diagnosis of their personal characteristics and motivation factors aimed at strengthening pull motives that comprise a base for their greater efficiency and effectiveness.

5. Conclusion

In order for employees to act as a source of competitive advantage, i.e., to contribute to the development of an enterprise's competitiveness, they need to be knowledgeable and motivated. Motivated employees are considered a vital link for both a company's efficiency and effectiveness, and motivated highly-educated employees

are today becoming a primary source of a company's competitive advantage.

This study, unfortunately, indicates that Croatian companies do not apply that philosophy and seem even to be unaware of it. Highly-educated Croatian employees, according to the findings, perceive that many regular motivation strategies are insufficiently present or underdeveloped in their companies, are generally not satisfied with the motivation strategies applied, and are significantly less satisfied with the motivation strategies provided than they consider them important, which could all lead to diminished productivity. Furthermore, they are more satisfied with nonmaterial motivation strategies (probably because they perceive those strategies more present than material ones), and assign more importance to them. This suggests that alternative methods of motivating Croatian highly-educated employees, besides financial rewards, should not be neglected, which is in accordance with the fact that knowledgeable workers are in general satisfied with their salaries (because they are on average paid better), and therefore primarily interested in intrinsic awards. Finally, the findings reveal that there are no differences in work motivation between highly-educated Croatian employees with different characteristics, implying that they, regardless of their demographic or company characteristics, perceive that motivation practices are not given enough attention by their managers, and that they should not be treated uniformly or as a group when motivated, because what motivates one person does not necessarily motivate another, as the situational approach to work motivation suggests.

Overall, the findings from this research could help Croatian managers and HR experts enhance employees' productivity by understanding what motivates them and their degree of satisfaction with existing motivation strategies.

REFERENCES

Anđelić, Lj. 1996. Motivacija i zadovoljstvo na radu u prehrambenoj industriji (Motivation and work satisfaction in food industry). M.Sc. thesis. University of Zagreb – Faculty of Economics and Business. Zagreb.

Cohen, S. 2006. Compliment your staff with nonmonetary rewards. Nursing Management 37 (12): 10, 14.

Drucker, P. F. 1999. Management Challenges for the 21st Century. New York, NY: HarperCollins Publishers, Inc.

Eskildsen, J. K., Kristensen, K., Westlund, A. H. 2002. Work motivation and job satisfaction in the Nordic countries. Employee Relations 26 (2): 122-136.

Franić, J. 2007. Važnost materijalnog nagrađivanja u motivaciji mladih managera u Hrvatskoj (The importance of compensations for motivating young managers in Croatia). M.Sc. thesis. University of Zagreb – Faculty of Economics and Business. Zagreb.

Hartley, S. 2007. Motivating workers. Businessdate 15 (1): 1-3.

IOMA. 2007. Rewards Are Now Critical to Keep Valued Employees. www.ioma.com/hr 7 (5): 1, 10-12.

Jindal-Snape, D., Snape, J. B. 2006. Motivation of scientists in a government research institute – Scientists' perceptions and the role of management. Management Decision 44 (10): 1325-1343.

Klepac, J. 2002. Razvoj motivacijskih strategija u funkciji uspješnosti poslovanja banaka u Republici Hrvatskoj (Motivation strategies for improving performance in Croatian banking sector). M.Sc. thesis. University of Zagreb – Faculty of Economics and Business. Zagreb.

Lee-Ross, D. 2002. An exploratory study of work motivation among private and public sector hospital chefs in Australia. Journal of Management Development 21 (8): 576-588.

Leung, A. S. M., Clegg, S. R. 2001. The career motivation of female executives in the Hong Kong public sector. Women in Management Review 16 (1): 12-20.

Linz, S. J., Good, L. K., Huddleston, P. 2006. Worker Morale in Russia: An Exploratory Study. William Davidson Institute Working Paper Number 816: 1-24.

Strickler, J. 2006. What Really Motivates People?. The Journal for Quality & Participation 29 (1): 26-28.

Takahashi, K. 2006. Effects of wage and promotion incentives on the motivation levels of Japanese employees. Career Development International 11 (3): 193-203.

Zofi, J. S., Meltzer, S. 2007. Making motivation personal. www.nursinghomesmagazine.com 56 (3): 92-93.

In the last issue of our Journal Mr. Andraž Grum omitted:

Žiković, S (2005), Formiranje optimalnog portfolija hrvatskih dionica i mjerenje tržišnog rizika primjenom VaR metode : magistrsko delo, [S. Žiković], Ljubljana, from the reference list of his work: Measuring Market Risk for Commercial Banks in the Volatile Environment of an Emerging Market Economy.

Cost Allocation Accounting Methods Used in the Croatian Production Sector

Hrvoje Perčević, Ivana Dražić - Lutilsky*

Abstract

Before conducting the research, two main hypotheses were proposed:
H1: The majority of Croatian production companies use traditional accounting methods for cost allocation.
H2: Direct production costs make up the largest portion within the production cost structure for the majority of Croatian production companies. Because of this production cost structure, modern cost allocation accounting methods would not contribute to more reliable company profitability evaluation and business decision-making.
The research is based on a specific sample including every important Croatian public production company. The process of cost allocation process is not easy. It is a difficult and complicated procedure that requires the application of appropriate accounting methods. The process of allocating costs to cost objects is realized through the application of certain accounting methods. These accounting methods often cannot provide fair and objective cost allocation because they have arbitrary bases that are not always appropriate.

JEL: M41 **DOI: 10.2478/v10033-008-0006-8**

1. Introduction

Cost allocation is a serious problem in almost every company. Every company faces the problem of allocating costs to defined cost objects. The cost allocation process is not easy. It is a difficult and complicated procedure that requires the application of appropriate accounting methods. The process of allocating costs to cost objects is realized through the application of certain accounting methods. These accounting methods often cannot provide fair and objective cost allocation because they have arbitrary bases that are not always appropriate or reliable. Therefore, accounting theory and practice constantly try to improve upon existing methods and develop new ones that could provide fair and objective cost allocation.

Cost allocation is an important procedure not only in production companies, but also in service companies. The basic purpose of cost allocation is to enable the determination of the cost of a product per unit in production companies and the cost of a provided service in service companies. Consequently, cost allocation methods directly affect the product or service profitability evaluation and, at the same time, influence segment and company profitability. The significant problem is the

*Perčević: Faculty of Economics and Business, University of Zagreb, Trg J.F.Kennedy-a 6, Zagreb, e-mail: hpercevic@efzg.hr

*Dražić - Lutilsky: Faculty of Economics and Business, University of Zagreb, Trg J.F.Kennedy-a 6, Zagreb, e-mail: idrazic@efzg.hr

choice of the cost allocation accounting method. Certain accounting methods for cost allocation do not apply in the same way and in the same form to every company. These methods need to be adjusted to the company with regard to the company's basic characteristics, such as organizational structure, type of production, technology, accounting system, etc. Also, it is important to emphasise that certain accounting methods can be appropriate for cost allocation in one company, but cannot ensure reliable cost allocation in another.

One of the most important factors that affect the choice of accounting method is the production cost structure. The reliability of the accounting method for cost allocation significantly depends on the production cost structure. In order to determine which accounting methods for cost allocation are used in Croatian production companies, an empirical research has been conducted for the most significant Croatian production companies.

2. Purposes and Process of Cost Allocation

2.1. Purpose of Cost Allocation

Cost allocation is a process that every company must address. The procedure of allocating costs to defined cost objects is one of the most important procedures in every company. This procedure yields significant information for qualitative business decision-making processes. Cost allocation provides management with information regarding product or service profitability evaluation, segment evaluation and company profitability evaluation, all of which are necessary for both strategic and operational decisions. (Horngren, Datar, Foster 2003, p.482)

The basic purpose of the cost allocation process is to determine the cost of a product or service. Besides this basic purpose, cost allocation is performed in order to enable the following: (Horngren, Datar, Foster, 2003, p.483)

1. To provide information for economic decisions
2. To motivate managers and employees
3. To justify costs or compute reimbursement
4. To measure income and assets for reporting to external parties

The first purpose is the most important, because the cost allocation process is mostly implemented for enabling economic decisions on pricing, quantity of production, product mixes, the implementation of a new product, the acceptance of a certain customer's order, etc. Cost allocation can motivate managers and employees to design products that are simpler to manufacture. Also, cost allocation can be used to justify costs or compute reimbursement when certain costs are not included in the cost of a product or service. Finally, cost allocation is necessary for income and assets measurement for external reporting. (Horngren, Datar, Foster, 2003, p. 482)

According to the existing IFRS, only production costs can be included in the value of work in progress and finished products.

2.2. Process of Cost Allocation

Since cost allocation is a difficult and complicated process, certain steps must be taken before the cost allocation process is possible. These include:

1. cost determination
2. cost classification
3. the choice of cost allocation accounting method

The cost accounting system has to be designed in a way that enables both cost determination and cost classification. While cost determination is a process that is also required for the purpose of external reporting, cost classification is a process that is extremely important for internal management reporting. Cost classification is essential to the cost allocation process in that it determines the cost of a particular product and thus enables product profitability evaluation.

2.2.1. Cost Classifications

Cost classifications directly enable cost allocation. For the purposes of cost allocation, costs need to be classified according to the following criteria:

1. management function
2. accounting treatment
3. traceability to product
4. cost behaviour
5. decision significance
6. managerial control (Cherington, Hubard, Luthy, 1985)

The abovementioned criteria of cost classifications are the most commonly used in accounting theory and

practice. The detailed review of cost classifications and its major sub classifications are presented in the following figure:

Cost Classification	Major Sub classifications
Time period	1) Historical costs 2) Budgeted costs
Management function	1) Manufacturing costs 2) Selling costs 3) Administrative costs
Accounting treatment	1) Product costs 2) Period costs 3) Capital costs
Traceability to product	1) Direct costs 2) Indirect costs
Cost behaviour	1) Variable costs 2) Fixed costs
Decision significance	1) Relevant costs 2) Irelevant costs
Managerial control	1) Controllable costs 2) Uncontrollable costs

Figure 1. Cost Classifications Cherington, Hubard, Luthy (1985)

It is important to emphasise that the same cost can be included in several or all cost classifications. However, all of the cost classifications mentioned above do not have the same significance for particular accounting purposes. For the purpose of cost allocation, the relevant cost classifications are:

- traceability to product
- management function
- accounting treatment

These cost classifications are needed to by the accounting system of a company in order to enable the cost allocation process. The most important cost classification for the cost allocation process and inventory evaluation is classification related to accounting treatment. In order to provide the cost allocation process, all costs of a particular accounting period must be divided into two main categories**:** *(i) product costs or (ii) period costs*. (Kaplan, Atkinson 1989, p. 9)

Generally, product costs are all the costs related to the manufacturing aspect of a company. These are manufacturing costs that are directly or indirectly involved in producing products. Product costs include direct material costs, direct labour costs and indirect manufacturing costs. Direct costs are costs that can be identified with particular cost objects. Direct cost can be traced to the particular product. Indirect manufacturing costs, or overhead, are those costs that cannot be traced to the particular product. Because overhead cannot be identified with the particular product, it needs to be allocated to the product using the appropriate accounting methods.

Product costs are related to the finished product, and in this way affect future economic value. So, from an accounting point of view, these costs are capitalised as inventory and held as unexpired until the finished products are sold. Product costs are not charged as expenses within the period in which they are incurred, but in the period in which the finished products will be sold.

Period costs are costs that are charged as expenses within the period in which they are incurred. These costs have no future economic benefit because they are related to the non - manufacturing functions of the company. Period costs become expenses in the same period in which they are incurred and are matched to the revenues of the particular accounting period. That way, period costs have an immediate impact on financial results within the period of their appearance. Period costs include selling costs and administrative costs. These costs are not related to the production aspect of the company.

The complete accounting cost treatment is shown in the following figure:

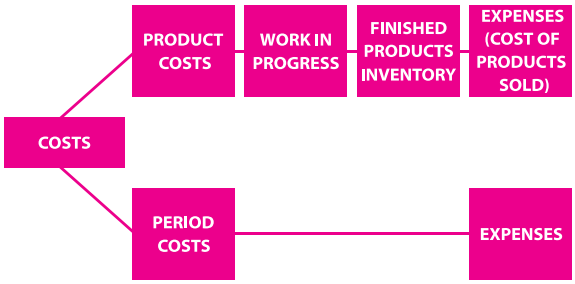


Figure 2. Accounting Cost Treatment

Product costs are capitalised, first as work in progress and then, when products are fully completed, like finished products. During their capitalisation, product costs become an asset and are presented in the balance sheet as inventory. When finished products are sold, the capitalised product costs finally become expenses and are presented in an income statement to match with corresponding revenues. Period costs are expenses and are presented in an income statement within the period of their appearance. (Perčević, 2005)

2.2.2. Phases of the Cost Allocation Process

The cost allocation process is carried out through the following phases:

1. the assignment of direct costs to cost objects
2. the allocation of indirect costs from a support department to an operating division (manufacturing)
3. the allocation of indirect costs from an operating division to products (or services) that are defined as a cost objects
4. the determination of the cost of a product (by adding the allocated indirect costs to previously assigned direct costs of a particular product)

Before the cost allocation process is carried out, costs must be determined and appropriately classified in order to enable the cost allocation process. Costs must be first classified as product costs and period costs. Product costs are capable of being inventoried, while period costs are considered expenses of the accounting period. So, from an accounting point of view, product costs are relevant to the cost allocation process, because these costs create the value of particular products. Product costs must be properly allocated to the products that caused their appearance. In order to make the cost allocation process easier to realize, product costs are classified as direct and indirect costs. Direct product costs can be directly traced to the particular product, so the assignment of these costs to products is easy. Indirect product costs cannot be directly traced to the products, so these costs need to be allocated to products by the application of a certain accounting method. The whole cost allocation process is focused on indirect product costs, because only an objective allocation of indirect costs to products can lead to reliable product profitability evaluation and thus make a decision-making process more qualitative. Indirect product costs are first allocated from support departments to operating divisions (manufacturing), then from the operating division to particular products. Different accounting methods are used for indirect cost allocation from support departments to operating divisions and for allocation from operating divisions to products. After the indirect cost allocation to products is completed, the final cost allocation phase determines the cost of a particular product. In order to determine the cost of a product, allocated indirect costs are added to a product's previously assigned direct costs. When the total costs of a particular product are divided by the quantity of production, the cost of a product per unit is computed and the cost allocation process is completed.

One of the most important issues in the cost allocation process is the choice of the accounting methods that will be applied for the indirect cost allocation to operating divisions and to products.

3. Accounting Methods for Cost Allocation

Cost allocation is a complex process that is carried out through the application of certain accounting methods. The choices dictating the appropriate accounting method include:

- the choice of costs that need to be allocated
- the choice of cost pools
- the choice of appropriate cost allocation bases
- the calculation of cost allocation rate(s)

For the purpose of external financial reporting, only production costs need to be allocated to products, while period costs are recognized as expenses within the accounting period. Costs that need to be allocated are grouped into defined cost pools in the process of cost allocation. The cost pools are formed when the company uses more cost allocation bases. Costs are allocated from cost pools to products by identified cost allocation bases. A cost allocation base is the factor that links in a systematic way an indirect cost (or group of indirect costs) to a particular cost object (product or service). (Horngren, Datar, Foster, 2003, p. 96) On the basis of the cost allocation base, cost allocation rates are calculated. These rates are used to perform the cost allocation from cost pools to cost objects.

In the cost allocation process, two kinds of accounting methods are needed:

1. accounting methods for allocating indirect costs of a support department to operating divisions
2. accounting methods for allocating indirect costs from operating divisions to cost objects (products and services)

3.1. Accounting Methods for Allocating Indirect Costs from Support Departments to Operating Departments

Companies usually distinguish their operating departments from their support departments. An operating department is a production department in manufacturing companies in which the products are manufactured. A support department, also called a service department, provides the services that assist other internal departments in the company. (Horngren, Datar, Foster, 2003, p. 526) Direct production costs are directly allocated to operating departments and, within them, to particular products. Indirect production costs can be caused by both types of departments – operating and support departments. Indirect costs of support departments need to be allocated to operating departments and, after that, to products as cost objects. Indirect costs of operating departments must be allocated to particular products only.

Accounting theory and practice recognize three methods of allocating the indirect costs of support departments to operating departments:

1. *direct allocation method*
2. *step-down allocation method*
3. *reciprocal allocation method* (Horngren, Datar, Foster, 2003, p.526)

3.1.1. Direct Allocation Method

The *direct allocation method* is the most widely used method of allocating support department costs. This method allocates the costs of support department directly to the operating departments. The basic advantage of this method is its simplicity. This method doesn't require the prediction of the usage of support department services by other support departments. A main disadvantage of the direct method is its failure to recognize reciprocal services provided among support departments. (Horngren, Datar, Foster, 2003, p.96) Because of this disadvantage, the direct method is not considered an accurate and objective method of cost allocation.

3.1.2. Step-Down Allocation Method

The *step-down allocation method* is also called the sequential allocation method. This method allows for partial recognition of the services provided by support departments to other support departments. The application of the step-down allocation method requires the support departments to be sequenced in order for the step-down allocation to proceed. A popular step-down sequence begins with the support department that renders the highest percentage of its total services to other support departments. The sequence continues with the department that renders the next highest percentage, and so on, ending with the support department that renders the lowest percentage. Under the step-down method, once a support department's costs have been allocated, no subsequent support department costs are allocated back to it. (Horngren, Datar, Foster, 2003, p.529) While the step-down allocation method is considered more accurate and objective than the direct method, it does not recognize all of the reciprocal services provided among support departments.

3.1.3. Reciprocal Allocation Method

The *reciprocal allocation method* allocates costs by explicitly including the mutual services provided among all support departments. This method fully incorporates interdepartmental relationships into support department cost allocations. (Horngren, Datar, Foster, 2003, p.529) By using this method, the costs of a support department are allocated to other support and operating departments according to the services provided to those departments. The reciprocal allocation method involves the following three steps:

1. expressing support department costs and support departments' reciprocal relationships in the form of linear equations
2. solving the set of linear equations to obtain the complete reciprocated costs of each support department
3. allocating the complete reciprocated costs of each support department to all other departments (both support departments and operating departments) on the basis of the usage percentages (based on total units of service provided to all departments) (Horngren, Datar, Foster, 2003, p.530)

The reciprocal allocation method is considered the most accurate and objective method. However, the basic disadvantage of this method is its complexity. The reciprocal method is very hard to implement and to apply.

3.2. Accounting Methods for Allocating Indirect Costs from Operating Departments to Cost Objects (Products)

When the indirect costs of support departments are allocated to operating departments, all indirect costs are then allocated from operating departments to particular products that are identified as cost objects. There are three basic accounting methods used in manufacturing companies in order to determine the cost of a particular product:

1. job order costing
2. process costing
3. activity based costing (Lucey , 1996 p. 175)

These accounting methods are also considered costing systems whose main pupose is to determine the cost of a product. The first two costing systems are known as traditional costing systems. While the application of traditional costing systems depends on the type of manufacturing process, activity-based costing systems can be applied regardless of the type of manufacturing process. The main issue for companies is: when is it convenient to use traditional costing systems, and when should activity-based costing system be applied? To answer this question the operating conditions and the manufacturing cost structure should be considered. (Perčević, 2006)

3.2.1. Traditional Costing Systems

The basic distinction between job costing and process costing systems is in the determination of the cost object. In job costing, the cost object is a job that consists of a unit or multiple units of distinct products or services. In process costing, the cost object is the mass of identical or similar units of a product or service. Therefore, job costing can be applied in manufacturing that is initiated by a customer's order, while process costing can be used in mass production that is continually performing and is not initiated by a customer's order.

Cost allocation is similar to job costing and process costing. In both costing systems, direct manufacturing costs are traced to products or services. These costs are directly assigned to particular products or services that cause their appearance. Direct manufacturing costs include direct material costs and direct labour costs. The main problem of every costing system is indirect manufacturing costs allocation. Because these costs cannot be directly identified with a particular product or service, indirect manufacturing costs need to be allocated to products or services on some reasonable basis that correctly presents the relationship between indirect manufacturing costs and a certain product. This relationship is often very difficult to express by a single allocation base. It is important to emphasise that there is no allocation base that can accurately provide indirect cost allocation to products. The chosen cost allocation base can be more or less objective, but it cannot be 100% accurate. Indirect manufacturing costs are usually assigned to products or services using the following cost allocation bases:

1. direct labour hours
2. machine hours
3. direct material costs
4. total direct costs
5. quantity of production (Engler, 1988, p. 427)

Indirect manufacturing costs are assigned to the cost object by an overhead allocation rate that is computed on the chosen cost allocation base. (Lucey, 1996, p. 88)

$$\text{OAR} = \frac{\text{total in direct manufacturing costs}}{\text{cost allocation base}}$$

Companies can use either one or more overhead allocation rates for assigning indirect manufacturing costs to products or services. It is widely held that the more overhead allocation rates are used the more accurate the cost per unit. In addition, the product profitability evaluation is more reliable and objective for the sake of decision-making.

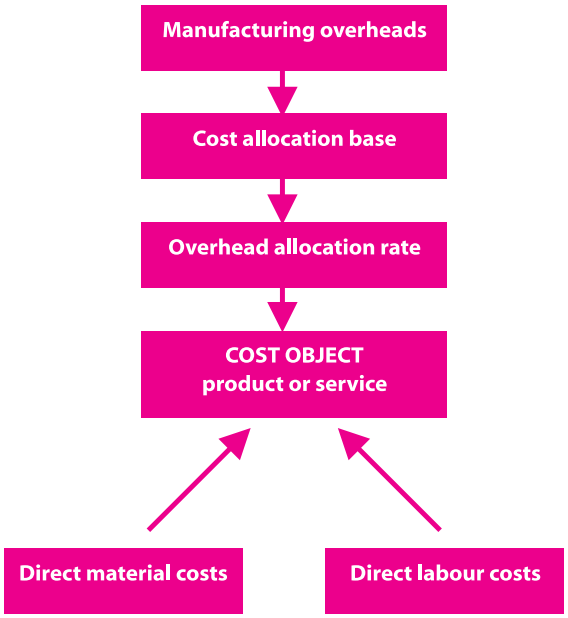


Figure 3. Cost allocation in traditional costing systems

In traditional costing systems, the indirect manufacturing costs are allocated to cost objects on arbitrary bases that could affect product profitability evaluation. The impact of the application of traditional costing systems on product profitability evaluation depends on certain conditions, among which manufacturing cost structure is considered the most important. If indirect manufacturing costs are significant within the total manufacturing costs, the traditional costing system may give a distorted picture of product profitability evaluation. Otherwise, the traditional costing system can provide a relatively objective product profitability evaluation.

3.2.2. Activity-Based Costing System

ABC system was designed to correct the deficiencies of traditional costing systems. The primary purpose of the ABC system is to provide fair and accurate cost allocation, and thus an accurate product profitability evaluation as well. Accordingly, the ABC system focuses attention on indirect manufacturing costs. The aim is to define the most appropriate way for indirect manufacturing cost allocation to cost objects.

The main assumption of the ABC system is that products consume activities and activities consume resources. (Horngren, Datar, Foster, 2003, p.141)

The more activities are set up, the more complex the ABC system. An activity is defined as any event, action,

transaction or work sequence that incurs cost when producing a product or providing a service. (Horngren, Datar, Foster, 2003, p.141)

In the ABC system, direct manufacturing costs are also directly traced to products or services, so most attention is paid to the indirect manufacturing costs that are allocated to activities rather than departments or jobs (as in traditional systems). Basically, the application of the ABC system goes through two main phases. In the first phase, indirect manufacturing costs are allocated to activity cost pools. It is important to determine the correlation between a particular indirect manufacturing cost and an identified activity. Every indirect manufacturing cost must be assigned to the actual activity that incurs it. The second phase in ABC application is assigning indirect manufacturing costs from activity cost pools to products using defined cost drivers. A cost driver is any factor or activity that has a direct cause – effect relationship with the resources consumed. (Weygandt, Kieso, Kimmel, 2005, p. 144) The ABC system uses multiple cost allocation bases to assign indirect manufacturing costs to products or services. The usage of multiple allocation bases can provide a more accurate and objective product profitability evaluation.

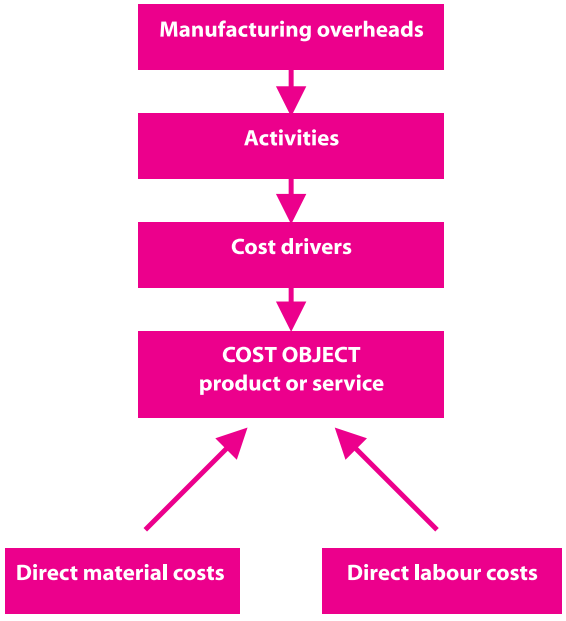


Figure 4. Cost allocation in ABC system

Cost drivers should correctly show the relationship between certain activity and cost objects. Otherwise, even this costing system can lead to product cost distortion and unreliable product profitability evaluation. The ABC system is very complex and takes much more effort and resources to implement than traditional systems. Its application is justified only if the benefits from the ABC system exceed the cost of its implementation. So, when the management of a company decide to implement the ABC system they must be sure that the ABC system will provide more useful cost information for business decision-making than traditional systems.

4. Accounting Methods for Cost Allocation and Production Cost Structure in Croatian Production Companies

The empirical survey conducted in the Croatian production sector attempted to determine production cost structure and accounting methods applied in Croatian production companies. The sample included the most significant Croatian public production companies that take the highest portion of total Croatian production.

4.1. Production Cost Structure Analysis

One of the most important factors that must be considered in choosing a costing system is the manufacturing cost structure. Manufacturing cost structure can be used as a technological development indicator of the national manufacturing sector. The most relevant technological development factor of the national manufacturing sector is the portion of indirect manufacturing costs (manufacturing overheads) in total manufacturing costs. According to the survey, in the majority of Croatian manufacturing companies, the portion of indirect manufacturing costs is below 30%. This indicates the technological underdevelopment of the Croatian manufacturing sector.

In the last five years indirect manufacturing costs have increased in 42,9% of the companies surveyed, yet the increase was not significant. Indirect manufacturing costs have remained at the same level in 31,4% of companies, while 25,7% of companies have recorded a reduction in indirect manufacturing costs. This indirect manufacturing costs movement in the last five years confirms the technological underdevelopment of the Croatian production sector.

The portion of direct labour costs within total production costs is below 20% in the majority of companies. This is in accordance with modern, technologically developed production sectors. However, the main reasons for such a low level of direct labour costs within total production costs are production reduction and hence direct labour reduction, not production process automation (as in developed production sectors). The survey also indicated that in the last five years, 42,9%

of the companies have seen their direct labour costs decrease, yet not significantly. Over the same period, direct labour costs remained at the same level in 28,6% of the companies, while 22,9% of the companies recorded an increase in direct labour costs. The trends in direct labour costs indicate that the Croatian production sector has not enhanced its automation within the last five years and is technologically underdeveloped.

Direct material costs are the most significant cost category in the Croatian production cost structure. The portion of direct material costs within total production costs is between 50 – 80 % in the majority of companies.

The production cost structure of the Croatian production sector is illustrated in this figure:

Figure 5. Production cost structure in Croatian production sector

Direct production costs are dominant within the total production costs in the Croatian production sector. The portion of indirect production costs is below 30%, while in the developed production sector this percentage is above 50%.

4.2. Accounting Methods for Cost Allocation in Croatian Production Companies

Accounting methods for cost allocation in Croatian production companies are connected to the production cost strucure. The application of a certain accounting method mainly depends on the production cost structure.

According to the empirical research results, the majority of Croatian production companies (77%) apply a direct allocation method for allocating costs from support departments to operating departments, while 2% use the step-down method. (Perčević, 2005)

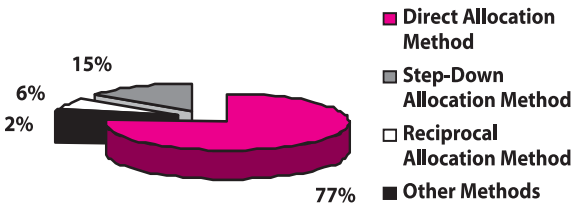


Figure 6. Accounting Methods for Allocating Indirect Costs from Support Departments to Operating Departments

Due to the determined production cost structure, traditional costing systems, such as accounting methods for allocating indirect production costs from operating departments to products, are appropriate costing systems for product profitability evaluation in Croatian production companies. Since indirect production costs are not dominant within the total production costs in the majority of Croatian production companies, the application of traditional costing systems in these circumstances could obtain relatively accurate and objective product profitability evaluation. The empirical survey conducted in the Croatian production sector confirms that traditional costing systems are used in the majority of Croatian companies for product profitability evaluation. (Perčević, 2005)

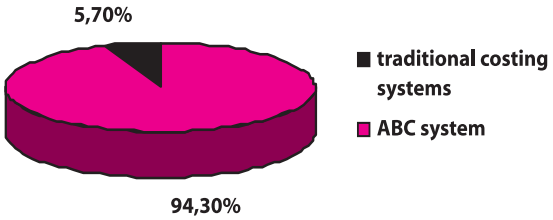


Figure 7. Costing systems applied in the Croatian production sector

According to the empirical survey, only 5,7% of companies in Croatia apply the ABC system, while the other 94,3% of companies use traditional costing systems for product profitability evaluation. It was also determined that the process costing system is applied in 54,3% of those companies that apply traditional costing systems, while 31,4% of the companies used a job order costing system. The rest of the companies that apply traditional costing systems use both traditional costing systems. (Perčević, 2005)

These research results confirm the initial hypotheses. The majority of Croatian production companies use

traditional accounting methods for cost allocation because these methods are appropriate for the technologically underdeveloped production sectors that characterises the high level of direct production costs within the total production cost structure. The research results indicate that direct production costs comprise the highest portion in the production cost structures of the majority of Croatian production companies. Because of such production cost structures, modern cost allocation accounting methods would not give a more reliable company profitability evaluation, nor facilitate business decision-making processes.

5. Conclusion

The cost allocation process is a rather difficult and complicated procedure that requires the application of appropriate accounting methods. The process of allocating costs to cost objects is realized through the application of certain accounting methods. These accounting methods often cannot provide fair and objective cost allocation because they are based on certain cost allocation bases that are arbitrary and not always appropriate for reliable cost allocation. Therefore, accounting theory and practice constantly try to improve upon the existing methods and to develop new ones that could provide fair and objective cost allocation.

One of the most important factors that affect the choice of accounting method is the production cost structure. The reliability of the accounting method for cost allocation significantly depends on the production cost structure. In order to determine which accounting methods for cost allocation are used in Croatian production companies, empirical research was conducted on the most significant Croatian production companies.

The research results of an empirical survey conducted in the Croatian production sector indicate that direct production costs comprise the highest portion within total production costs in Croatian production companies. According to this finding, the Croatian production sector can be considered technologically underdeveloped. In these conditions, traditional accounting methods can provide objective and relatively accurate cost allocation and product profitability evaluation. The results of the empirical survey confirm that traditional accounting methods are used for cost allocation and product profitability evaluation in the majority of Croatian production companies. These research results confirm the initial hypothesises proposed at the beginning of this paper.

References:

Cherington J.O., Hubbard E. D., Luthy D. H. (1985): Cost and Managerial Accounting, WCB Publishers, Dubuque, Iowa

Engler C.(1988): Managerial Accounting, Irwin, Homewood, Illinois

Horngren C. T., Datar S. M., Foster G. (2003): Cost Accounting – A Managerial Emphasis, Prentice Hall, New Jersey

Kaplan R. S., Atkinson A. A. (1989): Advanced Management Accounting, Prentice Hall International, London

Lucey T. (1996): Costing, DP Publications, London

Lucey T. (1996): Management Accounting, Letts Educational, London

Perčević H. (2005): Utjecaj računovodstvenih metoda alokacije troškova proizvodnje na ocjenu profitabilnosti proizvoda, magistarski rad, Ekonomski fakultet Zagreb

Perčević H. (2006): The Impact of Costing Systems on Product Profitability Evaluation, microCAD 2006., International Scientific Conference, University of Miskolc, March 15 – 17, 2006., zbornik radova – section P Economic Challenges

Perčević H. (2005): Accounting Policies on Inventories According to IAS 2 and Their Impact on Financial Results, Babes – Bolyai University of Cluj-Napoca, Faculty of Economics and Business Administration, International Conference "The Impact of European Integration on the National Economy," zbornik radova - Accounting Section, str. 315 – 324, October 2005, Cluj Napoca, Romania

Weygandt J.J., Kieso D.E., Kimmel P.D.(2005): Managerial Accounting, John Wiley & Sons