Managing Global Transitions

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Optimal Exchange Rate and Fiscal Policies for Slovenia on its Way into the Euro Area

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This paper analyzes the design of macroeconomic policies for Slovenia on its way into the Euro Area. We simulate different policy scenarios, distinguishing in particular between different exchange rate regimes. For this purpose, we use the model SLOPOL4, a macroeconometric model for Slovenia. We determine 'optimal' exchange rate and fiscal policies for Slovenia as solutions of optimum control problems with a quadratic objective function and the model SLOPOL4 as a constraint. Several optimization experiments are carried out under different assumptions under a fixed exchange rate, a flexible exchange rate and a crawling peg regime approximating Slovenia's entry into the Euro Area. The sensitivity of the results is examined with respect to several assumptions.

Key Words: optimal control, econometric model, macroeconomic policy, Slovenia, sensitivity analysis.

JEL *Classification:* E5, E6, C5, O5

Introduction

In this paper, we report about an application of optimum control theory to macroeconomic policy design for Slovenia. The OPTCON algorithm is applied to determine solutions for optimum control problems with a quadratic objective function and the non-linear dynamic model SLOPOL4, a macroeconometric model for Slovenia. Optimization experiments are carried out under different assumptions about the exchange rate regime. The results are politically relevant because Slovenia was the first of the Central and Eastern European (CEE) EU member states to enter the Euro Area on January 1, 2007. Indeed, it was an explicit objective of Slovenian policy-makers to introduce the euro as early as possible, and

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Slovenia participated in the exchange rate mechanism ERM-II from June 2004 onwards. This paper analyses whether the decision to participate in the ERM-II so soon after EU accession was a good strategy in terms of macroeconomic performance.

The structure of the paper is as follows: the second section describes the econometric model SLOPOL4. In the third section, we discuss different exchange rate regimes (two of them counterfactual) for the period of Slovenia's preparing to adopt the euro as legal tender. The fourth gives a brief account of the OPTCON algorithm used to derive deterministic and stochastic optimum control solutions. Details about the optimization experiments conducted are given in the fifth section, and the main results of these experiments are summarized in the sixth section. Finally, the seventh section concludes.

The SLOPOL4 Model

For our analysis, we use the SLOPOL4 model of the Slovenian economy. It was originally developed as SMEEM, a combination of a macroeconomic model and an energy system model for carrying out analyses relating to the energy sector. Based on this blueprint, a structural econometric model of the Slovenian economy was built, called SLOPOLi (SLOvenian economic POLicy model, version no. i, with i denoting the version $i = 1, 2, \ldots$). The choice of an econometric model to represent the Slovenian economy and the need to update it continuously are motivated by the fact that major problems typically arise when constructing models of CEE countries due to short and unreliable time series and structural breaks during the transformation period and subsequent catching-up processes.

The version used here, SLOPOL4, is a medium-sized macroeconometric model of the small open economy of Slovenia. It consists of 45 equations: 15 behavioral equations and 30 identities. The former were estimated by ordinary least squares (OLS) using quarterly data for the period 1992:1 (where available; 1994:1 otherwise) to 2001:4. Data for Slovenia were provided by the Slovenian Statistical Office, the Institute of Macroeconomic Analyses and Development (IMAD) and the Bank of Slovenia. Euro Area data were taken from the EUROSTAT database, except for the short-term interest rate in the Euro Area which was extracted from the database of the German Bundesbank.

The model includes behavioral equations for several markets (goods, labor, foreign exchange, money) and various rigidities (wages, prices).

It combines Keynesian and neoclassical elements. The former determine the short and medium run solutions in the sense that the model is demand driven and persistent disequilibria in the goods and labor markets are possible. The supply side incorporates neoclassical features. Most of the behavioral equations contain lagged dependent variables, reflecting adaptive expectations and costs of adjustment. In this section, the behavioral equations are sketched very briefly. For more details, see Neck, Weyerstrass, and Haber (2004); a more detailed description of an earlier version of the model can be found in Weyerstrass, Haber and Neck (2001).

The consumption of private households is explained by a simple Keynesian consumption function, depending on current disposable income and on lagged consumption (in accordance with the habit persistence hypothesis). Capital formation is derived from the profit maximization of firms. Real gross fixed investment is influenced by the change in total domestic demand (an accelerator hypothesis), the user cost of capital approximated by the real interest rate and by the capacity utilization rate, i. e. the ratio of actual to potential GDP. Real exports of goods and services are a function of the real exchange rate and of foreign demand for Slovenian goods and services. As the aggregate Euro Area is Slovenia's largest trading partner by far (in 2001, according to balance of payments data, the Euro Area accounted for 60 percent of Slovenian foreign trade), the rest of the world is approximated by the Euro Area. Therefore, foreign demand is measured by Euro Area real GDP, and we only consider the exchange rate between the Slovenian tolar and the euro. Slovenian real imports of goods and services depend on domestic final demand and on the real exchange rate.

Money demand depends on real GDP and the short-term interest rate. The long-term interest rate is linked to the short-term rate in a term structure equation. The exchange rate equation combines elements from the uncovered interest parity and the purchasing power parity theories. Thus, the nominal exchange rate between the Slovenian tolar and the euro depends on the interest differential and the price ratio between Slovenia and the Euro Area.

Labor demand (actual employment) is influenced by final demand for goods and services and by the real gross wage, while labor supply depends on the real net wage and on the size of the population. The wage rate is determined by the price level, by the difference between the actual unemployment rate and a proxy for the natural rate of unemploy-

ment (or the NAIRU), by labor productivity and by the average labor tax rate, which is defined as the difference between the average gross and net wages as a percentage of the gross wage (hence 'labor taxes' include income taxes and social security contributions). Consumer prices depend on domestic and international factors. The former comprise unit labor costs, the capacity utilization rate and the nominal money stock. In addition, Slovenian prices depend on the oil price and on the nominal exchange rate. For Slovenia as a small open economy, import prices are important, and they rise when the domestic currency is devalued (equaling an increase in the exchange rate).

Total government expenditures are linked to government consumption and to transfer payments to households; total government revenues are linked to labor tax revenues. The budget deficit is given by the difference between total government expenditures and revenues. Potential output, which is determined by a Cobb-Douglas production function with constant returns to scale, depends on trend employment, the capital stock, and autonomous technical progress. Trend employment is defined as the labor force minus natural unemployment. The NAIRU is approximated by a four-quarter moving average of the actual unemployment rate.

Exchange Rate Regimes

When setting up the optimization experiments, we consider three scenarios simulated over the period 2004 to 2009 according to the different exchange rate regimes assumed during the phase of transition into the European Economic and Monetary Union. The baseline scenarios were generated by simulating the model, using historical values of all exogenous variables including the control variables as inputs. Although baseline simulations were carried out over the period 2004 to 2009 for each exchange rate regime, the different exchange rate regimes were assumed to hold for 2004–2006 only, because in 2007 Europe's common currency, the euro, was introduced in Slovenia. Exchange rate regimes were set up as (1) fixed exchange rates (unilateral peg), (2) flexible exchange rates (free floating) and (3) a crawling peg with a decreasing rate of depreciation (2004: 1.5 percent; afterwards −0.5 percentage points per year). For the period 2007 to 2009, after the euro had been introduced, completely fixed exchange rates were modeled for each scenario. Table 1 summarizes these scenarios.

TABLE 1 Exchange rate regime scenarios

2004–2006	Fixed exchange rates
	Flexible exchange rates
	Crawling peg
2007–2009	EURO

For the purpose of simulating these three scenarios, historical values or (where not available) forecasts of the exogenous and the control variables over the simulation period were taken and used as inputs into the model to obtain forecast values for the endogenous variables. We used more or less plausible values for these variables; for example, we assumed a slowly decreasing short-term rate of interest, constant growth rates of Euro Area variables and Slovenian government expenditures, a constant labor tax rate, etc. This exercise can be regarded as simulating 'business as usual,' i. e. the continuation of previous trends, in particular for the policy instruments, but under different exchange rate regimes.

In order to explore the implications of the exchange rate system during the preparation period for adopting the euro, a regime of completely flexible exchange rates is compared to the crawling peg regime and to a regime of completely fixed exchange rates which may be interpreted as early introduction of the euro or as mimicry of Slovenia's membership in the ERM of the EMS-II until 2006. For the optimization runs with fixed exchange rates, the Slovenian tolar was fixed at the actual conversion rate of the tolar to the euro. In the flexible exchange rate scenario, the short-term rate of interest is available as an active monetary policy instrument for internal stabilization purposes. In the other regimes, the interest rate and hence monetary policy have to be adjusted to stabilize the exchange rate or are directly determined by European developments in financial markets and can therefore not be considered as an active policy instrument.

The simulations under the three different assumptions about the exchange rate regime result in smooth time paths for the endogenous variables, with decreasing unemployment and increasing current account surplus and government budget deficit. The behavior of money supply and the price level depends on the exchange rate regime. Government consumption and transfers grow in parallel to each other. These simulation experiments can be regarded as benchmarks for the optimization experiments to be described in the fifth section.

The OPTCON Algorithm

We want to calculate time paths of macroeconomic policy instruments that are 'optimal' according to an objective function of a hypothetical policy-maker for Slovenia. Many theoretical (e. g. Petit 1990) and empirical (e. g. Chow 1981) studies have been carried out using optimum control theory to obtain recommendations concerning monetary or exchange rate and fiscal policies for stabilization purposes. To obtain optimal economic policies for our model, we apply the OPTCON algorithm, which was developed by Matulka and Neck (1992). OPTCON determines approximate solutions of optimum control problems with a quadratic objective function and a nonlinear multivariable model.

The objective function has to be quadratic in the deviations of the state and control variables from their desired values. It has the following form:

$$L = \frac{1}{2} \sum_{t=1}^{T} \begin{bmatrix} x_t - \tilde{x}_t \\ u_t - \tilde{u}_t \end{bmatrix} W_t \begin{bmatrix} x_t - \tilde{x}_t \\ u_t - \tilde{u}_t \end{bmatrix}, \tag{1}$$

$$W_t = a^{t-1} W, \ t = 1, 2, \ldots, T, \tag{2}$$

where x_t denotes the vector of state variables, u_t denotes the vector of control variables, $\tilde{x}_t$ and $\tilde{u}_t$ are the desired values of the state and control variables, W_t is the matrix containing the weights given to the deviations of the state and control variables from their desired values respectively, and α denotes the discount factor. The dynamic system has to be given in a state space representation. OPTCON can solve both deterministic and stochastic optimum control problems.

OPTCON starts by approximating a deterministic solution of the nonlinear dynamic system. Then, the nonlinear system is optimized. This is done iteratively, starting with the previously calculated approximation, by running a backward recursion and applying Bellman's principle of optimality in order to obtain the parameters of a policy feedback rule. Afterwards, a forward projection (simulation) of the model is performed.

Optimization Experiments

In this paper, five 'main' and several 'minor' objectives are considered. The 'main' objective variables cover the most important macroeconomic challenges Slovenian policy-makers are confronted with. With respect to the Slovenian participation in the EU, catching up with incumbent EU members in terms of per-capita GDP was of great importance during the

adjustment period. In addition, reducing the rate of unemployment and the rate of inflation were obvious goals over the years under consideration. These objectives ought to be reached with a balanced government budget and external equilibrium. For the optimization experiments, a desired real GDP growth rate of 4.5 percent p. a. is assumed. Optimizations are carried out for the period 2004 to 2009, but the final year is ignored to avoid terminal point effects; hence, the period of interest is 2004 to 2008. The desired rate of unemployment is assumed to be reduced by one percentage point per year from 9 percent in 2003 to 4 percent in 2008. The desired rate of inflation declines gradually from 6 percent in 2003 to 2 percent in 2008. It is assumed that the aim is to balance the government budget and the current account (both in percent of nominal GDP).

As 'minor' objective variables, real GDP and its components (consumption of households, investment, government consumption, exports and imports) are considered. For these variables, ideal values are specified consistent with the desired 4.5 percent growth rate of real GDP. The introduction of 'minor' objective variables reflects the policy-makers' aim of obtaining smooth paths for the main macroeconomic aggregates, but also serves as a substitute for introducing inequality constraints on state variables, which is not feasible in OPTCON. In addition, the policy instrument (control) variables are regarded as minor objective variables to reflect costs to the policy-makers of changing instruments, but also due to formal requirements of the OPTCON algorithm and in order to prevent erratic fluctuations.

In the weight matrix of the objective function, all off-diagonal elements are set to zero. In addition, all endogenous variables of the model which are not mentioned are given the weight zero, implying that they are not of direct relevance to policy-makers. The 'main' variables are assigned the weight 10,000, while the 'minor' objective variables are given a weight of 1, except for the control variables, which get weights of 1,000 for the short-term interest rate, 10 for the tax rate and 10 for the others. These weights reflect both the relative importance of the 'main' and 'minor' objective variables and their different orders of magnitude. The discount rate is set as 1, implying equal weights for all periods. This was set in view of the relatively short time horizon of the optimizations.

In the optimization experiments, we once again distinguish between the three exchange rate regimes as discussed in the third section. Therefore, we have one scenario with the short-term rate of interest as a policy instrument (the flexible exchange rate case) and two scenarios without

this instrument of monetary policy. The standard economic policy variables are used as instruments: public consumption, transfers, the labor tax 'wedge' (i. e. the difference between the average gross and net wages as a percentage of the gross wage) and the interest rate (partly – depending on the monetary regime).

Results of the Optimization Experiments

In this section, we briefly describe some results of the optimization experiments. Table 2 displays the time paths of key macroeconomic variables under the scenarios of a flexible exchange rate (FLEX), a fixed exchange rate (FIX) and a crawling peg (CRAWL). All values of the variables shown are deviations from the corresponding simulation time paths (baseline solutions) in order to show the potential of the optimum control approach for each of the possible scenarios. Although the model is a quarterly one, the results are converted to annual data for all experiments in order to avoid showing seasonal influences, which may hide the main insights to be gained from the exercise. We first show the main results of the deterministic control problems. Here no stochastic elements are taken into consideration.

Although the development of the Slovenian economy already looks favorable in the simulation with historical values for exogenous and control variables, it can be improved still further under an optimal policy. In particular, the optimization experiments call for an investment in the inflation-unemployment trade-off: fiscal policies should first be applied in a restrictive way, reducing inflation and the budget deficit at the cost of lower growth and higher unemployment during the first few years. Afterwards, it may turn towards a more expansionary path (although still less so than in the baseline simulation), thereby gradually leading the economy to higher real growth rates, lower unemployment and slightly higher inflation, all compared to the baseline values. The reduction in the budget deficit reduces the rate of interest, especially at the beginning of the optimization period. The current account is activated, both by lower import demand due to the lower domestic inflation rate and lower aggregate demand and by higher exports, again caused by the lower price level. The Slovenian tolar appreciates in nominal terms (except in the fixed-exchange rate scenario) but depreciates (except in the first period) in real terms due to the lower inflation rate (all relative to the baseline solution).

In previous work, the sensitivity of optimum control results for Slove-

TABLE 2 Time paths of key macroeconomic variables

Scenario	2004	2005	2006	2007	2008	2009
Unemployment rate (percentage points)						
FLEX	0.093	0.113	0.103	0.093	0.082	0.072
FIX	0.088	0.108	0.080	0.058	0.043	0.031
CRAWL	0.074	0.109	0.097	0.082	0.076	0.063
Real GDP growth rate (percentage points)						
FLEX	−0.478	0.198	0.073	0.091	0.094	0.111
FIX	−0.431	−0.001	0.411	0.190	0.164	0.157
CRAWL	−0.475	0.103	0.225	0.116	0.113	0.110
Inflation rate (percentage points)						
FLEX	−0.170	−0.197	0.071	−0.010	0.026	0.039
FIX	−0.160	−0.063	0.051	0.051	0.062	0.070
CRAWL	−0.188	−0.133	0.053	0.019	0.048	0.071
Budget deficit (percentage points of GDP)						
FLEX	−0.761	−0.772	−0.664	−0.548	−0.406	−0.232
FIX	−1.663	−1.818	−1.368	−1.038	−0.622	−0.118
CRAWL	−1.516	−1.075	−0.885	−0.648	−0.667	−0.140

nia with respect to variations in the objective function, the vector of the control variables and the discount rate has been thoroughly examined. The main conclusion from these calculations was that a higher weight of the main objectives generally leads to more active optimal economic policies without much loss of stability (Weyerstrass and Neck 2002). A shorter time horizon, on the other hand, produces less expansionary policies at the beginning and more expansionary activity at the end of the optimization horizon. Reducing labor taxes improves the results, significantly so in the case of employment, as compared to a setting without this policy instrument. Flexible exchange rates are generally an advantage as they allow monetary policy to be used as an additional instrument to influence domestic policy objectives but the loss of this instrument (as actually occurred due to Slovenia's participation in the European Monetary System ERM-II and finally in the Euro Area) results in only a minor deterioration in the country's macroeconomic performance. These results also hold under the present setup. Therefore, they are not shown here in detail.

TABLE 2 *Continued from the previous page*

Scenario	2004	2005	2006	2007	2008	2009
Current account (percentage points of GDP)						
FLEX	−0.058	0.196	0.150	0.125	0.076	0.014
FIX	0.273	0.354	0.185	0.028	−0.125	−0.281
CRAWL	0.104	0.313	0.158	0.079	−0.025	−0.124
Nominal exchange rate (percent)						
FLEX	−0.40	−0.13	−0.18	−0.17	−0.16	−0.14
CRAWL	−0.17	−0.06	−0.09	−0.10	−0.07	−0.07
Real exchange rate (percent)						
FLEX	−0.24	0.22	0.10	0.13	0.11	0.09
FIX	0.15	0.21	0.16	0.11	0.05	−0.02
CRAWL	−0.05	0.27	0.15	0.16	0.06	0.04
Real long–term interest rate (percentage points)						
FLEX	0.059	0.012	−0.249	−0.165	−0.177	−0.145
FIX	−0.768	−1.263	−1.082	−0.758	−0.376	0.061
CRAWL	−0.317	−0.614	−0.703	−0.414	−0.245	−0.048

It should be mentioned, however, that our result of only minor negative macroeconomic effects (if at all) of the loss of monetary sovereignty due to Slovenia's membership in the Euro Area was corroborated by a study using ex post data and applying a slightly different methodology. If the impact of Euro Area integration on the supply side of the Slovenian economy is taken into account more explicitly, we even obtain gains in terms of macroeconomic performance (Weyerstrass and Neck 2008). Similar results are obtained from simulations of econometric models for Serbia and Bosnia and Herzegovina and from simulation and optimization experiments with a global macroeconometric model (see Neck 2011 for an overview). Hence, we expect that entering the Euro Area will benefit other EU member states, too, provided the Eurozone preserves its stability under the conditions of the recent crisis.

With OPTCON, it is possible to deal with stochastic parameters (in addition to additive stochastic error terms in the model equations, which are of less interest) when calculating optimal policies. To study the sensitivity of the optimal policies with respect to the stochastics of the model, we proceed as follows. We introduce stochastic terms either (a) for all parameters in the model ('symmetric case'), or (b) for only some of

the parameters, where the selection of the parameters assumed to be stochastic is random ('asymmetric cases'). To explore how an 'increase' in the amount of uncertainty affects the results of the optimization experiments, we start from the solutions of the deterministic optimization experiments and gradually introduce a rising number of stochastic parameters until the 'symmetric case' is reached. To carry out this task, a fairly large number of stochastic optimization experiments were performed (for more details, see Neck, Haber and Weyerstrass 2010). It turns out that in the symmetric case, the maximum deviation of the values of the calculated variables from their deterministic counterparts is much smaller than if only a small number of stochastic terms are introduced. Increasing the number of stochastic terms (switching to a 'more symmetric' setup) thus reduces these deviations and drives the stochastic optimum control solution towards the corresponding deterministic one. This result is similar to the ones obtained by systematically varying the stochastic nature of the parameters of another model (Neck and Karbuz 2000). It may be interpreted to mean that the results of stochastic optimizations can be misleading if they only take a very restricted amount of uncertainty into account, assuming that the deterministic optimal solution comes close to the 'true' optimum. Whether the latter assumption is true, however, has to be examined by further studies.

Conclusions

In this paper, we have shown how optimum control theory can be used to obtain insights into the design of economic policy decisions for a country on its way into the Euro Area. We used the OPTCON algorithm and SLOPOL4, a medium-sized structural macroeconometric model of the Slovenian economy. Assuming that over the optimization horizon of 2004 to 2009, Slovenian policy-makers aimed at high GDP growth rates, low rates of inflation and unemployment, balanced budgets and balanced current accounts, we investigated the effects of different assumptions about the exchange rate regime and other elements of the optimization context on optimal policies and on the objective variables. It turned out that the differences between the exchange rate regimes are relatively small and the loss of the monetary policy instrument resulting from adopting a fixed exchange rate regime can be compensated for by adjusting the fiscal policy instruments, which can secure high GDP growth, decreasing unemployment and low inflation without endangering the aim of an almost balanced budget. Next, a sensitivity analysis was

conducted with respect to some basic elements of the objective function and to the stochastic nature of the parameters. With respect to variations in the objective function, deterministic optimizations turned out to be quite robust. On the other hand, the results may be significantly altered by introducing (asymmetric) uncertainty, while increasing the number of stochastic parameters in the model generally leads to lower deviations of the stochastic results from the deterministic case.

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Economics and Mathematical Theory of Games

Ajda Fošner

The theory of games is a branch of applied mathematics that is used in economics, management, and other social sciences. Moreover, it is used also in military science, political science, international relations, computer science, evolutionary biology, and ecology. It is a field of mathematics in which games are studied. The aim of this article is to present matrix games and the game theory. After the introduction, we will explain the methodology and give some examples. We will show applications of the game theory in economics. We will discuss about advantages and potential disadvantages that may occur in the described techniques. At the end, we will represent the results of our research and its interpretation.

Key Words: the theory of games, matrix games, economics
JEL *Classification:* C7

Introduction

We all know a lot of different games that are played for relaxation or a financial gain. There are also a lot of people (young and old) that are playing games every day. Some of these games (roulette, for example) involve no skills and are purely games of chance. We will not be interested in this kind of games. However, on the other side there are games (chess, for example) that are entirely games of skills. Moreover, there are also games (football, for example) that involve both, chance and strategy. Finally, there are so called *games of strategy and conflict.* They involve choices of alternative strategies, conflicting interests of the players, and payoff to the players. Playing the stock market, developing real estate, conducting a business against competitors – these are examples of such games. Actually, these and other similar activities would not ordinarily be thought of as games but they are games in the sense that we have just described.

The game theory started to develop in 1944 with the book *Theory of Games and Economics Behavior,* written by John von Neumann and Oscar Morgenstern. This book was a major step in the use of mathematical analyses to solve some problems in the modern society. In 1970s the theory of games was applied to biology. Nowadays, the game theory is an

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TABLE 1 Price decision

	C_2: raise	C_2: no change	C_2: lower
C_1: raise	0	−10	−50
C_1: no change	3	0	−10
C_1: lower	50	3	0

important tool in many fields. Until now, eight game theorists have won the Nobel Memorial Prize in Economics Science. Let us also mention that John Maynard Smith was awarded the Crafoord Prize for applications of the game theory to biology.

Usually we speak of a game as a process of interaction that involves individuals (two or more). Game is a subject of some fixed rules and has a specified collection of payoffs according to every possible outcome. As we already mentioned, there are games that are played for relaxation. On the other hand, there are games that are studied by the scientists. These games may be far from amusing, as it is illustrated by the following examples.

The first example is actually an example of a game, which we can be found in economics.

EXAMPLE 1

Suppose that a specific product is manufactured only by two companies, the company C_1 and the company C_2. Of course, they are in competition for the entire market. We also know that the first company C_1 is the larger company and it has a larger share of the market. Every January both companies have to decide whether to raise, lower, or not change the price for the product. In table 1, the gains and losses (in millions of euros) for the first company corresponding to the various possible pairs of decisions are represented.

The natural question here is: What decision should the first company make according to the table 1? This is the point, where we can use the theory of games and mathematical analyses to solve the problem.

The next example is so called *battle of the sexes.*

EXAMPLE 2

Mary and George decided to go out on a date this evening. Of course, they have to decide where to meet and what to do together. They have two possibilities: they can meet in the center of the city and go to the cinema, or they can go dancing to the nearby dancing club. Mary likes

TABLE 2   Battle of the sexes

	G: dancing	G: cinema
M: dancing	M: 3 G: 2	M: 1 G: 1
M: cinema	M: 0 G: 0	M: 2 G: 3
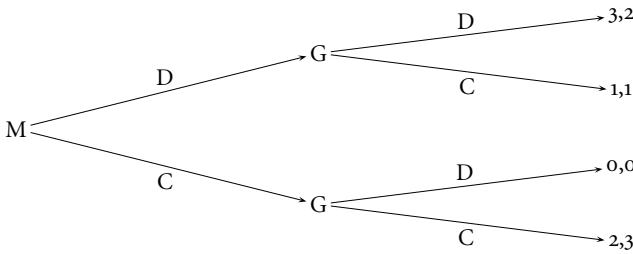
FIGURE 1   Battle of the sexes

to dance and she would prefer to go to the dancing club. On the other hand, George would like to go to the cinema. In any case, they both prefer doing something together than canceling the date.

The payoffs of this game are represented in table 2. The numbers quantify the utilities obtained by Mary and George for each combination (the first number is for Mary and the second one for George). We can present the outcomes of the battle of the sexes also with a graph (figure 1).

Here, each vertex represents a point of choice for a player (M – Mary, G – George). The lines out of the vertex show a possible action for that player (D – dancing, C – cinema). The payoffs are specified at the end of the graph (Vega-Redondo 2003).

More examples can be found in (Mizrahi and Sullivan 1993), (Khoury and Parsons 1981), and (Brown and Brown 1977).

Methodology and Examples

The mathematical theory of games deals with the situations in which two or more persons with conflict interests are involved. The outcome of such games depends on some chance, but primarily on skills and intelligence of the participants. In some certain areas of economics, politics, military science, and operations research there are many conflicting situations to which the theory of games can be applied.

In this section, we shall discuss only about two-person games (primarily zero-sum two person games) because of the difficulties that arise in

the mathematical theory of n-person games. We will also assume that the players play as well as it is possible.

First, we will introduce the matrix game played by two players. Let G be a $m \times n$ matrix of some real numbers (here are no restrictions: numbers can be positive, negative, or even zero). This matrix is also called the *payoff matrix* of a given matrix game which is played by two persons. One of the players is the row player R and the other player is the column player C.

$$G = \begin{bmatrix} g_{11} & g_{12} & \cdots & g_{1n} \\ g_{21} & g_{22} & \cdots & g_{2n} \\ g_{31} & g_{32} & \cdots & g_{3n} \\ \vdots & \vdots & \ddots & \vdots \\ g_{m1} & g_{m2} & \cdots & g_{mn} \end{bmatrix}. \tag{1}$$

Let us point out that the entries g_{ij} of a matrix G represent the payoff from C to R: numbers g_{ij} are 'wins' for a row player and 'looses' for a column player. Here, of course, a negative win is a loss and a zero win is a draw.

How do we play this game? The row player R chooses a row (the natural number between 1 and m) and the column player C chooses the column (the natural number between 1 and n) of a given matrix G. Then they simultaneously tell their choices. Of course, before that the players must not disclose their choices to each other. The most common way to play this game is that both, the row player and the column player, write their choices secretly on a slip of paper and then they simultaneously expose the written number.

Now, suppose that R chooses row i ($i \leq i \leq m$) and C chooses column j ($1 \leq j \leq n$). Then the number g_{ij} in the matrix G is the chosen number. If $g_{ij} > 0$, then C pays R exactly g_{ij} EUR. On the contrary, if $g_{ij} < O$, then R pays C the amount of $-g_{ij}$ EUR. In the case of $g_{ij} = 0$ no payments are made.

Let us show one simple example of a matrix game.

EXAMPLE 3

$$G = \begin{bmatrix} -1 & 10 \\ 1 & 5 \end{bmatrix}. \tag{2}$$

Suppose that the above matrix represents the payoff matrix of a matrix game. If we look at the numbers in the given matrix, then we see that the row player can win 10 EUR by choosing the first row (this is the best outcome for him). On the other hand, the column player will probably not choose the second column since in that case he will definitely lose at least 5 EUR. However, if he chooses the first column, he can lose just 1 EUR or even win 1 EUR. Thus, if C is intelligent, he will choose the first column. And if the row player concludes this assumption, he will decide to play the second row and win 1 EUR.

Therefore, the result that we conclude is: the row player will play the second row and the column player will choose the first column. Therefore, R will win 1 EUR and C will lose 1 EUR.

From the matrix G, we can easily see that the row player will always win if he chooses the second row. On the other hand, he can lose, if he tries with the first row. Hence, the row player can guarantee that he will always win at least 1 EUR by choosing the second row and the column player can guarantee by playing the first column that he will get no more than that.

We can say that there is a sort of equilibrium in this game and the value 1 EUR represents and illustrates the so called *rationality assumption.* We assume that we should choose our strategy in such a way that the worst thing that could happen to us is as good as possible. Therefore, in this kind of games the rational assumption is that we expect to win only what we can guarantee for ourselves.

STRATEGIES IN MATRIX GAMES

If the row player of a matrix game G chooses row i, $1 \leq i \leq m$, the worst thing that can happen is that he would win (or lose, if the entry is negative) the least entry in the chosen row. Thus, he would choose the row whose least entry is as big as possible. In other words, he would play any row whose least entry has the value

$$\max_{1 \leq i \leq m}(\min_{1 \leq j \leq n} g_{ij}). \qquad (3)$$

This is called *the maximin strategy.*

Similarly, if the column player of a matrix game G chooses row j, $1 \leq j \leq n$, the worst thing that can happen is that he loses the largest entry in the chosen column. Therefore, if the column player tries to make his outcome as good as possible, he will choose the column whose largest entry is as small as possible. That entry has the value

TABLE 3   Maximin strategy and minimax strategy

					Row minima
	0	3	1	4	0
	3	−2	4	−1	−2
	3	−3	2	−2	−3
Column maxima	3	3	4	4	

$$\min_{1 \le j \le n}(\max_{1 \le i \le m} g_{ij}). \tag{4}$$

This is *the minimax strategy.*

In the Example 3, the maximum of the row minima is 1 and also the minimum of the column maxima is 1. This value is in the second row and first column ($g_{21} = 1$). Thus, maximin strategy for the row player is to play the second row and the minimax strategy for the column player is to play the first column.

In the above example, the maximin value is equal to the minimax value. The following example of a matrix game will show that this is not always true.

EXAMPLE 4

Let us consider a matrix game with the payoff matrix.

$$G = \begin{bmatrix} 0 & 3 & 1 & 4 \\ 3 & -2 & 4 & -1 \\ 3 & -3 & 2 & -2 \end{bmatrix}. \tag{5}$$

Table 3 will help us to calculate maximin and minimax values.

Now we can easily calculate that the maximin value is equal to 0 and the minimax value is 3. Therefore, the maximin strategy for the row player is to play the first row and the minimax strategy for the column player is to play the first or the second column. This means that the column player has two possibilities: he can choose either column 1 or column 2. Nevertheless, the most important here is that the maximin value is not equal to the minimax value.

If the row player plays the first row, he will not do worse than gain nothing. On the other hand, if the column player plays either the first or the second column, he will not do worse than lose 3 EUR. This means that if the row player chooses the first row and the column player plays the first column, then both players gain nothing. On the other hand,

if the row player chooses the first row and the column player plays the second column, then the row player win 3 EUR.

Let us also mention that one of the players has to do better than lose on any given play. This points out that the maximin and minimax strategies are generally too cautious. Moreover, this game is unstable. In other words, if one of the players insists on always playing a particular strategy, then the other player can take the advantage of this fact. For example, if the row player decides to play the first row all the time, then (after a few plays) the column player will always choose the first column. Thus, both players will gain nothing. However, if the player *R* notices that *C* is always playing the first column, then the row player will switch to the second row. Thus, *R* will win 3 EUR. Nevertheless, after a few plays *C* will switch to column 2 and start taking 2 EUR from the row player. Furthermore, when the row player notices that *C* always plays column 2, he will start to choose row 1. Therefore, we are back at the beginning. This shows that no one strategy is good for either player if this game is played many times.

In the last few decades, a lot of mathematicians have been studied matrix games and the game theory. They have done a tremendous work at this field. Let us just mention the recent result of Akain, Gaubert, and Guterman (2011). They showed that several decision problems originating from max-plus or tropical convexity are equivalent to mean payoff (zero-sum, two players) game problems.

The following problems are basic in max-plus or tropical algebra. The problems are taken from Akain, Gaubert, and Guterman (2011). See also Akain, Gaubert, and Guterman (2010).

PROBLEM 1

Given $m \times n$ matrices $A = (A_{ij})$ and $B = (B_{ij})$ with entries in $\mathbb{R} \cup \{-\infty\}$, does there exist a vector $x \in (\mathbb{R} \cup \{-\infty\})^n$ non-identically $-\infty$ such that the inequality $Ax \leq Bx$ holds in the tropical sense, i. e.,

$$\max_{1 \leq j \leq n}(A_{ij} + x_j) \leq \max_{1 \leq j \leq n}(B_{ij} + x_j) \tag{6}$$

for every $i \cup \{1, 2, \ldots, m\}$?

PROBLEM 2

Given $m \times n$ matrices $A = (A_{ij})$ and $B = (B_{ij})$ with entries in $\mathbb{R} \cup \{-\infty\}$, and two vectors c, d of dimension n with entries in $\mathbb{R} \cup \{-\infty\}$, does there

exist a vector $x \in (\mathbb{R} \cup \{-\infty\})^n$ such that the inequality $Ax + c \leq Bx + d$ holds in the tropical sense, i. e.,

$$\max(\max_{1 \leq j \leq n}(A_{ij} + x_j), c_i) \leq \max(\max_{1 \leq j \leq n}(B_{ij} + x_j), d_i) \qquad (7)$$

for every $i \cup \{1, 2, \ldots, m\}$?

PROBLEM 3

Given $m \geq n$ and an $m \times n$ matrix $A = (A_{ij})$ with entries in $\mathbb{R} \cup \{-\infty\}$, are the columns of A tropically linearly dependent? For example, can we find scalars $x_1, x_2, \ldots, x_n \in \mathbb{R} \cup \{-\infty\}$, not all equal to $-\infty$, such that the equation $Ax = 0$ holds in the tropical sense, meaning that for every value of $i \cup \{1, 2, \ldots, m\}$, when evaluating the expression

$$\max_{1 \leq j \leq n}(A_{ij} + x_j) \qquad (8)$$

the maximum is attained by at least two values of j?

Akain, Gaubert, and (Guterman 2011) proved that the first problem is equivalent to the existence of a winning initial state for a mean payoff game problem. The second problem can be transformed in linear time to the problem of knowing whether a prescribed initial state of a mean payoff game is winning, and vice versa. Moreover, the third problem can be transformed in quadratic time to the problem of the existence of a winning initial state in a mean payoff game.

Using the Game Theory in Economics

As we already mentioned, economics is one of the major fields where the game theory is used. Bargaining, fair division, social network formation, and voting systems auctions are just some of the economics phenomena, which are analyzed with the use of a game theory. Note also that the payoff of the game represents the utility of individual players and in modeling situations this is money. In other words, money corresponds to the individual's utility. However, here we have to be careful because this assumption can be faulty (Vega-Redondo 2003).

Scientists usually focus in their research on the sets of strategies, which are known as equilibrium in games. The most famous is the *Nash equilibrium.* A set of strategies is the Nash equilibrium if no player can do better by unilaterally changing his strategy. In other words, the Nash equilibrium is a concept of a game in which each player is assumed to know the strategies of the other players and no player has anything to gain by changing only his own strategy unilaterally. For example, David and John

are in the Nash equilibrium if David is making the best decision taking into account John's decision and John is making the best decision taking into account David's decision. Let us point out that this does not necessary mean the best payoff for David and John. Usually players might improve their payoff, if they choose another strategy.

When analyzing some specific game, scientists usually start by presenting a game. This game is an abstraction of an economic situation. Then some solution concepts are chosen. At the end, the researchers illustrate which strategy sets are the equilibrium of the appropriate type. Here we can use either a *descriptive analyses* or a *prescriptive, normative analyses.* Some researchers believe that by finding the equilibrium of a studied game they can predict how actually human population will behave when they are in the situations analogous to the game. This is a descriptive way of analyses. Nevertheless, in normative analyses scientists see a game theory as a suggestion for how people ought to behave in a specific situation and not as a predictive tool for the behavior of human beings.

In the following, we will present a fundamental problem in the game theory, the so called *prisoner's dilemma,* which demonstrates why two people might not cooperate even if it is in both their best interests to do so.

In the prisoner's dilemma, two players can choose either cooperative or defective move. If both players cooperate then they both gain, but if one of the players defects, then he will gain more and the other, who cooperates, will gain less. And finally, if both players defect, both gain little.

Example 5

A classical example of the prisoner's dilemma is presented as follows: Two criminals (say, P_1 and P_2) are arrested under the suspicion that they have committed a crime. However, the police do not have enough proofs to convict the suspects. Thus, the police separate both prisoners and visit each of them to offer the same deal: the one who offers evidence against the other one will be freed.

If both prisoners remain silent, then both are sentenced to only four months in jail. In fact, they are cooperating against the police and they both gain. However, if one of them betrays the other one and the other remains silent, the betrayer goes free (he gains more) and the other one will be punished with six-year sentence. If both prisoners betray, both will be punished (two years in jail), but less than if one of them refused

TABLE 4   The prisoner's dilemma

	P_2: silent	P_2: betrays
P_1: silent	P_1: 4 months P_2: 4 months	P_1: 6 years P_2: goes free
P_1: betrays	P_1: goes free P_2: 6 years	P_1: 2 years P_2: 2 years

TABLE 5   An example of the prisoner's dilemma

	B: cooperates	B: defects
A: cooperates	A: 5 points B: 5 points	A: –10 points B: 10 points
A: defects	A: 10 points B: –10 points	A: 0 points B: 0 points

to talk. The dilemma resides in the fact that each prisoner has a choice between only two options, but cannot make a good decision without knowing what the other one will do (table 4).

Therefore, the question is: how should the prisoners act?

In the next example, we will present the prisoner's dilemma between two players which can be applied to everyday life.

EXAMPLE 6

In many situations the kind of distribution of losses and gains, that we have described in the above example, seems natural. For simplicity, we might consider the prisoner's dilemma as follows: if both players defect, then they both get 0 points. If only one defects, he will get 10 points and the cooperator 10 points. Finally, if both players cooperate, then each of them gets 5 points. Of course, there would always be a temptation to defect, since the gain for mutual cooperation is only 5 points and the gain for one-sided defection is 10 points (table 5).

The problem in the prisoner's dilemma is that if both players were purely rational, they would never cooperate, since the rational decision means that you make the decision, which is best for you whatever the other actor chooses. Hence, if both decision makers are rational, both will decide to defect and none of them will gain anything. However, if both would cooperate, both would gain. This paradox is formulated more explicitly through so-called *principle of suboptimization:* optimizing the outcome for a subsystem will in general not optimize the outcome for the system as a whole (the whole is more than the sum of its

TABLE 6 The prisoner's dilemma in the advertising

	F_2: advertising	F_2: no advertising
F_1: advertising	F_1: loses F_2: loses	F_1: benefits greatly F_2: loses much
F_1: no advertising	F_1: loses much F_2: benefits greatly	F_1: benefits F_2: benefits

parts). We will continue with the example of the prisoner's dilemma in the advertising.

EXAMPLE 7

At the beginning, let us mention that the advertising is sometimes called a real life example of the prisoner's dilemma.

Suppose that two competitive firms in Slovenia (we will denote them by F_1 and F_2) have to decide how much money they will spend on the advertising. The profit derived from the advertising for the firm F_1 is, of course, partially determined by the advertising made by the firm F_2. Similarly, the effectiveness of the firm F_2's advertising depends on the advertising conducted by the firm F_1. If both, the firm F_1 and the firm F_2, choose to advertise receipts remain constant and the expenses increase due to the cost of the advertising. Both firms would benefit if they both decide not to advertise. However, if one of the firms chooses not to advertise, the others could benefit greatly by the advertising (table 6). More about the prisoner's dilemma you can read in Heylighen (1992; 1995).

Conclusion

The game theory is a branch of mathematics that deals with the analyses of situations involving parties with conflicting interests. When dealing with simple games we can represent a complete mathematical solution. On the other hand, we can find principles of the game theory also in complicated games such as chess, cards, and checkers, as well as in real-world problems (in economics, property division, politics, and warfare). The theory of games is actually the theory of social situations. Namely, most researchers in the game theory focus on how groups of people interact: how intelligent individuals interact with one another in a specific situation to achieve their own goals.

In the classical game theory, players move, bet, or strategize simultaneously. In this branch of the game theory both hidden information and chance elements are frequent features.

The theory of games is one of the tools that have been used to study a wide variety of not just human but also animal behavior. It was first developed in economics to explore and understand the behavior of markets, firms, consumers and other economic behaviors. Nowadays the game theory has been applied to political, psychological, and sociological behaviors as well.

As we have already mentioned, the game theory is also used in the study of animal behavior. Note that even Charles Darwin made a few informal game theoretic statements. Later, the development of the game theory in economics was applied to biology.

Furthermore, the game theory has also been used to develop theories of ethical or normative behavior. In schools, the game theory helps to understand good and proper behavior.

Let us also mention that applications of the theory of games have not been so far reaching as was hoped. Actually considerable difficulties arise in the mathematical theory of n-person games for $n > 2$.

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Adaptive Strategies in Response to the Economic Crisis: A Cross-Cultural Study in Austria and Slovenia

Dietmar Sternad

This study builds on prior research on culture-specific differences in strategic decision-making and strategic issue analysis, and extends it to the field of strategic crisis adaptation. Taking an upper echelons perspective, it is investigated whether the cultural dimension of uncertainty avoidance had an effect on strategic directions that managers chose in response to the 2008–2009 global financial and economic crisis. Building on a framework of strategic crisis responses and a quantitative survey conducted among 257 managers in Austria and Slovenia, the findings suggest that strategic issue interpretations of the economic crisis as well as country differences influence whether firms are using externally versus internally-directed strategic responses, and pro-active versus retrenchment strategies. The differences in strategy deployment between the two countries, however, could not be consistently traced to differences in the cultural dimension of uncertainty avoidance, thus suggesting that other country-specific factors like institutional or social differences also play an important role.

Key Words: adaptation, crisis, uncertainty avoidance, Austria, Slovenia
JEL *Classification:* L10, L20

Introduction

Businesses are influenced by major changes in their environment, those events and developments external to the organization which considerably and structurally affect (a) the attainability of an organization's strategic objectives and/or (b) the strategic choices open to the organization. The financial crisis of 2008–2009 and the subsequent global recession constitute a major environmental change with an impact on a variety of different industries and countries at the same time. All EU countries (with the only exception of Poland) showed a negative real GDP growth rate in the year 2009 (Eurostat 2010), leading to considerable negative demand effects all across the continent, accompanied by

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lower sales revenues, pressure on margins, and a lack of resource availability. In addition, economic crises lead to rising unemployment, credit shortage, more price-sensitive customers, increased competitive rivalry based on price, a significant decline in exports, and a higher level of business failures (Pearce and Michael 2006; Bricongne et al. 2011). Although most businesses are adversely affected by recessions, for management researchers, 'recessions are a godsend [...] they are [...] a natural setting in which to study how firms cope with environmental challenges' (Geroski and Gregg 1994, 1). Despite this, Kitching et al. (2009) noticed a general lack of research focusing on strategic adaptation to major economic downturns.

Upper echelons theory (Hambrick and Mason 1984; Carpenter, Geletkanycz and Sandres 2004; Hambrick 2007; Rost and Osterloh 2010) posits that the strategic choices that organizations make – and thus also decisions on how to strategically adapt to major economic crises – are considerably influenced by the characteristics of their top executives, specifically also by their cognitive base and values. These influences can be direct – when managers act upon their individual preferences – or indirect, when values affect executives' perceptions which are subsequently shaping managerial action (Hambrick and Brandon 1988). Managers' cognitive bases and values, in turn, can be influenced by the national cultures in which they were socialized (Brockner 2003; Dickson, BeShears and Gupta 2004).

Several authors (for instance Schneider 1989; Haiss 1990; Ross 1999) support the argument that strategic decision-making can be influenced by national culture. Barr and Glynn (2004) found that cultural differences could have an influence on strategy, however, only at the level of specific cultural dimensions, thereby concluding that strategy research should take these fine-grained differences into account. Following this advice, the aim of this paper is to explore whether the difference in one dimension of national culture, uncertainty avoidance, has an influence on strategic action as the output of the strategic adaptation process when companies are faced with a major economic crisis.

In an empirical study, it was investigated how managers in two European countries (Austria and Slovenia) perceived and interpreted the global financial and economic crisis of the years 2008–2009, and how their organizations strategically reacted to this external event.

The findings of this paper contribute a cross-cultural perspective to the literature on strategic adaptation; thereby following Sminia's (2009)

call for research that focuses on the links between a firm's environment and strategy-making processes, Elbanna's (2006) demand for more research on the role of national context in strategic decision-making processes, and Hambrick's (2007) urge for more studies on upper echelons effects in different national contexts.

Strategic Adaptation to Environmental Change

An adaptive perspective of the environment-organization relationship assumes that organizations actively adapt to changes within their environment through taking and implementing decisions which are altering their strategy, structure, and processes (Frishammar 2006).

The term adaptation is so widely used in the strategic and organizational literature that Starbuck (1965, 468) noted that 'one could legitimately discuss all the aspects of organizations which are relevant to adaptation, which means, in turn, that one could legitimately discuss everything that has been written about organizations.' It is therefore necessary to define what is meant by 'adaptation.' In Chakravarthy's (1982) terms, I take a *process perspective on adaptation* (rather than investigating the *state of adaptation* or *adaptive ability* of a firm). I base my investigation on Mintzberg's (1977) notion that organizations through a stream of decisions develop a certain pattern to orient themselves towards the environment. Taking into account the nature of strategic decisions as including high resource commitments and affecting the overall scope and direction of a company, and building on former perspectives on strategic adaptation (e. g. Miles and Snow 1978; Eunni, Post and Berger 2005; Dervitsiotis 2006), I define strategic adaptation for the purpose of this study as the process by which management actively aligns an organization to a changing environment through setting actions which involve high resource commitments and affect the organization's overall scope and direction (Sternad 2011).

Changing environments can pose constraints as well as create opportunities for organizations (Hrebiniak and Joyce 1985), so do major economic crises (Wan and Yiu 2009). Weick (1995), however, voiced an important caveat not to fall victim of, as he called it, an 'innocent-sounding phrase,' as 'the' in 'the environment' could imply that there is one singular reality which can be measured objectively, which he literally calls a 'nonsense' (Weick 1995). Weick's argument is that an environment is only disclosed to actors within an organization through the process of sense-making. The sense-making aspect is also pointed out by Haeckel

(1999, 75) when he states that '[e]very adaptive system […] survives by making sense out of its environment and responding with appropriate action.'

Economic crises are environments which are both uncertain and complex, and in which individuals' limited cognitive abilities and processing capacities make a full understanding of all involved factors and the relationship between them virtually impossible (Tung 1979; Frishammar 2006). Thus, one and the same external event can be perceived differently by different managers. As, according to upper echelons theory, executives' cognitions and perceptions can have an influence on their strategic decision-making tendencies (Hambrick and Mason 1984), it becomes crucial to take managerial perceptions and interpretations of environmental events into account when investigating how organizations strategically adapt to economic crises.

Possible Cultural Influences on Strategic Adaptation Behaviour

According to cultural immersion theory, perceptions, interpretations, and responses to environmental stimuli are influenced by the culture in which people live significant parts of their life through subconsciously developed 'shared schemas' (Dickson, BeShears, and Gupta 2004). Some definitions of culture specifically embed the role that this concept plays in interpreting the environment (Schein 1984; Trompenaars 1996; Hoffman 2007). Geletkanycz (1997, 617), for example sees national culture as 'a common frame of reference or logic by which members of a society view organizations, *the environment,* and their relations to one another' (italics added by the author of this article).

The proposition that national cultural differences influence on strategy is supported by Gilbert and Lorange (1994) and Schneider and Barsoux (1997). Conceptual papers on the issue were provided by Brock, Barry, and Thomas (2000), and Schneider (1989); the latter assuming that culture is playing a role in the way in which strategic issues are interpreted and priorities are established. Brockner (2003) also identified an influence of national culture on decision-making tendencies. Although Samiee and Athanassiou (1998) were of the opinion that the effect of culture on strategic decision-making processes had not yet been widely investigated, also a range of empirical studies exist (for example Kagono et al. 1985; Sullivan and Nonaka 1988; Haiss 1990; Hegarty and Hoffman 1990; Schneider and DeMeyer 1991; Kotha, Dunbar, and Birs 1995; Hitt et al. 1997; Geletkanycz 1997; Hennart and Larimo 1998;

Steensma, Marino, and Weaver 2000; Markóczy 2000; Parnell 2004; Barr and Glynn 2004; Ayoun and Moreo 2008) about the asserted link between culture and strategy, however as yet yielding ambiguous results. Some authors (like for instance Markóczy 2000 or Hoffman 2007) did not find a link at all, leading Markóczy (2000) to pose the question whether cultural differences are actually overrated. Those, who found cultural influences on strategic decision-making processes, were usually focusing either on *strategic decision contents* (examples include Hitt et al. (1997), who found that while US managers focused on discounted cash-flow, ROI, and projected demand, their Korean counterparts emphasized growth and expansion, or the recent work of Dimitratos et al. (2011), who presented evidence that differences in national culture can also affect international strategic decisions of firms) or on *cultural influences on managers' attitudes.* Geletkanycz (1997), for instance, revealed that the cultural dimensions of individualism, uncertainty avoidance, power distance, and short-term orientation correlated with executives' commitment to the status quo rather than advocating strategic chance.

In this article, I attempt to combine these two perspectives – cultural influences on strategy content as well as on managerial attitudes – by proposing that strategic action can be influenced by culture in at least two ways (see figure 1): First, directly, when decision-makers select between strategic alternatives based on their culturally-influenced personal perceptions and basic assumptions, and second, indirectly, when culture affects how decision-makers interpret major trends and events in the environment (also termed 'strategic issues' by Ansoff 1975), with this interpretations in turn influencing strategic action. Following Mintzberg, Raisinghani, and Théorêt (1976), the diagnosis of issues in large part determines the subsequent choice of action. This is also supported by Dutton and Jackson (1987) and is a general assumption of strategic issue diagnosis research (e. g. Daft and Weick 1984; Dutton, Fahey, and Narayan 1983; Julian and Ofori-Dankwa 2008; Plambeck and Weber 2010).

One of the dominant concepts in strategic issue diagnosis is the categorization of environmental developments as opportunities or threats. Kovoor-Misra (2009) suggested that whether a crisis is perceived as an opportunity or a threat has an effect on the focus of attention of decision-makers. Dutton and Jackson (1987) note that opportunity interpretations include the perception of a situation as something positive over which one has considerable control, while a situation that is seen as a threat is
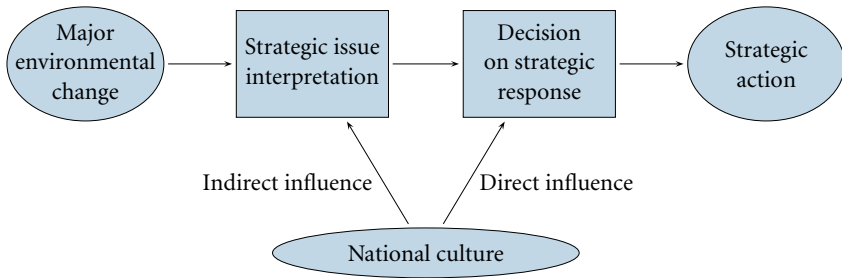
FIGURE 1   Direct and indirect influence of national culture on strategic
adaptation decisions

usually associated with potentially negative consequences and little con-
trol over what is happening.

In this empirical study, it is examined whether an indirect influence
of cultural differences on strategic adaptation choices mediated through
opportunity/threat interpretations exists; and/or whether the differences
in cultural dimensions directly affect the selection of strategic responses
to an economic crisis.

Strategic Responses to an Economic Crisis

Several authors have investigated the strategic actions firms are taking
when faced with situations of sudden economic downturn and recession.
From a review of the literature in this field, the following basic tendencies
emerge:

First, firms are using a wide range of strategic actions in response to
economic crises, the selection of which is also dependent on the type of
environment they are embedded in (Smart and Vertinsky 1984; Grewal
and Tansuhaj 2001). Strategies include rationalization or retrenchment
strategies on the one hand, as well as strategies of counter-cyclical pro-
tection or reinforcement of existing resource bases (Whittington 1991),
on the other hand, with cost-cutting and retrenchment being very com-
mon in times of recession (Bigelow and Chan 1992; Geroski and Gregg
1994; 1997; DeDee and Vorhies 1998; Michael and Robbins 1998). On an-
other dimension, some strategies are internally-directed (like reinforc-
ing control systems or improvement of business processes), while oth-
ers are externally-directed towards the market – including for instance
changes in marketing strategies (Shama 1993), changes in pricing strate-
gies (Chou and Chen 2004), or changes in the international orientation
of the firm (Lee et al. 2009; Enderwick 2009; Williamson and Zeng 2009;

Schuh 2011). Recent research (Latham and Braun 2010; Sternad 2011) also showed a tendency towards focussing on customer retention in times of crisis. Merely financial strategies were identified as being the least effective responses to economic downturn in a study by Laitinen (2000).

Second, strategies employed in times of recession impact on both short-term company performance as well as long-term performance in recovery (Whittington 1991). It was found that an over-reliance on retrenchment strategies can result in negative long-term effects (DeDee and Vorhies 1998), while counter-cyclical investment strategies can potentially lead to higher performance during recovery (Whittington 1991; Roberts 2003; Wan and Yiu 2009). Already Edith Penrose (1995, 244) in her classic work *The Theory of the Growth of the Firm,* first published in 1959, found that 'depression is sometimes looked on as a good time to expand: costs are low, plant can be constructed and equipment bought cheaply.'

Third, it was proposed by several authors (e. g. Chastain 1982; Laitinen 2000; Pearce and Michael, 2006; Kitching et al. 2009; Rhodes and Stelter 2009) that a balanced (or 'ambidextrous' in the words of Kitching et al. 2009) approach covering both short-term efficiency improvements and selective market-oriented investments can lead to a higher chance of success both during as well as after the crisis.

I propose a two-dimensional matrix to classify possible strategic actions in response to an economic crisis. The first dimension is based on Chattopadhyay, Glick, and Huber's (2001) distinction between externally-directed action (strategic action that is directed towards the market) and internally-directed action (action that is directed towards changing the structure, processes, systems, or resource use within the organization). The second dimension distinguishes between pro-active strategies (including counter-cyclical investments) and retrenchment strategies. This dimension resembles a similar conceptualization for the classification of recession strategies put forward by Whittington (1991, 15), who used the terms 'counter-cyclical hoarders' and 'recessionary rationalisers.' The resulting four types of strategies in response to economic crises – pro-active/external, pro-active/internal, retrenchment/external and retrenchment/internal – are not mutually exclusive. They can, as was pointed out above, be used in combination in 'ambidextrous' strategies. Figure 2 provides examples for strategic actions that can be placed into the four quadrants of strategic adaptation strategies in response to economic crises.

	External	Internal
Pro-active	*External pro-active strategies* Investment into new markets Diversification of the business Investment into sales Investment into marketing Customer acquisition Customer retention	*Internal pro-active strategies* Investment into technology Investment into quality Investment into HR Investment into R&D Investment into production Investment into logistics
Retrenchment	*External retrenchment strategies* Withdrawing from markets Divestment of products/product lines Rationalization in sales Rationalization in marketing Selling parts of the business Focus on the core business	*Internal retrenchment strategies* Rationalization in administration Rationalization in technology Rationalization in HR Rationalization in R&D Rationalization in production Rationalization in logistics

FIGURE 2   Classification of Strategies in Response to Economic Crises

Hypotheses on the Link between the Cultural Dimension of Uncertainty Avoidance and Strategic Adaptation Processes

In Schneider and De Meyer's (1991) study, national culture was found to have an effect on both external and internal strategic responses to environmental change. Several researchers and research teams have proposed 'cultural dimensions,' constructs aiming at reducing cultural complexities and measuring national cultural differences between societies. Among the best-known studies in this field are Hall's (1960; 1976), Trompenaars and Hamden-Turner's (1998), Hofstede's (1980), and House et al.'s (2004) GLOBE study.

One cultural dimension – uncertainty avoidance – which can be found in both Hofstede's as well as House et al.'s study, lends itself well for studying possible cultural effects on managerial thinking and actions in economic crises, as they are by their nature times of uncertainty. For firms, which are faced with an economic downturn, it is hard to predict how long the crisis will last, and how deep it will become. While the cultural dimension of uncertainty avoidance was associated with stress measures such as nervousness and tenseness at work in Hofstede's work (Venaik and Brewer 2010), the construct was more focused on aspects like valuing rules, order, and predictability in the GLOBE study (Sully de Luque and Javidan 2004). Uncertainty avoidance was also found to be related to managerial resistance to change (Geletkanycz 1997) and to the propensity to take risks (Bontempo, Bot-

tom, and Weber 1997), with the degree of risk in turn being a major criterion in decisions of how to strategically react to a crisis. Sully de Luque and Javidan (2004, 618), for instance, see the tendency in societies with higher levels of uncertainty avoidance to '[t]ake more moderate calculated risks.' Pro-active strategies in times of economic downturn carry a considerable amount of risk due to an uncertain future, while retrenchment strategies can be seen as a more 'secure' path on known ground. They are more likely to yield short-term effects and carry a lower risk regarding the expected outcomes. Therefore, I hypothesize that managers in cultures with a higher degree of uncertainty avoidance are more inclined to use retrenchment strategies (both internal and external):

HYPOTHESIS 1a *Internal retrenchment crisis adaptation strategies will be more common in cultures with a higher degree of uncertainty avoidance.*

HYPOTHESIS 1b *External retrenchment crisis adaptation strategies will be more common in cultures with a higher degree of uncertainty avoidance.*

In contrast to the hypotheses above, which are asserting a direct relationship between the cultural dimension of uncertainty avoidance and managers' propensity to choose certain categories of adaptive strategies, it is explored in the following whether an indirect link exists between uncertainty avoidance and the choice of strategic action, with strategic issue interpretation as opportunity or threat as a mediating variable. If radical changes – especially negative ones with uncertain outcomes – are likely to be seen as a threat in cultures which are valuing predictability, are risk-averse, and less in favour of changes, then we can assume that higher levels of uncertainty avoidance in a culture could foster the interpretation of a major negative environmental change such as a global economic crisis (in which risk and uncertainty are inherent) as a threat. Staw, Sandelands, and Dutton (1981) found that the interpretation of events and developments as a threat tend to be associated with more defensive responses. Therefore, I suggest that threat interpretations mediate a relationship between the level of uncertainty avoidance in a society and defensive retrenchment strategies (both externally and internally-directed):

HYPOTHESIS 2a *The degree to which internal retrenchment strategies are used in response to an economic crisis is positively influenced by the*

level of uncertainty avoidance in a culture, mediated through threat interpretation.

HYPOTHESIS 2b *The degree to which external retrenchment strategies are used in response to an economic crisis is positively influenced by the level of uncertainty avoidance in a culture, mediated through threat interpretation.*

Method

SAMPLE AND DATA COLLECTION

The hypotheses were tested in a quantitative study among managers in Austria and Slovenia, two European nations which were chosen for the reasons (a) that they are likely to exhibit both common cultural characteristics (due to their centuries of common history under Habsburg rule) as well as cultural differences (due to their affiliation with two major European cultural areas – the Slavic and Germanic languages regions, and due to the decades of communist influence in Slovenia before 1991), (b) that they share comparable institutional environments (both are EU member states), and (c) that the 2008–2009 financial crisis had a similar impact on the countries in terms of time and magnitude.

After a qualitative pre-study including semi-structured interviews with Austrian and Slovene top managers, I conducted a quantitative study in September 2010 in which a link to an online questionnaire was distributed via e-mail to managing directors of Austrian and Slovene companies in three industries that were particularly affected by the 2008–2009 financial and economic crisis in both countries: printing, construction of machinery, and travel agencies. The Compnet (Austria) and PIRS (Slovenia) business databases were used for the contact addresses of all companies in these industries except one-person firms. The procedure followed the multiple-contact method suggested by Dillman (2007). Representatives of 346 out of all 1,667 contacted companies responded, yielding an overall gross response rate of 20.8%. I excluded respondents who were (a) in their positions for less than two years, (b) not of Austrian or Slovene nationality, (c) working for foreign companies (local subsidiaries of foreign companies remained included), or (d) not sufficiently filling out the questionnaire. 257 of the questionnaires were valid and usable for further analysis (157 from Austria, 100 from Slovenia).

Various steps were taken to minimize the risk of bias in the research: In line with other cross-cultural studies (Shane, Venkatraman,

and MacMillan 1995; Geletkanycz 1997), back-translation procedures were employed to minimize translation problems. Following Huber and Power (1985), the following steps were taken to minimize the influence of retrospective report bias: (1) using the most appropriate persons as informants. As members of the management board or managing directors are likely to be the most knowledgeable persons on strategic issues, they were directly targeted with the research; (2) taking away the fear that the research could have possible adverse effects on the respondents' interests through ensuring full anonymity to the participating managers; (3) using scales that were pre-tested in prior research (in the case of strategic issue analysis). To mitigate the risk of non-response bias, mean responses of the first quartile were compared with the fourth quartile of respondents for each variable, as is has been found that late respondents often react similarly to non-respondents (Armstrong and Overton 1977; Ghobadian et al. 2008). The absence of significant differences signals a low threat of non-response bias. No single factor emerged in an unrotated factor analysis, thus suggesting that common method bias is also not a major concern (Podsakoff and Organ 1986).

MEASURES

Considerable effort was put into the design of the survey instrument, which was developed in a three-step process. First, literature was reviewed for existing and tested constructs that represent the key issues and concepts. Second, the initial instrument was reviewed by five management researchers for content validity regarding the concepts that it ought to measure. Third, as conducting qualitative interviews with members of the target population is seen as vital to ensure content validity for the development of a scale which is used in quantitative research (Johnson and Harris 2003), managing directors of six companies in Austria and Slovenia were interviewed to check face validity, clarity, and meaningfulness of the questions, thus pre-testing both the relevance of the questions and the clarity and comprehensiveness of the questionnaire, while at the same time trying to minimize cross-cultural equivalence bias (Fontaine 2008). The instrument was subsequently modified with minor changes according to the additional input gained from both management researchers and practicing managers.

STRATEGIC ISSUE DIAGNOSIS

The opportunity and threat constructs were measured with items which were slightly adapted from those proposed by Julian and Ofori-Dankwa

(2008), and included the aspects of potential gain, positiveness, and controllability for opportunity, and possible negative implications and potential reduction in profits for threat. An item measuring limited controllability was included for in the questionnaire, but had to be excluded in the subsequent analysis due to reliability concerns. Based on the recommendation of Hinkin (1998), all strategic issue diagnosis items were measured on a 5-point Likert-type scale. The scores for each construct were calculated as an average of the item scores that together constitute the construct. Cronbach's alpha for the resulting three-item opportunity construct was 0.776, and 0.822 for the two-item threat construct.

STRATEGIC ACTION

Following two dimensions proposed by Chattopadhyay, Glick and Huber (2001) and Whittington (1991), and incorporating different strategic adaptation measures in response to crises identified by Whittington (1991), Geroski and Gregg (1997), DeDee and Vorhies (1998), Laitinen (2000), and Roberts (2003), four categories of strategic action in response to the crisis were measured as follows: (1) *Pro-active/external strategies* included items on the extent of investment into new markets and diversification of the business, on the importance of customer acquisition and customer retention strategies (measured on a 5-point Likert-type scale with the anchors 1 = 'not used at all' and 5 = 'highly used'), and on the extent of investment into sales and marketing (both measured on a bipolar scale from 'strong rationalization' to 'strong investment,' with the answers subsequently transposed as follows: 'strong rationalization,' 'some rationalization' and 'no changes' into 1, 'some investment' into 3 and 'strong investment' into 5 on a scale of 1–5. The resulting 6-item variable 'Pro-active/external' was calculated as the average of the individual item scores, with all items carrying the same weight. Cronbach's alpha of this construct was measured as 0.746. The other three categories were measured using the same logic: (2) *Retrenchment/external* strategies included items on the extent of using the following strategies: withdrawing from markets, divestment of product/product lines, selling parts of the business, focus on the core business (5-point Likert-type scale), rationalization in sales, and rationalization in marketing (bipolar scales transposed to 'strong investment,' 'some investment,' 'no changes' = 1, 'some rationalization' = 3, 'strong rationalization' = 5). Reliability for the 6-item construct was measured at $\alpha = 0.658$. (3) Pro-active/internal strategies consisted of six items on investment into technology, quality, HR, R&D,

production, and logistics (each measured on a bipolar scale transposed as in (1) above) with an $\alpha = 0.725$. (4) *Retrenchment/internal strategies* were measured with items on the extent of rationalization in the areas of administration, technology, HR, R&D, production, and logistics (each measured on a bipolar scale transposed as in (2) above). Reliability was measured at $\alpha = 0.708$.

DIFFERENCES IN UNCERTAINTY AVOIDANCE

In line with prior cross-cultural studies (Geletkanycz 1997; Barr and Glynn 2004), national cultural values were not explicitly surveyed but assigned to respondents from a widely recognized study, thus also reducing the risk of common method bias. Due to the sample (managers), relative recency, research method (quantitative study), and contents (frequently used cultural dimensions), the findings on cultural practices of the GLOBE study (House et al. 2004) were used to determine differences in the cultural dimension of uncertainty avoidance between Austria and Slovenia. On the 1 (low) to 7 (high) GLOBE scale, Austria showed a higher level of uncertainty avoidance (5.17; first quartile of countries) than Slovenia (3.78, third quartile) (House et al. 2004). Following Peng, Peterson and Shy's (1991) advice, the differences between the two countries on the GLOBE scores were dichotomized into 'high' versus 'low,' as the ordinal nature of responses is more dependable than their interval aspects.

CONTROL VARIABLES

Control variables included company size (as for example Peters 1992; Chen and Hambrick 1995; Dean, Brown and Bamford 1998; and Latham 2009 found size-specific differences in strategic adaptation to environmental change), industry (as according to Spender (1989) firms within one sector often use 'industry recipes' in response to environmental change), the availability of slack resources (using the two-item self-report scale developed by Chattopadhyay, Glick and Huber 2001), and respondents' gender and age group.

Results

87.5% of the respondents were owners, board members or managing directors of their companies. Firm sizes ranged from 1–50 employees (66.5%), 51–250 employees (21.8%), 251–500 employees (7.0%) to more

than 500 employees (4.7%). 81.1% of respondents were male, 18.9% female.

Descriptive statistics on strategic action in response to economic crisis, strategic issue diagnosis, and on key control variables are presented in table 1. Significant correlations between the individual strategic choice categories could be determined. The two pro-active strategies (external and internal) positively correlate with each other, as do the two retrenchment strategies. On the other hand, as one would also intuitively assume, all pro-active and retrenchment strategies are negatively correlated with each other. Furthermore, the results suggest that interpretations of the crisis as an opportunity is significantly related to the use of pro-active strategies, and that threat perception is linked to the extent that internal retrenchment strategies are used. The use of three strategies (pro-active external, pro-active internal, and retrenchment-external) as well as threat perception significantly correlate with country differences in the cultural dimension of uncertainty avoidance.

Descriptive statistics on country level are presented in table 2 together with the results of first tests of country differences without taking into account any of the control variables. Both *t*-tests and non-parametric Mann-Whitney-U-tests show the same results: Significant country differences were found in the use of external and internal pro-active strategies (both were more common in Slovenia) and of external retrenchment strategies (more common in Austria), as well as in the perception of the crisis as a threat (higher in Slovenia). No country-specific differences could be determined for opportunity perceptions and for the use of internal retrenchment strategies. Overall, we can see that external pro-active strategies were by far the most frequently used strategic response to the economic crisis in both countries.

Hierarchical multiple regression with external and internal retrenchment strategies in response to the crisis as the dependent variables were used to control for possible effects in company size, industry differences (dummy-coded), availability of slack, and gender and age of respondents (see table 3 for the detailed results). Possible mediating effects were tested using the three regression equations as suggested by Baron and Kenny (1986).

The results show a link between the perception of the crisis as a threat and the use of internal retrenchment strategies. However, there is no significant influence of the cultural dimension of uncertainty avoidance on the use of internal retrenchment strategies. Hypothesis 1a was, therefore,

TABLE 1 Descriptive statistics

Item	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Pro-active/external	3.12	0.86										
2. Pro-active/internal	1.85	0.84	0.52***									
3. Retrenchment/external	1.72	0.67	−0.28***	−0.27***								
4. Retrenchment/internal	1.76	0.78	−0.17**	−0.36***	0.40***							
5. Opportunity	2.69	1.03	0.24***	0.35***	−0.07	−0.02						
6. Threat	4.18	0.89	0.08	0.00	0.09	0.22***	−0.17**					
7. Company size	0.34	0.47	−0.03	0.08	0.13*	0.16*	0.09	0.15*				
8. Slack	3.39	1.17	−0.02	0.12	−0.11	−0.12*	0.26***	−0.21**	0.16*			
9. Gender	0.81	0.39	−0.01	−0.01	0.11	0.06	0.10	−0.01	0.08	0.16**		
10. Age	0.38	0.49	−0.06	−0.11	0.01	0.06	−0.05	0.00	0.08	−0.08	0.14*	
11. Country	n.a.	n.a.	−0.33***	−0.26***	0.17**	0.02	−0.12	−0.26***	0.21**	0.30***	0.13*	0.03

NOTES The table shows means, standard deviations and bivariate correlations of the main variables in the study. Stars indicate two-tailed significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Scales: Company size: ≤ 50 employees, $1 \geq 50$ employees; Gender: female = 0, male = 1; Age: <50 years: 0, >50 years: 1. Other variables: 5-point Likert-type scale from 1 (low) to 5 (high).

TABLE 2 Country differences of the main variables

	Descriptive statistics				T-test		Mann–Whitney–U-test		
	Austria		Slovenia						
	(1)	(2)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Opportunity	2.59	0.994	2.85	1.063	−1.953	0.052	6744.5	−1.912	0.056
Threat	4.00	0.972	4.46	0.652	−4.567	0.000***	5622.5	−3.800	0.000***
External pro-active strategies	2.89	0.775	3.47	0.868	−5.638	0.000***	4943	−5.012	0.000***
Internal pro-active strategies	1.67	0.689	2.11	0.972	−3.930	0.000***	5772	−3.569	0.000***
External retrenchment strategies	1.81	0.680	1.58	0.627	2.716	0.007**	6141.5	−2.966	0.003**
Internal retrenchment strategies	1.77	0.767	1.73	0.811	0.389	0.698	7413	−0.686	0.493

NOTES (1) mean, (2) standard deviation, (3) T-value, (4) p (2-tailed), (5) Mann–Whitney–U, (6) Z, (7) p (2-tailed). The table shows means and standard deviations for the strategic issue analysis and strategic variables on a country-level, as well as results of T-tests and Mann–Whitney–U tests testing whether significant differences exist between the Austrian and Slovenian results. Stars indicate two-tailed significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Variables are scaled on a 5-point Likert-type scale from 1 (low) to 5 (high).

TABLE 3 Multiple Hierarchical Regression Results

	DV: External retrenchment strategies				DV: Internal retrenchment strategies			
	I	II	III	IV	I	II	III	IV
Step 1: Control variables								
Age	−0.049 (0.089)	−0.061 (0.089)	−0.060 (0.089)	−0.062 (0.088)	0.045 (0.105)	0.041 (0.106)	0.047 (0.105)	0.046 (0.104)
Gender	0.193 (0.111)	0.244 (0.115)*	0.244 (0.115)*	0.221 (0.113)	0.099 (0.131)	0.115 (0.136)	0.113 (0.134)	0.104 (0.134)
Company site	0.222 (0.092)*	0.241 (0.092)*	0.230 (0.094)*	0.172 (0.094)	0.299 (0.108)**	0.307 (0.110)**	0.255 (0.110)*	0.230 (0.112)*
Slack	−0.089 (0.037)*	−0.099 (0.037)	−0.093 (0.038)*	−0.119 (0.038)**	−0.108 (0.043)*	−0.114 (0.044)*	−0.185 (0.044)	−0.096 (0.045)*
Step 2: Industry (dummy-coded)								
Industry (dummy 1)		0.068 (0.136)	0.069 (0.136)	0.058 (0.133)		0.127 (0.161)	0.136 (0.159)	0.132 (0.159)
Industry (dummy 2)		0.247 (0.141)	0.251 (0.141)	0.235 (0.138)		0.184 (0.167)	0.204 (0.165)	0.197 (0.165)
Industry (dummy 3)		0.279 (0.137)*	0.279 (0.137)*	0.284 (0.135)*		0.214 (0.163)	0.216 (0.160)	0.218 (0.160)
Step 3: Strategic issue diagnosis								
Threat			0.030 (0.049)	0.070 (0.050)			0.157 (0.058)**	0.174 (0.059)**
Step 4: National differences								
Country				0.297 (0.092)**				0.125 (0.110)
N	245	245	245	245	244	244	244	244
Model R^2	0.050*	0.076**	0.077*	0.117**	0.054*	0.061*	0.090**	0.095**
Adjusted R^2	0.034	0.049	0.046	0.083	0.038	0.033	0.059	0.06
R^2 change†	0.050*	0.026	0.001	0.039***	0.054*	0.008	0.029**	0.005

NOTES †with p for F change. The table shows multiple hierarchical regression results with the four strategic action categories in response to economic crisis as dependent variables (DV). Control variables are entered in a first step (models I), followed by dummy-coded industry variables (models II), strategic issue diagnosis variables (models III) and country differences (models IV). The presented values in the four steps of the model are unstandardized regression coefficient with standard errors in parentheses. Stars indicate significance (of the model and of the significant change in F between the models) at the following levels: * $p < 0.05$, ** $p < 0.01$,*** $p < 0.001$.

not substantiated. With one of the conditions for a mediating effect also not being fulfilled, also Hypothesis 2a needed to be rejected. In the case of external retrenchment strategies, differences in uncertainty avoidance levels had an effect. As external retrenchment strategies were significantly more frequently reported in Austria even after all control variables were entered into the model, h1b received support. Testing for a possible mediating effect of threat perception between uncertainty avoidance and external retrenchment strategies using Baron and Kenny's (1986) three regression equations, however, failed on one condition, as the effect of the independent variable (country differences) on the dependent one (external retrenchment strategies) was higher in the equation in which the presumed mediator threat perception was controlled (not standardized coefficient = 0.281, $p < 0.01$) than in the equation without this strategic issue diagnosis variable (not standardized coefficient = 0.229, $p < 0.01$). Therefore, hypothesis 2b could not be substantiated – threat perception does not mediate the relationship between national differences and the use of external retrenchment strategies.

Discussion and Conclusions

The findings of the empirical study are ambiguous as to whether differences in the cultural dimension of uncertainty avoidance influence on the strategic decision-making process when firms adapt to an economic crisis situation. It was hypothesized that in cultures with higher uncertainty avoidance, managers tend to use more retrenchment strategies, both internal as well as external ones. While in one category, external retrenchment strategies, a potential significant influence of the uncertainty avoidance variable was found, such a relationship could not be determined for internal retrenchment strategies. Therefore, differences in uncertainty avoidance did not provide a consistent explanation of differences in the choice of strategic action in response to the economic crisis.

The results add to the inconclusive discussion in which some studies (e. g. Geletkanycz 1997; Hitt et al. 1997; Barr and Glynn 2004) confirm the existence of cultural influences on strategic decision-making processes, while others (e. g. Markóczy 2000; Hoffman 2007) did not find significant variations in strategy-related beliefs and practices of managers between cultures. The findings of this study seem to support the latter group, thus also confirming the results of Ayoun and Moreoe's (2008) work in which cross-cultural differences in uncertainty avoidance levels

also only had minimal influence on managers' strategic orientations. A possible explanation can be found in the possibility that country-specific differences that do affect strategic choice are a complex combination of different factors such as culture, institutional framework, business climate, or public opinion. The difficulty to disentangle cultural factors from institutional influences and economic systems was also acknowledged by Schneider (1989).

Reducing country differences to cultural differences, and in particular also to one specific cultural dimension, without considering other institutional or social factors is also one of the major limitations of this study. Further limitations include the two-country instead of a multi-country study design, and the selection of countries for the sample from the same region – Central Europe. Ethnocentric bias (Adler 1983) could be a possible issue as the author is a citizen of one of the two observed countries. A cross-cultural research team would be preferable. Another limitation lies in the retrospective questions that were asked after the crisis situation occurred, thus being susceptible to hindsight bias – the tendency to recollect one's own interpretations as more 'correct' after the event (Wright et al. 2004) and to attributional bias – attributing outcomes to salient, however incorrect causes (Huber and Power 1985). Only industries on which the crisis had a considerable negative influence were included in the study. It is possible that different strategic adaptation tendencies exist in industries, which were less negatively or even positively affected by the economic downturn. Together with the high proportion of small firms and male respondents as well as the fact that the sample only included firms that survived the economic crisis, this limits the possibility to generalize the results to the whole population of firms.

The limitations of this study present opportunities for further research: Follow-up studies could include a larger set of countries. Together with a selection of culturally more distant countries, also from different continents, this could yield more pronounced results. Other forms of research – particularly also qualitative one – that observe strategic reactions in real-time as opposed to retrospective might alleviate problems of potential hindsight bias and attributional bias. As the sole use of cultural differences achieved insufficient explanatory power, further studies could add other country-specific factors to their design, such as institutional differences, short-term public opinion, business climate, or more generally, as Tsui, Nifadkar and Yi Ou (2007) suggest, the political, social, and economic context. Further cross-cultural studies on strategic adap-

tation could attend to other major environmental changes in addition to economic crises, such as technological discontinuities or changes in the institutional environment, thereby also extending our knowledge on whether different types of environmental change trigger different strategic responses.

Other research opportunities emerge from one major counter-intuitive result of this study, the high level of external pro-active strategies, which were used in both countries, Austria and Slovenia, in response to the crisis compared to retrenchment strategies. Companies focused more on customer acquisition and retention, as well as on creating new market opportunities than they did on rationalization. Recent research results from other regions also support this general tendency. Battisti and Deakins (2010) in their study of firms in New Zealand, for example, observed that market-oriented strategies led to better performance in the recession than cost-cutting. In their work on Chinese manufacturing SMES, Naidoo (2010) showed that marketing innovations as an exemplary pro-active strategy are instrumental to building competitive advantages that increase the likelihood of firm survival during an economic crisis. These results, combined with recent theoretical advantages on how firms can capitalize on opportunities created by a changing environment (Wan and Yiu 2009) could lead to a research agenda in which different pro-active crisis response strategies and their effects on firm performance are investigated in more detail, thus adding to our understanding how these strategies can also improve firm performance in prima facie adverse environmental conditions.

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Economic Benefit Assignment in Environmental Cost Allocation: Toward a Suggestion Model

Collins C. Ngwakwe

This paper aims to suggest a model to reward a 'dirty product' which has the potential to offer sales promotion services to other 'clean products' in a multiple product firm. The paper suggests a model – economic benefit assignment (EBA) for apportionment of direct waste costs where a polluting product offers a sales promotion benefit to other 'clean products' of the same company, which proposes that benefiting products should be assigned a proportion of the direct waste cost of the polluting product (as a service charge) based on the proportion of promotion benefit (sales benefit) received from the polluting product. The idea is that, based on transfer pricing theory, such promotion service would be paid for, if offered by an outside agent. Whilst academic debate is expected to ensue from this suggestion model, further case research is imperative to demonstrate industrial applicability.

Key Words: environmental cost allocation, waste cost allocation, economic benefit assignment, performance evaluation, activity based costing, transfer pricing
JEL *Classification:* M11, M41

Introduction

Contemporary pressure for corporate environmental responsibility has caused reforms in costing systems to properly account for environmental costs. Popular methodology to achieve transformation is rooted on polluter pays principle Stenis and Hogland (2002) in which the polluting department is meant to bear its polluting costs by applying the activity based costing (ABC) system (Kreuze and Gale 1994). Thus, improvement in traditional costing system has contributed to improving divisional performance evaluation and incentive schemes in decentralised organisations such as in multiple product firms (Cooper and Kaplan 1988a). This is a notable contribution as divisional performance and incentive schemes depend on effective cost allocation and transfer pricing (Baiman and Rajan 2002). However, although rationally, a pollut-

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ing product should take responsibility for associated environmental cost; this paper attempts to present a simple case of an intangible valuable service which a polluting product may offer to clean products of the same firm, and which may warrant possible sharing of an established direct waste costs of a 'dirty' product amongst benefiting products.

Consequently, the paper is guided by these questions: can direct waste costs of a 'dirty' product be possibly shared amongst multiple products, which derive sales promotion benefit from a 'dirty' product, and what possible method can be used for such allocation? Therefore, the objective of this paper is to use a simple case to explain how an acclaimed 'dirty' product may offer sales promotion service to 'clean' products in a multiple product firm; and to suggest a possible model to allocate the direct waste cost of a 'dirty' product to benefiting products.

The paper is organised as follows: the second section presents a brief conceptual background. The third section is the methodology, presentation and analysis of data. The fourth section presents the suggestion model. Finally, the fifth section concludes the paper.

Brief Conceptual Background

Revolution in business cost accounting system emerged in the late 1980s when famous American authors – Robin Cooper and Robert S. Kaplan posited that the conventional costing system requires adjustment to cope with contemporary trends in manufacturing technology and market conditions (Cooper and Kaplan 1988b). Corporate environmental stewardship has benefit from such innovation in costing system; it assists in tracing environmental costs to responsible products in a multiple product firm. However, complex interactions amongst multiple products may at times hinder objective performance evaluation in a multiple product firm. Such interactions may occur in firms' market environment. For instance according to Cooper and Kaplan; 'many customers value a single source of supply.' Consequently, a company may not simply drop a product line because it is unprofitable (Cooper and Kaplan 1988b); they posit that a product line, even when unprofitable, may boost the performance of other products in a multiple product firm. Hence, objective evaluation of a product performance in relation to other products is vital in building incentives to enhance the efficiency of activity centres (Vieira and Pereira 2010). However, objective performance evaluation may depend on objective cost allocation. Therefore, some authors have examined the fairness in internal cost allocation; for

instance, Choudhury (1990) examine cost allocation 'from the perspective of intra-firm distributive justice' and highlights that unfair cost allocation may cause redistribution of profit and rewards between organisational subunits. Nevertheless, if the controllability principle in cost allocation is adhered to, the uncontrollable factors in performance assessment is neutralised and thus instils fairness in performance evaluation (Giraud, Langevin and Carla 2008; Cohen, Loebn and Stark 1992).

Therefore, it is argued that cost allocation should be consistent with the goal of the firm. Thus, the Oregon Metro (2010, 3) stresses that:

> The cost allocation must balance equity with the agency mission, policies and objectives. When possible, costs should follow a cause and effect link to why the cost was incurred.

Similarly, according to Australian Water Corporation (2011) waste cost allocation should be based on 'equity (no cross-subsidisation), full cost recovery, and user pays charging.' Hence, Choudhury (1990) maintain that when performance rewards and/or incentives are based on profits, cost allocation should therefore be approached from the point of 'intra-firm distributive justice' to ensure the existence of fairness in cost allocation (Choudhury 1990, 217). Choudhury's assertion is confirmed by Horngren et al. (2010, 415) where they maintain that many companies are using return on investment (ROI) as performance measure because it is less complicated for the understanding of managers. Therefore, given that ROI is calculated based on net operating income, it means that wrong apportionment of operations' cost would produce distorted net operating income, and would lead managers into wrong performance evaluation and decisions. Managers' focus on tracking and allocation of costs should not be limited only to conventional costs within the direct and indirect category. Managers should look beyond these known costs and investigate hidden interactions amongst products outside the firm that result in abnormal services and benefits. If such interactions are not made to reflect in cost allocation problems such as in waste costs, there may be potential asymmetry in cost allocation.

To avoid possible bias in cost allocation especially as regards environmental costs, a close attention needs to be given to the performance of a product that is considered 'dirty' in a multiple product firm. In the simple case presented in subsequent pages, a 'dirty' product appears to be promoting the sales of 'clean' products in a multiple product firm. Therefore, the paper suggests that objective evaluation of product perfor-

mance in this company should recognise the obscured sales promotion service offered by the 'dirty' product. Although activity based costing has been effective in environmental cost allocation; it may not be 'inherently positive' in all cases (Englund and Gerdin 2008); in relation to this Kallunki and Silvola (2008) argue that internal and external characteristics of firms may influence the phase of using the ABC system. This implies that ABC may not be suitable in all stages of a product or firm's life cycle and/or specific conditions given the impact of internal and external factors including customer purchase habit and management's marketing priority. This is because in some conditions such as in waste cost allocation problems, whilst ABC allocates direct waste costs to a responsible product, such direct waste cost may be obscurely driven by management decision beyond the control of departmental manager. This is exemplified in this case where the management of WBC Company desires to boost sales of 'clean' products in a multiple product firm by increasing the production of a 'dirty' product in order to stock enough quantity of 'dirty' product in the stores, which the management of WBC believes motives customers to purchase the 'clean' products. This is based on the firm's experience that the 'dirty' product's quality endears it to customers and that such patronage is transferred to other products of the firm when stocked together in the stores. However, the cost allocation implication, notably, direct waste costs seem to be eluding the attention of WBC managers.

This paper proposes that such hidden service by a 'dirty' product deserve recognition, which conventionally should be priced in consonance with the transfer pricing objectives (Bailey and Boe 1976; Bailey and Collins 2005; Baldenius 2006). However, given complex marketing interaction existing between the multiple products in this case; further research is imperative to find possible internal transfer scheme for such obscure and valuable service from a polluting product. Whilst awaiting a suitable internal pricing scheme, a cost allocation model may help to apportion fairly the extra load of direct waste cost triggered by the clean products' reliance on the 'dirty' product's sales promotion service. This paper suggests a model, which suggests that management accounting deserve dynamic innovation (Emsley 2005; Sweeting and Kellet 1991) given growing influence of social and environmental factors in production planning, operations and marketing. The implication is that cost and management accounting systems would continue on a progressive modernization track in conformity with novel challenges arising from

social, environmental and climate change. The case summary, which is a foundation for the suggestion model, is briefly presented in the following pages.

Methodology

This suggestion model of environmental cost allocation is based on a six months market study of consumer purchase habit on products manufactured by WBC Company, a multiple product firm in Nigeria. It is also supported by an administration of short questionnaire to buyers of WBC products. In the paragraphs that follow, the market study data is presented and analysed; this is followed by a simple regression test, and subsequently an analysis of the questionnaire is presented to substantiate results.

WBC Company (a pseudo name) in place of the real company name, manufactures four products weavon, soap, cream, and perfect finish. Weavon is an artificial ladies' hair, acclaimed to be 'dirty' because of much waste involved in the manufacturing process. The company is considered suitable for this study because it is a typical example of a multiple product firm whose products exhibit two characteristics referred to in this paper as 'dirty' and 'clean'. It aroused research interest because the 'dirty' product (weavon), although operating at a loss is still retained by the firm. According to the marketing manager:

> We keep weavon in operation because it helps to retain our market share in the other three products – soap, cream and perfect finish, and occasionally we increase production volume of weavon to maintain stock in the stores to boost the sales of other products.

With the support of WBC Company, a simple market observation in five different retail shops was carried out from January to June 2010 to confirm the marketing manager's claim, and to suggest possible cost implications. Weavon – the 'dirty' product was placed in the stores for three months and was also removed from the stores for three months in an alternating fashion. However, the clean products – soap, cream, and perfect finish were kept in the stores throughout the six months observation. The aim is to ascertain whether the presence of the dirty product in the stores actually promotes the sales of the clean products and whether the sales volume of clean products may decrease if the dirty product is out of stock. Furthermore, direct waste cost implication on weavon due to increase in volume of production is obtained from the cost accounting

TABLE 1   January, 'clean' and 'dirty' products are placed together, sales volume of clean products is observed and recorded

Item	Shop 1	Shop 2	Shop 3	Shop 4	Shop 5	Total
Soap	400	300	200	350	220	1470
Cream	500	400	300	420	350	1970
Perfect finish	450	420	350	400	300	1920

TABLE 2   February, 'clean' products are placed together excluding the dirty product, volume of sales for the 'clean' products are observed and recorded

Item	Shop 1	Shop 2	Shop 3	Shop 4	Shop 5	Total
Soap	200	120	100	150	120	690
Cream	250	180	140	200	150	920
Perfect finish	220	200	120	180	140	860

TABLE 3   March, 'clean' and 'dirty' products are placed together, sales volume of clean products is observed and recorded

Item	Shop 1	Shop 2	Shop 3	Shop 4	Shop 5	Total
Soap	410	280	210	340	200	1440
Cream	520	410	305	400	360	1995
Perfect finish	460	440	370	410	320	2000

department of the wbc Company, and a methodology for allocation to benefiting products is suggested. The focus is on direct waste cost since according to the production manager:

> Heavy cleaning and washing of raw cotton and wool during the production of weavon enhances its admirable quality which we believe endears weavon to the patronage of our consumers.

Tables 1–6 show the sales performance of 'clean' products of the wbc Company when the 'dirty' product was placed and removed in stores with the 'clean' products in alternating fashion between January and June 2010.

PRESENTATION AND ANALYSIS OF MARKET STUDY

Tables 1–6 present the result of a six-month market study, which reveals that 'clean' products experience increase in sales volume if stocked together with the 'dirty' product, and that clean products experience decreased sales volume when the 'dirty' product is out of stock.

Tables 1, 3, and 5 present the sales volume of clean products whilst weavon was in store, with associated volumes of 5360, 5435, and 5570 re-

TABLE 4 April, products are placed together excluding the dirty product, volume of sales for the 'clean' products are observed and recorded

Item	Shop 1	Shop 2	Shop 3	Shop 4	Shop 5	Total
Soap	180	130	105	140	115	670
Cream	260	200	150	205	170	985
Perfect finish	230	210	130	185	150	905

TABLE 5 May, 'clean' and 'dirty' products are placed together, sales volume of clean products is observed and recorded

Soap	420	300	230	360	240	1550
Cream	510	405	315	420	380	2030
Perfect finish	440	450	360	400	340	1990

TABLE 6 June, products are placed together excluding the dirty product, volume of sales for the 'clean' products are observed and recorded

Soap	190	150	110	130	125	705
Cream	280	220	170	215	190	1075
Perfect finish	210	205	125	180	160	880

TABLE 7 Summary of sales volume of clean products

Sales volume with weavon in stores	Sales volume without weavon in stores
5360	2470
5435	2560
5570	2660

spectively. On the other hand, tables 2, 4 and 6 contain sales volume of the clean products whilst weavon was removed from the stores. Associated sales volumes recorded were 2470, 2560, and 2660 respectively. These sales volumes are summarised in table 7.

Physical observation of the above scenario indicates clear difference in the sales volume under the two conditions. A *t*-test of difference in means is employed to check statistically, if one can assert that a difference exists amongst the two observations of sales volume under the two conditions. The *t*-test is presented in table 8.

The *t*-test of difference in means show a difference in means between the two observations as the *t*-statistics is greater that the hypothesised mean (0). Therefore, one may conclude that the presence of weavon in stores influences the sale of other products of the wbc Company.

Additionally, a simple regression test is conducted to ascertain whether

TABLE 8   *t*-test: Paired two sample for means (sales of other products with weavon in stores and without weavon in stores)

Item	With weavon	Without weavon
Mean	5455	2563.333333
Variance	11325	9033.333333
Observations	3	3
Pearson correlation	0.991154274	
Hypothesized Mean Difference	0	
df	2	
t-statistics	285.232243	
$P(T \leq t)$ one-tail	$6.14561e^{-6}$	
t critical one-tail	2.91998558	
$P(T \leq t)$ two-tail	$1.22912e^{-5}$	
t critical two-tail	4.30265273	

TABLE 9   Sales volume of weavon and clean products during the months of placing weavon in stores

Months	Sales volume of weavon	Sales volume of clean products
January	5000	3560
March	5200	5435
May	5300	5570

the sales volume of weavon has a relationship with the movement in sales volume of the 'clean' products. The production and sales volumes of weavon is obtained from the marketing division of wbc for the months of January, March and May – the periods during which weavon was placed in stores alongside with the 'clean' products. The sales volumes of weavon constitute the independent variables (x). On the other hand, the sales volume of the clean products for the months of January, March, and May are used as the dependent variables (y). These volumes are presented in table 9 and are followed by a simple regression test in table 10. The regression statistics also indicate a significant relationship between sales volume of weavon and the sales volume of clean products.

PRESENTATION AND ANALYSIS OF QUESTIONNAIRE

To ascertain whether other factors (apart from weavon) contribute to influence buyers' decision to purchase other products of wbc whilst pur-

TABLE 10   Summary of regression output

Regression statistics		Multiple R					0.986640939
		R^2					0.973460342
		Adjusted R^2					0.473460342
		Standard error					985.8255858
		Observations					3

ANOVA		df	SS	MS		F	Sig. F
Regression		1	71294021	71294021		73.358921	0.0739932
Residual		2	1943704.2	971852.09			
Total		3	73237725				

Item	Coeff.	Std. error	t-stat.	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

chasing weavon, a short questionnaire was administered to buyers based on two key issues: to elicit buyers' opinion on whether they actually purchase other products (clean products) of wbc whilst purchasing weavon (dirty product) and to ascertain from buyers if other factors (besides weavon) influence their decision to purchase other wbc products as they visit the stores to purchase weavon. In consideration of existing public apathy to research questions, the questionnaire was limited to six questions to motivate willing buyers to respond to the questions fast within few minutes before or after doing their shopping. The two key issues upon which the questions were centred are:

i Whether the presence of weavon in the stores engenders buyers' decision to purchase other products of wbc, (questions 1–2).

ii If taste, fashion, quality, and price influence buyers' decision to purchase the clean products wbc as they visit the stores.

In section (i) of the questionnaire, respondents were asked to check their preferred box to indicate whether they actually purchase other products of wbc while purchasing weavon; and the responses are analysed in tables 11 to 12.

In section (ii) of the questionnaire, respondents were asked to check their preferred box to indicate the extent to which other factors (fashion, taste price, quality) influence their decision to purchase the clean products of wbc. They were instructed that checking (disagree and strongly disagree) would denote that they purchase clean products because of

TABLE 11   Question 1: I usually purchase other products of WBC when I buy weavon

Item	Frequency	Percent	Valid percent	Cum. percent
Strongly agree	700	87.5	87.5	87.5
Agree	80	10.0	10.0	97.5
Undecided	16	2.0	2.0	99.5
Disagree	4	0.5	0.5	100.0

TABLE 12   Question 2: I purchase a combination of WBC products because of the good quality of weavon

Item	Frequency	Percent	Valid percent	Cum. percent
Strongly agree	720	90.0	90.0	90.0
Agree	50	6.3	6.3	96.3
Undecided	25	3.1	3.1	99.4
Disagree	5	0.6	0.6	100.0

TABLE 13   Question 3: I purchase a combination of WBC products because it is a reigning fashion to have such combination

Item	Frequency	Percent	Valid percent	Cum. percent
Strongly agree	4	0.5	0.5	0.5
Agree	6	0.8	0.8	1.3
Undecided	50	6.3	6.3	7.5
Disagree	10	1.3	1.3	8.8
Strongly disagree	730	91.3	91.3	100.0

their desire for weavon. The objective of questions 3–6 was to ascertain from buyers whether (in addition to weavon) other factors such as (taste, fashion, quality and price) contribute to influence their decision to purchase the clean products whilst purchasing weavon. The summary of questions 3–6 show that only 5% of buyers agreed that taste, fashion, quality and price (and other undecided effects) influence their decision to purchase the 'clean products' of the WBC as they purchased weavon. However, 9.5% disagreed that these other factors influence their decision, which is interpreted to mean that the purchase of weavon is a major factor that influences buyers' choice to also buy other products of WBC (respondents were instructed that checking [disagree and strongly disagree boxes] would denote that they purchase clean products because of their desire for weavon).

TABLE 14   Question 4: I purchase a combination of WBC products because it is my taste

Item	Frequency	Percent	Valid percent	Cum. percent
Strongly agree	3	0.4	0.4	0.4
Agree	5	0.6	0.6	1.0
Undecided	40	5.0	5.0	6.0
Disagree	8	1.0	1.0	7.0
Strongly disagree	744	93.0	93.0	100.0

TABLE 15   Question 5: I purchase a combination of WBC products because it is a cheaper option compared to other similar products in the market

Item	Frequency	Percent	Valid percent	Cum. percent
Strongly agree	4	0.5	0.5	0.5
Agree	6	0.75	0.75	1.25
Undecided	10	1.3	1.3	2.55
Disagree	10	1.3	1.3	3.85
Strongly disagree	770	96.3	96.3	100.0

TABLE 16   Question 6: I purchase a combination of WBC products because all the products have good quality

Item	Frequency	Percent	Valid percent	Cum. percent
Strongly agree	1	0.1	0.1	0.1
Agree	5	0.62	0.62	0.72
Undecided	25	3.1	3.1	3.72
Disagree	50	6.3	6.3	10.02
Strongly disagree	719	89.9	89.9	100.0

TABLE 17   The extent to which other factors (fashion, taste price, quality) influence sale of WBC's clean products

Factors	(1)	(2)	(3)	(4)	Total Frequency	Percentage
Other factors	60	48	20	31	159	5%
Weavon as a factor	740	752	780	769	3041	95%

NOTES   Column headings are as follows: (1) fashion, (2) taste, (3) price, (4) quality. Other factors: (taste, fashion, quality, and price): strongly agree + agree + undecided; weavon as a factor: disagree + strongly disagree.

The preceding results closely echoes the WBC's marketing manager's claim that their customers purchase other products of WBC whilst pur-

TABLE 18   Total volume of weavon produced from January to June 2010 with
associated increase in direct waste costs

Item	January	February	March	April	May	June
Volume produced	5000	5100	5200	5250	5300	5400
Direct waste cost (000)	N100	N110	N130	N150	N155	N162

chasing weavon and that the absence of the 'dirty' product in the stores causes low sales of these other products. Consequently, given the market interactions between weavon ('dirty product') and 'clean products' of the wbc Company explored in the preceding sections; the author submits that such interactions (give and take services) although obscured, have concealed waste cost implications for the production of the dirty product (weavon). The suggested cost implication and corresponding suggestion model to approach a fair allocation of such cost are discussed in the subsequent sections.

Towards a Suggestion Model of Allocation of Increase in Direct Waste Costs of the Weavon ('Dirty Product')

Information from the production department shows an increase in the production of weavon, which according to the marketing manager is meant to keep enough quantity of weavon in the stores to promote the sales of other products. The crux of this paper is that this increase propels an increase in the direct waste cost of weavon, which could not have arisen if normal production quantity of weavon was maintained. Hence, this paper argues that since this increase in production of weavon and associated increase in direct waste cost is driven by the management's desire to promote the sales of other products. Therefore, weavon should not be held responsible for the increase in the direct waste costs since it is beyond the control of weavon department. Consequently, it may be objective to assign the increase in direct waste cost of weavon to the benefiting products according to the ratio of benefit derived (i. e. increase in the sales volume of 'clean' products) which results from stocking the 'dirty' product in stores. The increase in volume of weavon produced due to management decision and associated increase in direct waste cost for January to June is presented in table 18.

Using the month of January as the base year, the increase in direct waste cost associated with increase in the volume (table 18) of weavon is:

$$N10000 + N20000 + N20000 + N5000 + N7000 = N62000.$$

TABLE 19   Calculation of increase in sales volume of clean products resulting from keeping the 'dirty' product in stores

Sales volume for soap whilst weavon is in stock	4460
− Sales volume for soap excluding weavon in stock	− 2065
= Total increase in sales volume	= 2395
Sales volume for cream whilst weavon is in stock	5995
− Sales volume for cream excluding weavon in stock	− 2980
= Total increase in sales volume	= 3015
Sales volume for soap whilst perfect finish is in stock	5910
− Sales volume for soap excluding perfect finish in stock	− 2645
= Total increase in sales volume	= 3265
= Total	= 8675

The Suggestion Model of Allocation, Economic Benefit Assignment (EBA), is based on the ratio of promotion benefit derived in relation to other clean products:

$$EBA = \frac{ISV_a}{TISV_{cp}} IDWC_d, \tag{1}$$

where ISV_a = increase in the sales volume of a clean product, $TISV_{cp}$ = total increase in sales volume of the three clean products, $IDWC_d$ = increase in direct waste costs of dirty product (weavon).

However, in consideration of other potential factors that may influence buyers' choice (aside of weavon) to purchase the 'clean' products of WBC, the model above is adjusted to accommodate such other factors. For instance, buyers were asked to rate the influence of (taste, fashion, quality, and price) on their decision to purchase other products of WBC whilst purchasing weavon (see table 17).

Hence, taste, fashion, quality and price, and any other potential factor apart from the presence of weavon are termed as F_{a-z}. Therefore, they are used to adjust the model as $(1 - F_{a-z})$:

$$EBA = \frac{ISV_a}{TISV_{cp}} IDWC_d (1 - F_{a-z}), \tag{2}$$

where F_{a-z} = other factors (apart from weavon) influencing the purchase of clean products, measured in percentage.

Table 17 shows that aggregate percentage of other factors (taste, fashion, quality and price) which influence buyers' choice to purchase WBC's

'clean' products is about 5%. Therefore, the model is applied to allocate the increased direct waste cost of weavon as follows:

$$EBA = \frac{ISV_a}{TISV_{cp}} IDWC_d(1 - 0.05),$$

$$soap = \frac{2395}{8675} N62000(1 - 0.05) = N16261,$$

$$cream = \frac{3015}{8675} N62000(1 - 0.05) = N20470,$$

$$perfect\ finish = \frac{3265}{8675} N62000(1 - 0.05) = N22168.$$

From the market study presented in this paper, the 'dirty' product (weavon) is found to boost the sales of the other 'clean' products in the market, thereby offering an obscured sales promotion service to the 'clean' products, but this relationship appears to be neglected by management. This unrecognised service offered by the 'dirty' product gives rise to two conditions: the sales promotion service (though hidden) is unrewarded and the 'dirty' product continues to shoulder the burden of increasing direct waste costs associated with increased production volume of 'dirty' product which is strategically increased by management to sustain the sales of the clean products. Since the increase in production volume of weavon and increase in direct waste cost is beyond the control of weavon department, the above model apportions the amount of increase in direct waste costs (N62000) to the clean products according to the ratio of sales volume increase in relation to other benefiting products. Hence, weavon is freed from the burden of additional direct waste cost which it is not actually responsible to. The author suggest that such allocation would allow equity and fairness in waste cost allocation, and may impact on product costs and prices of both products of wbc. Furthermore, it may also impact fairly on performance evaluation. Overall, such fair allocation would incentivise weavon department toward continual effort in its cleaner manufacturing processes and in upholding its product quality.

Summary and Conclusion

This paper has attempted to suggest a model to reward a 'dirty product' which has the potential to offer sales promotion services to other 'clean products' in a multiple product firm. It is based on a simple case of a six

months market study in five retail cosmetic shops. Consumer purchase preference was observed on 'clean' products made by wbc Company as the 'dirty' product was made to be on and out of stock in the stores in an alternating fashion.

It is found that the polluting product of the company – weavon ('dirty product'), attracts consumers to patronize other three products ('clean products') of wbc amidst other substitute brands by other companies in the same shops. It is also found that the quality of weavon – the 'dirty product' of wbc Company endears it to consumers and that this patronage is transferred to other products of wbc such that if weavon is out of stock in the shops, the 'clean products' experience low sales volume in contrast to when the 'dirty product' is in stock.

This paper argues that since the cost of cleaning and washing of weavon enhances the 'dirty' product's admirable quality which in turn favours the 'clean products' of the wbc Company. Equity and objectivity in waste cost allocation should mean that the increase in direct waste costs, although direct to the 'dirty product,' be proportionately assigned to the 'clean products' which derive sales promotion benefit from the 'dirty product' according to the ratio of promotion benefit derived. It is argued that this is imperative given that the desire by the wbc management to place weavon in stores as a booster for other products increases the production of weavon and also increases the direct waste costs of weavon, which is beyond the direct control of weavon department. Hence, this paper suggests a model – Economic Benefit Assignment (eba) for apportionment of direct waste costs where a polluting product offers sales promotion benefit to other 'clean products' of the same company, and proposes that, given similar conditions to this case, benefiting products should be assigned a proportion of the direct waste cost of the polluting product (as a service charge) based on the proportion of promotion benefit (sales benefit) received from the polluting product. The idea is that (in consideration of transfer pricing theory) such promotion service would be paid for, if offered by an outside agent. Whilst academic debate is expected to ensue from this suggestion model, further case research is imperative to demonstrate industrial applicability. Further study is also recommended to investigate potential implication for performance evaluation. Such studies are imperative in contemporary period where proper environmental cost allocation has become relevant in divisional performance evaluation and toward incentivising managers' innovative practices in cleaner production.

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Labour Taxation and Its Impact on Employment Growth

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The paper aims to assess the characteristics of labour taxation for five different groups of workers and labour market performance (in terms of employment and unemployment rate) in the EU and to examine whether tax wedge affects employment growth in the EU. The descriptive empirical estimates show that the level of labour taxation varies greatly across EU Member States, by which the tax wedge tends to be higher among New Member States (excluding Cyprus and Malta). Furthermore, the panel regression analyses confirm statistically significant negative relationship between tax wedge and employment growth in the EU as a whole. Therefore, the empirical analysis suggests that the EU-27 should continue with the trend of reducing tax wedge, as this would have favourable effects on labour market performance, especially among New Member States.

Key Words: labour taxation, employment growth, labour market, economic policy, European Union
JEL *Classification:* J30, J38

Introduction

The impact of labour taxation on labour market outcomes has been a subject of numerous discussions in recent years. Namely, by creating a wedge between total labour costs to the employer and the corresponding net take-home pay of the employee, labour taxes in not perfectly flexible labour markets reduce demand for labour (if demand for labour is not perfectly inelastic) and employment and, therefore, increase unemployment (Vodopivec 2004) and intensify exit from the labour force. The existing literature suggests that labour taxation negatively affects labour market performance, yet the extent of its negative impact appears to be affected by the institutional features of the individual labour markets (for

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an overview of studies see, for example, Nickell (2003), de Haan, Sturm and, Volkerink (2003) and oecd (2006)).

In recent years, most of the oecd countries and the eu Member States started to reduce tax wedge on labour in order to alleviate unemployment problems, stimulate job creation, and improve general economic framework (oecd 2006; European Commission 2005). Therefore, the main objective of this paper is to assess the characteristics of labour taxation and labour market outcomes (in terms of employment and unemployment rate) in the eu Member States, to examine differences in labour taxation between eu-15 and New Member States (nms) and, most importantly, to analyse whether tax wedge affects employment growth in the eu.

In order to explain the characteristics of taxes levied on labour and indicators of labour market performance, we apply basic descriptive statistics. Further, we use cross plots and bivariate correlation analysis to examine the relationship between employment growth and labour taxation. To study the impact of tax wedge on employment growth in detail, we employ panel regression analysis on the sample of 27 eu Member States over the period 1999–2009, by which we expect a negative association. As the analysis of labour tax wedge would be performed for five different groups of workers and would include the latest available data (for the period 1999–2010), the study presents an important value-added in the field.

The rest of the paper is structured as follows. The second section gives a brief overview of previous empirical studies on the impact of tax wedge on labour market outcomes, followed by the presentation of data and methodology in the third section. The fourth section presents the descriptive statistics and dynamics of labour taxation and the results on the impact of tax wedge on employment growth in the eu. The fifth section concludes and gives relevant policy recommendations.

Literature Review

Tax wedge denotes the gap between the cost of labour and the purchasing power of wages (Cahuc and Zylberberg 2004, 753). In a classical competitive labour market approach, the increase of tax wedge can be presented by a downward shift in the labour demand curve. The more elastic is the labour supply curve (and/or demand curve), the higher is the negative effect of tax wedge on employment (Carey 2003, 39–40). Several theoretical and empirical studies try to explain the relationship between labour tax-

ation and labour market outcomes, taking into consideration different institutional features of the individual labour markets (i. e. regulations concerning employment protection, unemployment benefits, minimum wages, skill levels, rigidity of wages and structure of wage bargaining and other labour market policies and institutions). In the continuation of this section, we briefly present some of the most influential empirical studies performed on the macro-level.[1] An overview of these studies is available in de Haan, Sturm and Volkerink (2003), Nickell (2003) and OECD (2006).

In one of the most cited studies, Nickell and Layard (1999) studied the panel of 20 OECD countries between 1983–1994 and showed that a decrease in average tax wedge (including payroll, income and consumption taxes) for 5 percentage points would reduce the unemployment rate by 13%. Likewise in one of the following studies, Nickell (2003) reported that an increase in tax wedge by 10 percentage point would result in the reduction of labour input of the working age population by somewhere between 1 and 3%. Similarly, based on the panel of 21 OECD countries during 1983 and 2003, Bassanini and Duval (2006) confirmed that high tax wedge and generous unemployment benefits increase aggregate unemployment and lower employment prospect. Their obtained empirical results have shown that a 10 percentage points reduction of the tax wedge in an average OECD country would reduce equilibrium unemployment by 2.8 percentage points and increase the employment rate by a larger 3.7 percentage points (due to the positive impact on participation). The detrimental effect of labour taxation on unemployment in OECD countries was confirmed also by Belot and van Ours (2004). Using the panel of 18 OECD countries during the 1960–1994 period authors found that a 10 percentage point higher tax rate is related to a 1.2 percentage point higher unemployment rate.

Several important analyses on the impact of labour taxation on labour market performance have also been performed in the EU countries. For example, Daveri and Tabellini (2000) argued that the slowdown in the economic growth and an increase in unemployment in European countries over the 1965–1991 period were associated with higher labour taxes in combination with institutional characteristics of the labour market. Namely, the correlation was stronger in highly unionized countries of the Continental Europe and much less so in the Scandinavian countries with highly centralized trade unions. The importance of the collective bargaining arrangement was also confirmed by the study of the Euro-

pean Commission (2004), which found that the negative effect of tax wedge on employment is higher in the EU countries with intermediate levels of bargaining co-ordination.[2]

With the enlargement of the EU, a number of authors start to focus their research on the impact of labour taxation on the labour market performance of the NMS. Góra et al. (2006) confirmed a negative effect of tax wedge on employment growth in eight NMS and provided evidence that tax wedge more strongly affects employment rates among low-skilled workers, but high-skilled are rather immune from this effect. Kosi and Bojnec (2006) examined the effect of tax wedge on employment growth in the EU-25 over the period from 1997 to 2004. They established that the impact of labour taxation on employment growth tends to be significantly larger in the eight EU transition countries (NMS) than in the EU non-transition countries. In similar vein, Cazes (2002) found that payroll taxes in transition countries are positively correlated with unemployment rates, especially with long-term and youth unemployment rates. Furthermore, Võrk et al. (2007) showed, using panel regression analysis of eight NMS between 1996 and 2004, that higher tax wedge has a significant negative impact on labour force participation and employment rate (especially for elderly). The results showed that reduction of the tax wedge by 1 percentage point increases employment rate by about 0.2–0.7 percentage points. A detrimental effect of high tax wedges and/or inappropriate benefits systems on the generation of desirable labour market outcomes (employment, unemployment and inactivity) was confirmed also on the sample of ten Central and Eastern EU Member States (CEE)[3] by Behar (2009). A brief review of the literature suggests that tax wedge has been one of the significant reasons for unfavourable labour market performance among countries. Nevertheless, even the estimates of the negative impact of tax wedge on labour market outcomes may be relatively strong, they are subjected to criticism due to robustness of data and empirical model (Blanchard 2006).

Methodology and Data

The analysis of labour taxation is based on the average tax wedge indicator calculated according to the OECD methodology (see OECD 2008). The tax wedge is expressed as the ratio of total labour taxes to total labour costs as paid by an employer:

$$ATW = \frac{PIT + SSC_e + SSC_f + PT - CB}{w + PIT + SSC_e + SSC_f + PT}, \tag{1}$$

where *ATW* stands for average tax wedge, *PIT* is personal income tax, SSC_e social security contributions paid by employees, SSC_f social security contributions paid by firms/employer, *PT* payroll tax paid by employers, *CB* cash benefits and *w* net wage. In the analysis we observe tax wedge for five different groups of workers, i. e. single worker without children at three different wage levels (67%, 100% and 167% of average wage), single worker with two children receiving 67% of average earnings and two-earners family (one receiving 67% and the other 100% of average earnings) with two children. Workers are employed in industry sectors c–k.[4]

The methodological scope of this paper is twofold. Firstly, we examine the level of labour taxation for all of the above mentioned family types, employment rate, and unemployment rate in the EU Member States by using descriptive statistics. Moreover, we present differences between EU-15 and NMS (statistical significance of differences is tested by the Mann-Whitney U test).[5] The analysis is performed on the latest available data for 2009 and 2010.

In the second part of our empirical analysis, we firstly examine whether tax wedge can explain variations in employment growth among the EU countries by applying two-variable cross-country scatter diagrams and bivariate correlation analysis. We continue our empirical analysis with an in-depth study of the impact of tax wedge on employment growth. Following the macroeconomic empirical studies on this issue (see for example Nickell and Layard 1999; Daveri and Tabellini 2000; Belot and van Ours 2004; Võrk et al. 2007; Žižmond and Novak 2006), we employ a panel regression analysis, performed on the sample of 27 EU Member States over the 1999–2009 period. The panel regression analysis includes Driscoll-Kraay standard errors to control for heteroskedacity, autocorrelation and cross-sectional dependence.[6] We formed a regression function (2) with the following specifications:

$$EG_{i,t} = \alpha + \beta_1 \cdot \ln TW_{i,t} + \beta_2 \cdot D_{i,t} + \beta_3 \cdot DTW_{i,t} + \Pi \cdot \begin{bmatrix} \ln GDPpc_{i,t} \\ \ln IR_{i,t} \\ \ln LP_{i,t} \end{bmatrix} + \varepsilon_{i,t}, (2)$$

where *EG* denotes employment growth in country *i* at time *t*, *TW* stands for tax wedge, *GDPpc* for gross domestic product (GDP) per capita, *IR* for inflation rate and *LP* for labour productivity. Parameter ε stands for stochastic disturbances. Moreover, we also introduce dummy variable *D* in the interactive and multiplicative form *DTW* (*D* multiplied by *TW*)

in order to control for differences between EU-15 (dummy variable takes the value 0) and NMS (dummy variable takes the value 1). We perform five separate regression analyses, i. e. for each of the studied family types and wage levels (see above).

Data on employment growth were collected on the basis of Labour Force Surveys and present the change in percentage from one year to another of the total number of employed persons in the country (see http://epp.eurostat.ec.europa.eu). The main explanatory variable is tax wedge, other explanatory variables represent control variables. Therefore, as a measure of control for macroeconomic effects that may influence labour market developments, we include GDP per capita (expressed in Purchasing Power Standards – PPS) and inflation rate (in order to take into consideration effects in monetary or fiscal policy). Labour productivity is measured as GDP in PPS per hour worked.

The panel data on labour taxation were obtained from OECD and Eurostat databases (http://stats.oecd.org/index.aspx; http://epp.eurostat.ec .europa.eu). Data for control explanatory variables (except for labour productivity) were obtained from Eurostat and official reports of the European Commission (2009a; 2009b; 2010). The data on labour productivity were obtained from The Conference Board statistical database (http://www.conference-board.org/data/economydatabase).

Although the period we analyse is determined by the availability of the data, going further back in the past would not bring clear results in most of the NMS, as their economies were under great influence of the transitional economic and political processes (see Vodopivec, Wörgötter, and Raju 2005; Võrk et al. 2007; Jerman, Kavčič, and Kavčič 2010). Moreover, the analysis focuses on the size of the tax wedge-employment growth relationship on the labour demand side, while it does not study in detail the effects of factors at the labour supply side and other labour market institutions (for example minimum wage, skills, employment protection legislation, etc.).

Empirical Analysis

OVERVIEW OF LABOUR TAXATION AND LABOUR MARKET PERFORMANCE IN THE EUROPEAN UNION

There are large differences in the level of labour taxation among EU Member States. As can be seen from table 1, which gives an overview of the latest available data on tax wedge for three family types at three dif-

TABLE 1 Tax wedge according to the family type and level of average earnings, employment rate and unemployment rate (in %) in the EU, 2010

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Austria	43.3	47.9	50.4	26.4	40.0	71.7	4.5
Belgium	49.5	55.4	60.6	34.8	47.8	62.0	8.4
Bulgaria[a]	33.9	33.8	33.8	19.4	28.0	59.7	10.3
Cyprus[a]	:	:	:	:	:	69.7	6.4
Czech Republic	38.9	42.2	44.7	15.7	34.4	65.0	7.4
Denmark	36.7	38.3	44.5	11.0	33.7	73.4	7.6
Estonia	38.6	40.0	41.2	23.4	35.5	61.0	17.3
Finland	36.3	42.0	47.9	24.7	36.5	68.1	8.5
France	45.5	49.3	53.2	37.2	44.3	64.0	9.3
Germany	44.9	49.1	51.5	29.7	41.4	71.1	7.2
Greece	34.4	36.6	41.9	34.4	35.7	59.6	12.7
Hungary	43.6	46.4	52.7	26.6	39.2	55.4	11.2
Ireland	23.4	29.3	39.9	−9.5	21.1	60.0	13.7

Continued on the next page

ferent levels of average earnings, Belgium, France and Germany exhibit the highest level of labour taxation, whereas Ireland and Malta stand out with the lowest tax wedge.

All EU Member States, with exception of Bulgaria, record a progressive tax wedge (commonly due to progressive income tax rates), implying that the level of labour taxation increases with an increase of wage levels. Namely, average value of labour taxation in the EU-27 in 2009[7] amounted 37.0% for single worker with 67% of average earnings, whereas 43.8% for worker with 167% of average earnings. As can be seen from table 2, the progressivity of tax wedge is more intense among old Member States. Moreover, labour is less taxed for families (for a single worker with two children and 67% of average earnings on average amounted 20.5%, whereas for two-earner family 34.8%), mostly due to their entitlement to cash benefits.

Labour taxation in the EU is relatively high in international comparative framework, especially when compared to OECD countries that are not members of the EU. For example, average tax wedge for single worker with 67% and 167% average earnings amounted 24.0% and 31.8%, respectively, what for even 13.0 and 11.2 percentage points, respectively, ex-

TABLE 1   *Continued from the previous page*

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Italy	43.6	46.9	52.1	27.2	42.1	56.9	8.5
Latvia[a]	41.5	42.2	42.7	28.2	35.0	59.3	19.0
Lithuania[a]	38.9	40.7	42.1	8.0	36.6	57.8	18.0
Luxembourg	27.5	34.0	41.4	0.4	20.9	65.2	4.4
Malta[a]	17.7	22.3	26.4	1.1	18.8	56.0	7.0
The Netherlands	34.0	39.2	42.5	14.4	33.7	74.7	4.5
Poland	33.4	34.3	35.0	28.4	30.8	59.3	9.7
Portugal	32.8	37.7	43.8	21.6	33.1	65.6	11.4
Romania[a]	43.1	44.4	45.5	30.7	41.0	58.8	7.6
Slovakia	34.5	37.8	40.2	21.4	31.2	58.8	14.4
Slovenia	38.5	42.4	47.3	11.8	33.8	66.2	7.4
Spain	36.4	39.6	42.5	28.8	36.6	58.6	20.2
Sweden	40.6	42.7	50.8	32.2	38.5	72.7	8.6
United Kingdom	29.6	32.7	37.5	10.7	28.8	69.5	7.9

NOTES   Column headings are as follows: (1) single person, 0 children, 67% of average earnings, (2) single person, 0 children, 100% of average earnings, (3) single person, 0 children, 167% of average earnings, (4) single person, 2 children, 67% of average earnings, (5) 2-earner family, 2 children, 67% and 100% of average earnings, (6) employment rate (15–64 years), (7) unemployment rate (15–64 years). [a] Data refer to the year 2009. Adapted from Eurostat (http://epp.eurostat.ec.europa.eu) and OECD (http://stats.oecd.org/index.aspx).

ceeds the average of the EU-27 (differences are statistically significant at 5% level of significance). These high differences among others reflect less strict employment regulation among non-EU OECD countries.

Comparing old and new EU member countries, labour taxation is on average lower in NMS for all family types and at all levels of average earnings. However, the difference is not statistically significant at 5% level of significance, probably due to high variability in tax wedges in NMS (see table 2). As the low averages in NMS could be reasoned with the level of tax wedge in Cyprus and Malta,[8] two facts should be taken into consideration in further analysis. Firstly, a more appropriate measure of comparison between EU-15 and NMS is median tax wedge (see table 2) and, secondly, Cyprus and Malta should be studied separately from other (Central and Eastern) NMS, which share similar characteristics also due to the transitional development in the 1990s. This is in line with studies

TABLE 2   Descriptive statistics on labour taxation, employment and unemployment rate by groups of countries, 2009

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EU-27[a]							
Mean	37.0	40.5	44.7	20.5	34.8	64.5	9.0
St. deviation	7.4	7.5	7.6	11.8	7.5	5.9	3.6
Median	37.9	40.1	43.8	23.8	34.9	63.5	8.0
EU-15[b]							
Mean	37.2	41.5	47.1	21.1	35.7	66.9	8.4
St. deviation	7.6	7.4	6.4	13.5	8.0	5.9	3.4
Median	36.9	39.5	48.2	25.4	37.0	66.3	8.0
NMS[a,b]							
Mean	36.8	39.2	41.4	19.7	33.5	61.5	9.6
St. deviation	7.5	7.7	8.2	9.7	6.8	4.5	3.9
Median	38.7	40.7	42.1	21.2	34.2	60.6	7.8
CEE[b]							
Mean	38.7	40.9	43.0	21.6	35.0	61.4	10.3
St. deviation	4.2	5.5	6.9	7.9	5.0	3.5	3.9
Median	38.8	41.4	42.4	21.9	34.5	60.6	9.2
Estimates of the Mann-Whitney U test							
EU-15 vs. NMS	80.0	72.5	47.0**	68.5	61.5	42.5*	81.0
EU-15 vs. CEE	65.0	72.5	47.0	66.5	61.5	33.0*	58.0

NOTES   Column headings are as follows: (1) single person, 0 children, 67% of average earnings, (2) single person, 0 children, 100% of average earnings, (3) single person, 0 children, 167% of average earnings, (4) single person, 2 children, 67% of average earnings, (5) 2-earner family, 2 children, 67% and 100% of average earnings, (6) employment rate (15–64 years), (7) unemployment rate (15–64 years). [a] Cyprus is due to the lack of data excluded from the calculations of descriptive statistics for labour taxation. [b] EU-15 refers to the EU Member States that become members of the EU prior to 2004. NMS (12) refers to all EU Member States that joined EU after 2004. CEE-10 includes 10 Central and Eastern EU Member States that joined EU after 2004 (i. e. NMS without Cyprus and Malta). Significance level: * 5%, ** 10%. Adapted from Eurostat (http://epp.eurostat.ec.europa.eu) and OECD (http://stats.oecd.org/index.aspx).

performed by Ederveen and Thissen (2007), Võrk et al. (2006) and Behar (2009).

Taking into the account the above obtained conclusions, the descriptive statistical analysis shows that with the regard to the median measure CEE countries in 2009 record higher tax wedge for single workers with
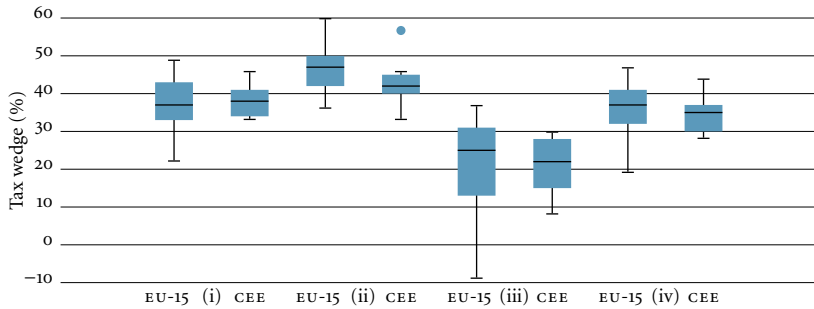
FIGURE 1   Comparison of labour taxation in EU-15 and CEE-10, 2009

NOTES   (i) and (ii) refer to single worker without children with 67% and 167% of average earnings, respectively, (iii) refers to single low-paid worker with two children and (iv) refers to two-earner family (one earning 100% and the other 67% of average earnings) with two children. The horizontal line inside the shaded box is the median value of the group; the bottom edge of the shaded box presents 25th percentile and the upper edge 75th percentile; the horizontal lines outside the box indicate the largest and the smallest value in the sample; the dot indicates the largest value in the sample of CEE-10 (56.7 per cent). Similar analysis on tax wedge for year 2005 was performed also by Behar (2009). Based on data from Eurostat (http://epp.eurostat.ec.europa.eu) and OECD (http://stats.oecd.org/index.aspx).

TABLE 3   Dynamics of labour taxation in EU-15 and CEE, 1999–2010, median

Group	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU-27	37.9	38.9	38.4	38.3	37.9	37.9	37.3	37.2	37.1	36.5
High tax wedge group	38.7	40.3	39.9	39.5	38.4	38.3	37.9	38.0	38.2	38.0
Low tax wedge group	37.1	37.6	37.0	37.1	37.4	37.6	36.8	36.4	36.1	35.0
Median EU-27	41.1	41.4	41.3	40.9	40.9	40.8	41.4	40.1	40.6	38.9

67% and 100% of average earnings, whereas the labour taxation is lower for high-paid single workers (even for 5.8 percentage points) and for both family types with children (see table 2). Differences between groups of countries are not statistically significant at 5% level of significance. Nevertheless, as it can be seen from figure 1, the height of the boxes and the distances between minimum and maximum values of tax wedge indicate higher labour taxation heterogeneity within EU-15.

Table 3 presents the dynamics of labour taxation at three different wage levels in EU-15 and CEE countries over the 1999–2010 period. The median labour taxation was, in general, slowly declining after the 2000 in both groups, by which the decline was the most pronounced in the last two years (except for high paid workers). The dynamics was more intense

in labour taxation of single average worker in EU-15, as the median tax wedge value increased for 3 percentage points in 2006 comparing to the year before and then again decreased in 2009 for 4 percentage points comparing to the year before (the dynamics mostly reflects changes in labour taxation in the Netherlands and Greece). Comparing EU-15 and CEE, the median labour taxation is higher in CEE countries for low-paid worker, whereas for high-paid workers the tax wedge is lower (yet, differences in labour taxation were not statistically significant over the studied period). On average, the decrease in labour taxation was greater among CEE countries at all family types and at all levels of earnings. Namely, over the 1999–2009 period the tax wedge for single worker at different wage levels varied between 3.1 and 3.7 percentage points in CEE, whereas in EU-15 from 0.4 to 1.3 percentage points.

Regarding the employment rate, the EU-15 countries recorded statistically significant (at 5% level of significance) higher tax wedge over the 1999–2010 period. The employment rate was steadily increasing in both groups of countries until 2008, followed by the decrease of employment in the last two years, reflecting the economic situation influenced by crisis. Therefore, the median employment rate decreased to 65.6% in 2010 in EU-15 and to 59.3% in CEE. On the other hand, the unemployment rate increased: the median unemployment rate in EU-15 in 2010 amounted 8.5%, while in CEE 10.8%, yet the difference is not statistically significant (see table 2).

As the dynamics of labour taxation and employment rate is quite similar, we examined whether there was any correlation between labour taxation and employment and unemployment rate over the 1999–2008 period. We find no evidence on the association between tax wedge and employment rate, as the bivariate correlation coefficients were statistically insignificant at 5% level of significance for all studied groups of workers. The correlation coefficients were statistically insignificant at 5% level of significance also between tax wedge and unemployment rate for single workers with 67%, 100% or 167% workers. However, the results show the existence of a weak positive association between labour taxation and unemployment rate for single low-paid worker with two children (the correlation coefficient amounted 0.257 at 5% level of significance) and for two-earner family (the correlation coefficient amounted 0.129 at 5% level of significance).[9] Therefore, a further analysis on the relationship between labour taxation and labour market performance is needed.
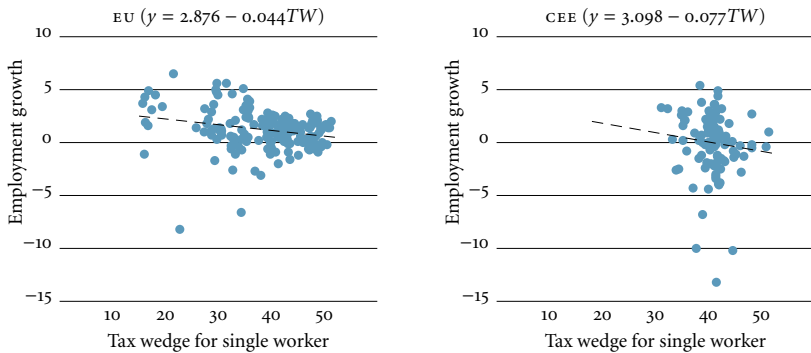
FIGURE 2   Relation between tax wedge and employment growth in EU-15 and CEE

NOTES   * with 67% of average wage; data refer to the period 1999–2009. Based on data from Eurostat (http://epp.eurostat.ec.europa.eu) and OECD (http://stats.oecd.org/index .aspx).

RELATIONSHIP BETWEEN LABOUR TAXATION AND EMPLOYMENT GROWTH

In this section, we focus on the relationship between tax wedge and employment growth. To study the association, we firstly use simple two-variable cross-country scatter diagrams to plot employment growth and tax wedge. As can be seen from figure 2, there is a weak negative correlation between tax wedge for low-paid workers and employment growth among EU and CEE Member States in the 1999–2009 period. The presence of the negative correlation between employment growth and labour taxation was observed also in scatter plots of all other studied family types. The existence of negative correlation was confirmed also by bivariate correlation analysis (see table 4). For example, the correlation coefficient between tax wedge for low-paid workers and employment growth in the EU-27 amounted –0.230 (statistically significant at 5% level of significance). However, the size of the negative correlation coefficient estimate between labour taxation for single workers and employment growth is decreasing with the rise of wages. The correlation coefficients in table 4 also show that correlation between labour taxation is higher (and statistically significant at 5% level of significance) among old EU countries. A significant negative correlation was observed for workers with children.

In order to examine the tax wedge-employment growth relation in more detail, we conducted panel data regression analysis for all EU Member States over the period from 1999 to 2009. As can be seen from table 5,

TABLE 4   Correlation coefficient estimates between employment growth and labour taxation

Country	(1)	(2)	(3)	(4)	(5)
EU-27	−0.230*	−0.195*	−0.140*	−0.174*	−0.236*
EU-15	−0.220*	−0.172*	−0.154*	−0.204*	−0.245*
CEE	−0.123	−0.095	−0.067	−0.051	−0.135

NOTES   Column headings are as follows: (1) single person, 0 children, 67% of average earnings, (2) single person, 0 children, 100% of average earnings, (3) single person, 0 children, 167% of average earnings, (4) single person, 2 children, 67% of average earnings, (5) 2-earner family, 2 children, 67% and 100% of average earnings. Signif. level: *5%.

TABLE 5   Estimates of the panel regression analysis for the EU-27, 1999–2009

Dependent variable	(1)	(2)	(3)	(4)	(5)
lnTW	−1.746*	−1.878*	−2.455*	−0.057	−1.644*
ln$GDPpc$	−0.041	−0.070	−0.114	−0.197*	−0.018
lnIR	0.611	0.624	0.646	0.577	0.583
lnLP	1.885*	1.926*	2.037*	2.165*	1.670*
D	−0.036	0.021	−0.192	−0.061	0.475
DTW	−0.003	−0.007	−0.005	−0.001	−0.022
Constant	0.520	1.376	4.011	−4.727	0.619
R^2	0.211	0.206	0.206	0.156	0.211

NOTES   Column headings are as follows: (1) single person, 0 children, 67% of average earnings, (2) single person, 0 children, 100% of average earnings, (3) single person, 0 children, 167% of average earnings, (4) single person, 2 children, 67% of average earnings, (5) 2-earner family, 2 children, 67% and 100% of average earnings. Signif. level: *5%.

the regression estimates confirm statistically significant negative impact of tax wedge on employment growth in all studied family types with the exception of low-paid workers with two children. The size of the negative impact of labour taxation on employment growth differs between workers according to their level of average earnings, confirming that the elasticities between tax wedge and employment growth are increasing with wage. Namely, an increase in tax wedge for low-paid worker for one percentage point reduces employment growth for 1.7%, *ceteris paribus,* whereas for high-paid workers decrease is higher and amounts 2.5%, *ceteris paribus.* We find no evidence on the difference in the negative impact of labour taxation on employment growth between EU-15 and NMS (the regression estimates for *DTW* are statistically significant). There-

fore, the results imply that lowering labour taxation would improve the employment growth among EU countries.

Although the panel regression coefficients on tax wedge are low and suffer from low R^2 values, findings are, in general, in line with various empirical studies, which also confirmed negative relation between tax wedge and labour market outcomes. For example, Ederveen and Thissen (2007) found a statistically significant positive relationship between unemployment rate and tax wedge on the sample of four CEE countries. Also Góra et al. (2006) showed a strong and significant negative relationship between employment growth and tax wedge in CEE and a strong impact of tax wedge employment rates of low-skilled workers. Behar (2009) as well concluded that high tax wedge and inappropriate benefit system are associated with poor labour market outcomes, but the evidence was weak.

Concluding Remarks and Policy Recommendations

This paper assessed the characteristics of labour taxation and labour market performance in the EU Member States based on the latest available data and examined whether tax wedge affected the employment growth in the EU Member States over the period from 1999 to 2009.

The findings of the paper imply that the reduction in taxes on labour could increase demand on labour and employment as it would motivate the employers to create jobs,[10] especially for low-wage workers, and increase people's willingness to work (OECD 2009). The establishment of the employment-friendly wage is also crucial for increasing productivity and improving general economic framework in the EU (European Commission 2005). Several Member States have already taken measures to reduce tax wedge such as reducing social security contributions for disadvantaged groups, lowering tax threshold for personal income tax, tightening the provision of contributions for self-employment, changing the legislation in the field of minimum wages and social security contributions, increase in nominal wages, etc. (more information on measures across the EU Member States are available in quarterly reports of the European Employment Observatory (http://www.eu-employment-observatory.net) and in Carone et al. (2009)).

Policy recommendation following from our empirical analysis is clear: the EU should continue with the trend of reducing labour taxation, as this would have favourable effects on employment growth and would consequently lead to higher productivity and improve competitiveness.

However, the reduction in tax wedge is not a sufficient measure to increase employment, as the reasons for high unemployment rate in many EU Member States are very diverse and complex, including high unemployment benefits, wage negation system and powerful labour unions, employment protection legislation, differences in distribution of wages within EU, etc.

To conclude, the findings of this paper are, in general, in line with previous empirical research, as the empirical estimates confirm the detrimental effect of tax wedge on employment growth. The added value of the paper comparing to previous empirical studies stems out of the panel regression analysis performed on five different groups of workers and thereby higher robustness of the results and the inclusion of the latest available data for EU countries. However, one has to remember the limitations of these findings deriving from the availability of good time series information on tax wedge, its composition, and other labour market outcomes; small number of variables used and therefore possible formation of omitted variables problem; and insufficient sources of variation and low value of R^2.

Notes

1 Although we mainly focus on the macroeconometric empirical literature (due to the nature of our methodological approach), there are also several empirical studies based on the micro data (see for example Gruber 1997; Kugler and Kugler 2003; 2009).

2 Likewise, Elmeskov, Martin and Scarpeta (1998) argued that the collective bargaining systems could influence the manner in which tax wedge affects unemployment. Authors showed that the effect of tax wedge is lower in countries with highly decentralised and centralised bargaining arrangements and stronger in countries with intermediate levels of co-ordination.

3 CEE countries are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

4 According to NACE Rev. 2, sectors C–K were replaced by sectors B–N.

5 The Mann-Whitney U non-parametric test was used due to small number of studied countries.

6 The presence of heteroskedacity, autocorrelation and cross-sectional dependence was confirmed by the likelihood-ratio test, Wooldrige test and Pasaran CD test, respectively.

7 Although the data for 2010 are available, we present descriptive statistics for 2009, as the data are accessible for all EU Member States, except Cyprus.

8 The low levels of tax wedge in Cyprus and Malta might be linked to their historical ties to Britain, as also Ireland and United Kingdom show one of the lowest tax wedges in the EU-15 (European Commission 2009a).

9 As the correlation coefficients are statistically insignificant for most studied cases we do not present them in a separate table, however are available at the authors.

10 Lower tax rate may increase companies' business expectations which may increase the companies' willingness to employ (Stubelj 2010).

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Najugodnejše menjalno razmerje in fiskalna politika za Slovenijo na njeni poti v območje evra
Reinhard Neck, Gottfried Haber in Klaus Weyerstrass

Članek analizira oblikovanje slovenske makroekonomske politike na njeni poti v območje evra. V njem simuliramo scenarije različnih politik s posebnim poudarkom na različnih režimih menjalnih razmerij. V ta namen uporabljamo slovenski makroekonomski model, imenovan slopol4. Ob uporabi tega modela smo določili najugodnejše menjalno razmerje in fiskalno politiko. Narejenih je bilo več optimizacijskih preizkusov z različnimi predpostavkami (stalnim menjalnim razmerjem, spremenljivim menjalnim razmerjem in plazečim stalnim tečajem) ob vstopanju Slovenije v območje evra.

Ključne besede: najugodnejši nadzor, ekonometrični model, makroekonomska politika, Slovenija, analiza senzitivnosti
Klasifikacija jel: e5, e6, c5, o5
Managing Global Transitions 10 (3): 231–243

Ekonomija in matematična teorija iger
Ajda Fošner

Teorije iger je področje matematike, ki se pojavlja tako v ekonomiji in managementu, kot tudi na drugih družboslovnih področjih. Teorija se uporablja v vojaške namene, v politiki, mednarodnih odnosih, na področju računalništva, biologije in ekologije. Namen članka je predstaviti teorijo iger v povezavi z matrikami, prednosti in slabosti teorije ter novejše raziskave na tem področju. Predstavljeni so nekateri osnovni primeri in uporaba teorije v ekonomiji.

Ključne besede: teorija iger, matrične igre, ekonomija
Klasifikacija jel: c7
Managing Global Transitions 10 (3): 245–256

Prilagodljive strategije kot odgovor na ekonomsko krizo: medkulturna raziskava v Avstriji in Sloveniji
Dietmar Sternad

Pričujoča študija temelji na predhodnih raziskavah o kulturnih razlikah pri strateškem odločanju in analiziranju, razširi pa jih na področje

stateškega kriznega prilagajanja. S pogledom od zgoraj smo poskušali ugotoviti, ali je kulturna razsežnost izogibanja negotovosti vplivala na strateške usmeritve, ki so jih managerji izbrali kot odgovor na globalno finančno in ekonomsko krizo v letih 2008–2009. Na podlagi izbora možnih odgovorov na strateške krize in podatkov, zbranih v kvantitativni raziskavi, opravljeni med 257 managerji v Avstriji in Sloveniji, lahko sklepamo, da različno razumevanje vprašanj, ki se zastavljajo ob ekonomski krizi, kakor tudi medkulturne razlike, vplivajo na odločitev o navzven ali navznoter usmerjenih strateških odzivih, ter na odločitev o proaktivnih ali varčevalnih strategijah. Vendar pa razlik v uporabi strategij v eni ali drugi državi ne moremo nedvoumno pripisati razlikam pri kulturni razsežnosti izogibanja negotovosti, kar namiguje na to, da imajo pomembno vlogo tudi za posamezno državo značilni dejavniki, kakršne so institucionalne in družbene razlike.

Ključne besede: prilagajanje, kriza, izogibanje negotovosti, Avstrija, Slovenija

Klasifikacija JEL: L10, L20

Managing Global Transitions 10 (3): 257–282

Dodeljevanje ekonomskih ugodnosti pri razporejanju okoljskih stroškov

Collins C. Ngwakwe

Cilj članka je predlagati model »nagrajevanja umazanega izdelka«, ki pa lahko spodbudi prodajo drugih, »čistih« izdelkov, ki jih izdeluje isto podjetje. Članek predlaga model dodeljevanja ekonomskih ugodnosti pri razporejanju neposrednih stroškov odpadkov, pri katerem okolju neprijazen izdelek spodbuja prodajo »čistih« izdelkov istega podjetja, iz česar sledi, da je treba »čistim« izdelkom pripisati del neposrednih stroškov odpadkov okolju neprijaznih izdelkov v sorazmerju s prispevkom, ki ga ti imajo pri spodbujanju prodaje posameznih »čistih« izdelkov. Zamisel temelji na teoriji transfernih cen, po kateri bi storitve spodbujanja prodaje sicer morali plačati zunanjemu izvajalcu. O predlaganem modelu sicer pričakujemo akademsko razpravo, vendar pa so nujne tudi analize primerov, s katerimi bi dokazali uporabnost modela v industriji.

Ključne besede: razporejanje okoljskih stroškov, razporejanje stroškov odpadkov, dodeljevanje ekonomskih ugodnosti, ocenjevanje učinkov, kalkuliranje na podlagi sestavin dejavnosti, transferne cene

Klasifikacija JEL: M11, M41

Managing Global Transitions 10 (3): 283–299

Obdavčitev dela in njen učinek na rast zaposlenosti

Primož Dolenc in Suzana Laporšek

Namen prispevka je prikazati značilnosti obdavčitve dela za pet različnih skupin delavcev in stanja na trgu dela v EU ter proučiti, ali obdavčitev dela vpliva na rast zaposlenosti v EU. Rezultati empirične analize kažejo, da med državami članicami EU obstajajo precejšnje razlike v obdavčitvi dela, pri čemer je davčni primež višji med novimi državami članicami (razen Cipra in Malte). Rezultati panelne regresijske analize tudi kažejo, da ima davčni primež statistično značilen negativen učinek na rast zaposlenosti v EU. Na podlagi empirične analize lahko sklepamo, da bo nadaljnje zniževanje davčnega primeža imelo ugodne učinke na rezultate na trgu dela v EU, zlasti med novimi državami članicami.

Ključne besede: obdavčitev dela, rast zaposlenosti, ekonomska politika, Evropska unija

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