Competitive Pressure and its Social Consequences in EU Member States and in Associated Countries

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Workpackage 1: "Competitive Pressure in the Corporate Sector, its Institutional Aspects and Policy Framework"

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Competitive pressure in the corporate sector, its institutional aspects and policy framework:

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1. Introduction

Competitive pressure manifests itself in a wide-range of economic and societal phenomena and is an agent of structural and societal change. The deepening and widening of international economic integration within the enlarged EU reduces the cross-border barriers to market competition and has a profound impact on firm behaviour. In addition, the emergence of new global economic powers, especially in Asia, adds to the intensity of competitive pressure in international and domestic markets. Within the COMPPRESS research project, WP1 "Competitive pressure in the corporate sector, its institutional aspects and policy framework" has attempted to capture some of its key implications such as the changing behaviour and adjustment of firms in response to the growing competitive pressure. In particular it aims at highlighting some of the implications of the growing competitive pressure on firm performance in some of the new EU members that joined the Union in 2004 (such as Hungary and Slovenia) and on the candidate countries that have set for themselves the target to do so in 2007 (Bulgaria and Romania).

Competitive pressure affects firms' behaviour and performance through a variety of channels, in the first place through the actions undertaken by other firms attempting to lure the same limited bunch of customers in the same market. Notably, competitive pressure in product markets arises not only from firms operating in the domestic market (both domestically and foreign owned) but also from imports. Hence, another factor that affects the level of competition on the product markets is the degree of openness of the economy in terms of the freedom of access by foreign firms to sell their products domestically. Actions by other firms provoke counteractions or other responses by incumbent firms that seeks to preserve or increase their market share. It is (some of) these counteractions or responses that we have sought to investigate within WP1.

The efficient operation of the market mechanisms also affects the degree of competition on the product markets. For example, the existence of various market imperfections (such as information asymmetry, state intervention on the market or administrative controls over the operation of the market) may also affect the level of effective competitive pressure. The latter can be also substantially reduced due to various entry or exit barriers. It is a basic underlying concept in economic theory as the role of competition in shaping the behaviour of economic agents is recognized, and reflected in (either explicitly, or implicitly), numerous theoretical models and derivations. It is also a key notion in economic policy as the understanding of the nature of competitive pressure and its impact on firms' behaviour and performance is a key factor behind piles of legislation and regulatory norms.

The intensity of competitive pressure faced by the firms operating in a given market is the complex outcome of the interactions of numerous agents. While it arises from the direct interaction of firms with their competitors in the marketplace, these interactions also reflect the indirect effect of the actions of other stakeholders such as government bodies entrusted with the implementation of public policy (in particular, the institutions with delegated authority to implement competition policy), creditors and other financial institutions, suppliers and customers, organized labour unions, business associations, etc. In the broader sense (North, 1990) institutions are the norms and rules, including the incentive systems that govern and structure the interactions of economic agents. In particular, competition policy is one of the areas where public intervention can and does directly affect firms' behaviour causing it to change compared to a situation of the absence of such regulation. Competition policy also represents one of the realms in which a European-wide approach has attained the highest degree of application. Within WP1 we have also addressed some competition-related interactions between firms and institutions and their effect on enterprise behaviour and performance.

The main research objective in Workpackage 1 was thus to analyze the effects of competitive pressure on the corporate sector in the context of the institutional and policy environment (the effect of the growing competitive pressure in these countries and the variety of firm-level responses), including the identification of different models and common patterns of enterprise adjustment, and the assessment of the impact of competition policy and its institutional framework on enterprise behaviour and performances.

We pursued the following research strategy. In the first phase of the project (undertaken in 2003), the main focus of research was on the actual measurement of competitive pressure in the corporate sector of the countries that we study. We defined relevant quantifiable indicators to reflect the level of competitive pressure that firms in these countries are subject to and quantified these indicators which has also allowed making cross-country comparisons. The indicators selected for this purpose are based on the use of detailed enterprise data containing individual firm level record for the corporate entities. The actual indicators were carefully selected in order to allow for the application of a uniform methodology across all countries.

During the second phase of research (undertaken in 2004) the focus of research turned to aspects of enterprise adjustment to competitive pressure in imperfect markets. The new EU member countries Hungary and Slovenia and, even more so, the EU candidates Bulgaria and Romania are countries that have undergone (and are still undergoing) a fundamental economic transformation from centrally planed to market economies. Their transitional markets are immature and still marred by numerous imperfections that affect all aspects of firm performance. The key research objective in WP1 during this phase was to examine empirically, and on a comparative basis, some important aspects of firm adjustment to competitive pressure, more specifically, the changes in productive efficiency and pricing policy.

In the third phase of research (undertaken in 2005) we developed further our methodological approaches and applied them extensively on firm level data for these countries. The empirical research efforts in this phase followed two main directions. First, we continued the comparative empirical analysis of firm adjustment to competitive pressure, by developing a methodology for analyzing some aspects of firms' behaviour and performance in imperfect markets and applying this methodology to empirical data. Second, we analyzed the effects of competitive pressure on the corporate sector in the context of the institutional and policy environment, by developing a methodology for analyzing the firm's responses to changes in this environment and applying this methodology to empirical data.

2. Measuring competitive pressure

2.1. Theoretical background

The literature is not unanimous about the definition of competition and there do not exist coherent and robust measures of competition or competitive pressure. In addition there is often a gap between notions and concepts used to define or reflect in the theoretical literature and the attempts to actually measure competition and competitive pressure in the empirical literature.

As to theoretical approaches of measuring competitive pressure, there are what came to be known as "structural" and "non-parametric" approaches (Bresnahan, 1989). The structural approach seeks to relate competitive pressure to the supply response of a representative firm to a given demand (function), given its cost structure/function. In turn, the non-parametric approach seeks to relate competitive pressure to revealed preferences in the market, regardless of the actual demand and cost curves.

Boone (2000) raises the issue of the monotonicity of the measures of competitive pressure, claming that a true measure of competition should be monotone in their parametrization (while many of the measures suggested in the literature do not satisfy this property). While no ultimate solution still exists, a common ground could be found by linking competition to the efficiency and profitability of firms: competition raises the profits of more efficient firms relative to less efficient ones and reduces the profits of the least efficient firms; as a results rising competition may induce re-location of resources by forcing inefficient firms to exit while allowing more efficient firms to increase their output (the "selection effect") of competition.

In the empirical literature, preference is usually given to more pragmatic ways of approaching the measurement issue: the choice of measures is generally confined to indicators that can be quantified on the basis of measurable and observable source data.

Whatever the differences in the approaches advanced in the literature, there seem to be a general accord in the literature on some basic premises regarding competition such as:

- Competitive pressure arises from the interaction of firms with their competitors on the marketplace.
- There is no unique way to quantify directly competition; what is quantifiable is at best a partial or indirect reflection of true competitive pressure; accordingly, there can be various possible approaches to the partial or indirect measurement of competition and competitive pressure.
- Both theory and empirical work suggest a link between competitive pressure and market structure, i.e. the way the market place is organized and structured.

In the remaining part of this section we review some of the main conclusions in the literature on market structure, focusing on indicators that are usually considered to reflect competitive pressure that stems from market structure.

There are several theories on the formation and evolution of market structure. The so called "technological theories" have their roots in the works of early evolutionary economists. Thus Schumpeter (1934) deduces that firms' size and their distribution in the market is determined by economies of scale and scope, specialization, coordination. Large firms operating in a concentrated market are the main engine of innovation and hence they are the main engines driving the evolution of market structures.

Later Demsetz (1973) suggested another paradigm of the evolution of technological structures, that of "efficient market strictures". In that line of thinking the "revealed" market structure reflects the growth of more efficient firms and this would then shape the evolution of the market structure. In other words, more efficient firms would tend to expand their market share at the expense of less efficient firms which would eventually be forced to exit.

Within the same strand of the literature, the works of Sutton's (1991, 1998) emphasized the importance of the return to innovation and endogenous sunk costs in shaping market structures and their evolution.

The so called "organizational theories" of market structure (see Carroll and Teece, 1999) underline the importance of the firms' internal organization and structure for their evolution and growth. Thus the "contracting cost" theories focus on the role of external and internal contracts as well as of contracting and transaction costs. By contrast, other organizational theories have advanced the idea that firms' growth and evolution depends on who controls the "critical resource" in the firm (the so called "critical resource" theories suggested by Grossman and Hart (1986)).

Other theoretical approaches to the explanation of market structure stress the importance of the institutional environment and institutional factors in general. Among the factors that have been put forward as determinants and driving forces of firms' dynamics are the regulatory environment (and in particular the regulation of entry and exit), the judicial

system and the efficiency of law enforcement, the financial system and the accessibility of external finance (financing constraints in imperfect capital markets) as well as the institutional framework of corporate governance systems (Kumar, Rajan and Zingales, 2001).

One of the influential theories of market structure was that put forward by R. Gibrat (1993) (and which came to be known as "Gibrat's Law") which argues that firms growth follows a random path and is independent of initial size, i.e. the growth path of individual firms during a given period of time does not depend on their size at the beginning of this period. The resulting distribution of firms' size (which shapes the market structure) is log-normal. A number of empirical works, starting from Simon and Bonini (1958), provided evidence which was consistent with Gibrat's Law. However, evidence from more recent empirical work based on more complete data sets is not always in agreement with Gibrat's Law; in particular, it has been found that newly established firms in general tend to grow faster than older firms (Geroski, 1995; Lotti and Santarelli, 2001).

Recent work by Sutton (1991, 1998, 2001a) develops further the theoretical understanding of market structure. He combines various theoretical notions (including those of the organizational and institutional theories) to develop his basic concept of the firm as an organized set of capabilities One of the arguments laid down by Sutton (2001b) is that the observed firm size depends also on the internal structure of firms and the ways they structure their business.

2.2. Empirical measures of competitive pressure arising from market structure

As noted, due to data and measurement constraints, there is often a mismatch between theoretical concepts of competitive pressure stemming from market structure and the actual indicators used in empirical work. Based on what is most common used in the empirical literature and the availability of data for the countries covered in this project we have selected the following indicators for the quantitative measurement of competitive pressure related to market structure:

a) Firms' size.

The most commonly used indicator of size is market share which also captures the market power of firms. (While size can also be measured by other indicators such as number of employees or firms' assets, these fail to capture the very important characteristic of market power.) Market share is most often defined as:

m_{ij} - firms' market share, within the firm's own market (the actual and potential competitors, which for practical purposes can be approximated by NACE sectors (from NACE 1-digit to NACE 3-digit sectors):

(1) $m_{ij} = Q_j / \sum_j Q_{ij}$, where Q_{ij} denotes the firms' sales.

There are also other indicators of size suggested in the literature, for example measures related to capital or labor intensity (Kumar, Rajan and Zingales, 2001) which have both a theoretical justification and specific importance; however, for the purposes of our analysis we stay with

b) Size distribution and concentration.

There is a growing literature on the actual definition and measurement of size distribution and its impact on competition which offer increasingly sophisticated measures

for this purpose. Still the mostly widely used indicators of competitive pressure related to size distribution are at the same time the simplest ones that have been in application for many years. The most popular amongst them are the measures of concentration. The degree of concentration of the firms' access to the market can be measured in different ways such as:

- the cumulative share of the k largest firms in a specific market (which for practical purposes can be approximated by NACE sectors (from NACE 1-digit to NACE 3-digit sectors))

- the Lorentz curve of distribution of firm size which in this case is a measure of the degree of inequality of market shares. The slope of the Lorenz curve reflects the degree of inequality (e.g. the Lorenz curve degenerates into a straight line when all firms are of equal size). Similarly, the degree of inequality can be reflected with the Gini coefficients computed on the distribution of market shares (it takes the value of 0 for equal size distribution).

- The Herfindahl index is probably the most widely used measure of industrial marekt concentration.

(2) $h_i = \sum_j m_{ij}^2 = \sum_j a_j (\mathbf{Q}) Q_j$, where $a_j (\mathbf{Q}) = Q_j / \{\sum_j Q_{ij}\}^2$

where for the practical purposes of this study the index can be computed for NACE sectors (from NACE 1-digit to NACE 3-digit sectors).

The Herfindahl index takes into account both the number of the firms in the specific market and their size differences (e.g. it takes the value 1 when there is only one firm in the market and is close to 1 when the number of firms is small and or when the degree of inequality in market shares is greater). In contrast to the Lorenz curve/Gini coefficient, the Herfindahl measure of concentration is non-zero for equal size distribution of firms in the market.

Empirical studies often employ some easy to compute indicators which highlight important aspects of competitive pressure related to market structure. In particular, some indicators seek to reflect competitive pressure related to the participation in the international division of labor and, in particular, trade. Thus competitive pressure may arise both from the import activity of foreign firms in the local markers and from the export activity of local firms in foreign markets. It is also widely acknowledged that foreign owned (FDI) firms may make a notable difference on local firm's behaviour, especially when the host is an economy which still has net reached a level of maturity. The impact of the presence of FDI firms on local competitive pressure may be reflected by the degree of their penetration in local markets.

More specifically, some of these indicators can be defined as:

- Exposure to export markets by NACE sectors (from NACE 1-digit to NACE 3-digit sectors) defined as the share of exports in the total firms' sales in the respective sector EM_i:

(3) $EM_i = \sum_j E_{ij} / \sum_j Q_{ij}$, where E_{ij} is the value of the individual firms' exports and Q_{ij}, as before, denotes the firms' sales.

- Import penetration by NACE sectors (from NACE 1-digit to NACE 3-digit sectors) defined as the share of imports in the total domestic sales in the respective sector IP_i:

(4) $IP_i = M_i / (M_i + \sum_j Q_{ij} - \sum_j E_{ij})$ where M_i is total imports in sector i and $(\sum_j Q_{ij} - \sum_j E_{ij})$ is the value of total domestic sales by domestic firms in sector i.

- foreign presence in domestic markets as measured by the market share of foreign owned firms by NACE sectors (from NACE 1-digit to NACE 3-digit sectors) F_i:

(5) $F_i = \sum_j QF_{ij} / \sum_j Q_{ij}$, where $QF_{ij} = Q_{ij}$ if the firm is foreign owned and is 0 otherwise.

The above can be evaluated for two categories of foreign firms:
- share of sales by foreign controlled firms (majority stake)
- share of sales of firms with foreign participation (minority stake)

2.3 Other measures of competitive pressure

The issues related to price competition (and some of the corresponding quantitative indicators) are discussed later in the paper so here we only touch upon non-price competition. Although the existence of non-price competition is widely acknowledged both in theory and in empirical applications, it is much more difficult to measure and quantify than price competition. In the absence of directly observable quantitative indicators, applied research usually resorts to indirect measures. One possible approach of devising theoretically justifiable indirect measures of non-price competition is to follow Sutton's (2001a) conceptual framework which emphasizes the importance of innovation and endogenous sunk costs in shaping the firms' dynamics and hence market structure. If firms grow in a competitive environment, they both face competitive pressure from other firms and exert such pressure on other firms. According to Sutton's model, the growth of firms (and hence competitive pressure generated and faced by them) is closely associated with innovation (and hence R&D activity) and endogenous suck costs (among which setup costs including entry costs play a key role). The importance of the latter can be indirectly measured by some of the observable firm-level indicators (which in turn can be interpreted as indicative of non-price competition):

- *Market share competition* by NACE sectors (from NACE 1-digit to NACE 3-digit sectors) as defined by the *level of advertising expenditure* in the sector A_i:

(6) $A_i = \sum_j AE_{ij} / \sum_j OE_{ij}$, where AE_{ij} is the firm's advertising expenditure and OE_{ij} is the firm's total operating expenditure.

- *Future market share competition* by NACE sectors (from NACE 1-digit to NACE 3-digit sectors) as defined by the *level of investment activity* in the sector I_i:

(7) $I_i = \sum_j FI_{ij} / \sum_j FA_{ij}$, where FI_{ij} is the firm's fixed investment and FA_{ij} is the firm's total fixed assets.

- *Future product competition* by NACE sectors (from NACE 1-digit to NACE 3-digit sectors) as defined by the *level of R&D expenditure* in the sector R_i:

(8) $R_i = \sum_j RDE_{ij} / \sum_j OE_{ij}$, where RDE_{ij} is the firm's advertising expenditure and OE_{ij} is the firm's total operating expenditure.

Most of the indicators of competitive pressure outlined above have been quantified for the countries participating in the study and these measures have been used in the empirical analysis of enterprise adjustment in response to competitive pressure.

3. The effect of competitive pressure on firm behaviour and performance: a theoretical framework

3.1. Conceptual issues and literature review

The existence of competitive markets is generally considered as an essential prerequisite for productive efficiency and a fundamental requirement for the efficient allocation of resources in the economy. However, in reality the conditions of perfect competition are never met; all product and factor markets are characterized by various degrees of imperfection. While this is the case in all economies (including mature market economies), the frequency and severity of market imperfections is likely to be much more pronounced in immature economies such as the Central and Eastern European countries that are still undergoing the transformation from central planning to market economy.

The degrees of imperfection – as well as the degrees of competition – in the product and factor markets depends on a variety of factors that affect the behaviour of market participants. What concerns product markets, it is usually assumed that the most important among them are the market structure (in terms of market power) and the actual functioning of the market. The market structure and, in particular, the presence of firms (groups of firms) with monopolistic (oligopolistic) concentration of market power is considered as one of the main characteristics of the degree of market competition. It is a well known fact that Central and Eastern European countries inherited from the past highly distorted economic structures characterized by a high degree of monopolization; despite the ongoing restructuring, this legacy still affects the emerging new market structures in these countries.

Another factor that affects the level of competition in the product markets is the degree of openness of the economy in terms of the freedom of access by foreign firms to sell their products domestically. Traditionally competitive pressure was a notion that used to be de-limited into national boundaries. National borders served as effective barriers that safeguarded – to a different extent – domestic firms from international competition and cushioned the effect of competitive pressure coming from abroad. The opening up of the Central and Eastern European economies and, especially the process of their integration with the EU, changed considerably the nature of competitive pressure that local firms are facing as well as its impact on firms' behaviour. Competitive pressure in the local product markets increasingly arises not only from firms operating in the domestic market but also from the activities of foreign firms operation on the domestic markets as well as from imports per se. The efficient operation of the market mechanisms also affects the degree of competition in the product markets. For example, the existence of various market imperfections (such as information asymmetry, state intervention in the market or administrative controls over the operation of the market) may also affect the level of effective competitive pressure. The latter can be also substantially reduced due to various entry or exit barriers.

The varying degrees of competitive pressure in the product and factor markets affect firm performance; indeed firms respond to changing competitive pressure by adjusting their behaviour. However, the firms' response (consequently reflected in the behaviour and performance of individual firms) largely mirrors the incentive and governance structure at the micro level. Thus the competitive environment will only have the expected effect on enterprise performance and will contribute to the improvement of productive and macroeconomic allocative efficiency if the proper incentive and governance structures are in place at the micro level. In contrast, if the latter is distorted, this may instigate the emergence of perverse behaviour, and the outcome (for example in terms of productive and allocative efficiency) may be different.

Another specific aspect of Central and Eastern European economies is the fact that while the firms' governance structures are rapidly changing, they also reflect the legacies of the past when all firms were state-owned. It is conventionally assumed that the transformation of ownership during the transition is a central component of the reform of governance structures. Both the privatization of the former state-owned enterprises (SOEs) and the emergence of new private companies play an important role for the establishment of proper governance structures based on entrepreneurship and leading to higher efficiency. However, many empirical studies have shown that the formation of the new governance structures tends to be a lengthy process. As indicated by the experience of some transition economies, some methods of privatization (in particular the voucher privatization) do not generate, at least in the initial phase, efficient governance structures. In addition, the incidence of soft micro budget constraints – an endemic phenomenon in the early years of transition – also tends to distort managerial incentives and erodes the effect of competitive pressure.

The firms' adjustment in response to competitive pressure can take various forms and can affect different facets of firm performance, such as the production technology (including the efficiency of factor utilization), the firm's capital structure, the demand for different production factors, the firm's pricing behaviour, etc. In this paper we focus on two types of adjustment: changes in productive efficiency and changes in pricing behaviour, which are among the most important features of the firms' response to changing competitive pressure.

Both the theoretical literature and empirical research suggest that, that when markets are imperfect, higher competition and competitive pressure enhance productivity and efficiency. Two main strands in the literature, based on two conjectures (Nickell, 1996; Djankov and Murrell, 2002):

- Productivity increases thanks to x-efficiency gains driven by competitive pressure. When competitive pressure is low, managerial effort if undersupplied which shifts the firm's production schedule away from the production frontier expressing the maximum amount of output obtainable with a given technology from a given mix of input quantities. The reverse occurs when competitive pressure rises because of the effect of factors such the emergence of opportunities for comparison and increased incentives for better performance including the threat of exit. Higher competition may also affect workers' effort, especially when they share the rents associated with product markets. All of these factors may lead to improvements in the firm's technical efficiency.

- High competition within an industry brings about high overall productivity due to rationalization of the industry entailing reallocation of resources across firms: when firms compete for market share, resources move from less efficient to more efficient firms which grow faster and increase their market share. In addition, the threat of bankruptcy which can be accompanied by job loss also strengthens work incentives which may translate into higher labour productivity in individual firms and within the whole industry.

The relevance of some of these theoretical conjectures for the Central and Eatsren European economies has been tested in the recent empirical literature.

On the basis of a comprehensive enterprise survey covering 3400 firms in 24 transition economies Carlin, Schaffer and Seabright (2004) and Carlin, Fries, Schaffer and Seabright (2001) find strong evidence of the power of competition in influencing firm performance. Both studies (which use a common dada set) highlight the power of competition in influencing firm innovation and growth. As to the more specific findings, the authors argue on the basis of their results that the presence of some market power together competitive pressure, especially from foreign suppliers, strongly and robustly enhances firm performance. At the same time, they also find evidence that firms in the transition economies may still be not fully prepared to face the full power of trans-boundary competitive pressure:

due to the weakness of local firms too strong a competitive pressure may even possibly have a destructive impact on local markets (drain on firm performance). In a similar vein, the results of the survey also highlight the danger of the incidence of unchallenged monopoly of single firms in these nascent markets; a much healthier environment is that where at least two or three equally strong firms compete with each other.

Estrin, Konings, Zolkiewski and Angelucci (2001) analyse firm performance in three Central and Eastern European countries (Bulgaria, Poland and Romania) and in general find evidence that domestic competitive pressure is associated with better firm performance. More specifically, firms that faced strong competition from imports, were more likely to undertake active restructuring in order to raise their efficiency. But similarly to Carlin, Fries, Schaffer and Seabright (2001), they also find that if the technology gap between domestic firms and importers is too large, import competition may discourage enterprise restructuring. In addition, according to their findings, firm responsiveness to competitive pressure in the transition economies is closely associated with the quality of corporate governance. In particular, firms in which the state retained a controlling stake were much less responsive to competitive pressure that firms dominated by private ownership.

Hanousek, Kocenda and Svejnar (2004) have traced the performance of the large Czech firms for a period of several years and have attempted to identify the effect of privatization on firm performance. In the case of the Czech Republic, large-scale privatization was implemented through the voucher schemes which allowed carrying out the ownership change relatively quickly; however, the governance structure that emerged after it (with ownership concentrated in poorly managed privatization funds) was not conducive for restructuring. Consequently, the formal change in ownership did not have a straightforward effect for the strengthening of competition and the authors do not detect major change in the behaviour of privatised firms in the immediate aftermath of privatization. By contrast, the do find out that the performance of foreign controlled firms is notably superior to that of domestic firms. The same phenomenon was characteristic for Romanian business environment, as the voucher scheme of privatisation was enforced in an early stage of transition, without clear effects on the governance structure and on firms' efficiency.

With respect to the effect of competitive pressure on firm level productive efficiency, most of the related empirical research has generally followed the approach of jointly estimating these factors in the context of an augmented production function. The seminal paper by S. Nickell (1996) – who was among the first to address this issue empirically in a comprehensive and consistent manner – in a way has set some standards which have been followed in a number of recent studies based on deterministic functional forms. Nickell's approach is also appealing due to its relatively simplicity: it is based on a production function which is augmented to analyze the impact of a number of additional factors on: a) the level of productivity and b) the change in productivity. The operationalisation of the analysis of the determinants of firm level efficiency requires in principle to define a structural efficiency model. This is still a rather blank field in economic theory and most empirical studies rely on partial models that allow estimating reduced form equations. Among the most commonly used in the analysis of the determinants of firm level efficiency are several factors which can be grouped into two main categories competition effects and governance effects.

Recently a growing body of empirical studies on firms' efficiency in the transition economies have turned to stochastic production frontiers. Due to the specificity of firm adjustment and performance during the transition (low starting levels of productive efficiency, substantial heterogeneity of performance across firms, time variability of productive efficiency due to restructuring) it is considered that this approach at least potentially has superior analytical power and may provide a better insight into the details of productivity change and its determinants. For example, Konings and Repkine (1998) use

stochastic production frontier techniques to study the production efficiency of Bulgarian and Romanian firms and find evidence of large inefficiencies in both countries. Jones, Klinedinst and Rock (1998) apply the same approach in their analysis of the performance of Bulgarian manufacturing firms. Halpern and Kőrösi (2001a) also analyze the efficiency of Hungarian firms during period 1990-1997 by using production frontier techniques. Using the same approach, Piesse and Thirtle (2000) make an attempt to distinguish between technological and efficiency components of the TFP of Hungarian firms in the late 1980s – beginning of 1990s.

Grosfeld and Tressel (2002) have analysed the performance of large Polish firms listed on the Warsaw stock exchange. They find evidence that product market competition has a strong positive effect on firm performance, especially in privatized firms. In addition they find that product market competition and good governance tend to reinforce each other's effect (and hence are complements rather than substitutes) on firm performance. Orazem and Vodopivec (2003) analyze how the efficiency of Slovenian firms changed in response to competitive pressures and find strong evidence that market competition fosters efficiency. While their results show that during the transition most Slovenian firms managed to raise their efficiency, the degree of these changes was closely associated with the competitive pressure they were facing. They also show that market rising competition as a result of new entrants (such as foreign-owned firms, and importers) also raise the overall firm efficiency in the industry.

Some recent studies on the impact of competition on enterprise performance in the transition economies have revealed quite a divergent picture of this aspect of enterprise adjustment. In a comprehensive survey-based study, Konings (1997) analyzed the relationship between competition and firm productivity in Hungary, Romania and Slovakia during the first phase of transition. The study did not find uniform patterns as regards the impact of competition on enterprise behaviour: the sample of the surveyed firms (more than 300 firms with different ownership status in the three countries) was rather heterogeneous across countries and ownership forms. One of the conclusions of the study, however, was that the impact of competition was the strongest in the case of newly established private firms whereas the results were mixed in SOEs and privatised firms. Halpern and Kőrösi (2001a) who analyze the impact of market structure on the efficiency of Hungarian firms during the period 1990-1997 find time-varying dynamics of firm efficiency during this period as well as considerable heterogeneity among the firms in their sample. One of the conclusions of the study is that the recent trend towards higher firm efficiency can be at least partly attributed to the greater competition in the domestic market, largely driven by firms with foreign participation.

Two studies on corporate performance in Russia come up with results similar to the above as to the evolution of competitive pressure during the transition and its impact on the efficiency of Russian firms. While an earlier study by Brown and Brown (1998) concludes that during the first years of transition market structure was not a significant determinant of firm performance in Russia, the later study by Brown and Earle (2000) finds strong evidence that competition on domestic product and labour market as well as import competition have had a positive effect on the total factor productivity of Russian firms.

Several empirical studies have focused on the impact of competitive pressure on the restructuring and performance of Bulgarian firms during the transition. Djankov and Hoekman (2000, 1996) find a positive effect of the liberalization and opening up of the economy on firms' efficiency, stressing however, that this effect is stronger for the non-exporting firms which in the past were less exposed to competitive pressure. Jones, Klinedinst and Rock (1998) using stochastic production frontiers techniques report mixed evidence of the effect of competition on firm performance in 1989-1992: on the one hand,

they find that private ownership (associated with better governance) has a positive impact on efficiency but the impact of other factors such as market structure and exposure to foreign markets was more ambiguous. On the other hand, a study of bank-enterprise relations in Bulgaria (Dobrinsky *et al.*, 2001) reveals that the protracted financial distress of Bulgarian firms during the transition and the absence of proper governance led to significant distortions in managerial motivation and incentives; in turn, these distorted incentives ware causing perverse responses of firms to competitive pressure.

Much of the empirical research on firms' pricing behaviour in imperfect markets is based on the notion of monopolistic price formation, i.e., the existence of a price mark-up over marginal cost. There are two possible straightforward approaches to the measurement of the firm's mark-ups: one of them requires relevant data on the firm's output prices and marginal costs; the second necessitates the quantification of the price elasticity of demand faced by the firm. Roberts and Supina (1996, 2000) have applied the first of these approaches to analyze the price mark-ups charged by different producers on a set of 13 homogeneous products. To do that they specify and estimate a cost function using plant level data and then construct estimates of the marginal cost that vary by plant. The individual firm-level mark-ups can be then calculated using plant level output price data. Morrison (1992) uses a similar approach based on generalized Leontief cost and expenditure functions to analyze the mark-up behaviour of U.S. and Japanese firms. The second approach (based on the demand elasticity) has been explored in Justman (1987) and Shapiro (1987), among others. The main practical problem of these two approaches (and the reason why their application has been relatively limited) is that they require detailed firm-level price and cost information which, in general, is not readily available and may be difficult to obtain. However, non of these approaches have been so far applied to economies in transition, mostly due to the absence of adequate data.

Another strand in the empirical literature originates in the seminal paper by Hall (1988) who analyzed the implications of market power on productive efficiency, factor demand and pricing behaviour. Using a two-factor production function, Hall showed that under imperfect competition the primal Solow residual is not solely attributed to autonomous technical change, but may partly reflect monopolistic pricing behaviour. He used his derivation to estimate average industry markups using for this purpose longitudinal industry-level data. Hall's approach was tested and extended in a number of subsequent studies (Shapiro, 1987; Domowitz, Hubbard and Petersen, 1988, among others).

Roeger (1995) established that in the presence of market power (violating the conditions for perfect competition), the dual Solow residual can also be decomposed into two such components: one attributed to autonomous technical change and another one – to the markup charged by the monopolistic firm. Importantly, he derived an easily estimable equation from the emerging wedge between the primal and dual Solow residuals that can be used for direct estimation of price markups. One of the most attractive features of Roeger's approach is the fact that it is exceptionally undemanding with respect to data: thus in the case of a two-sector production function its application only requires (firm- or industry-level) nominal values of value added, labour and capital costs.

Hall's work and, especially, Roeger's result inspired a series of empirical studies. Thus Oliveira Martins, Scarpetta and Pilat (1996) and Oliveira Martins and Scarpetta (1999) estimated sectoral markup ratios on the basis of longitudinal data for the OECD economies. Several studies related variations in markup ratios to the business cycle (Bloch and Olive, 2001; Linnemann, 1999; Weiss, 2000; Wu and Zhang, 2000). In a cross-country study, Hoekman, Kee and Olarreaga (2001) analyzed the impact of import competition and domestic market regulation on the formation of industry-level markups. Kee (2002) used an extension of Roeger's approach for the case of non-constant returns to scale (both Hall and

Roeger assume constant returns to scale) to compute markups for Singapore's manufacturing industries, again on the basis of longitudinal sectoral data for 1974-90.

More recently the same method has been applied to firm-level data (using either cross-sectional or pooled enterprise data), which in principle opens wider opportunities to analyze micro behaviour. Basu and Fernald (1997) emphasize the importance of inter-sectoral heterogeneity when analyzing the relationship of markups and returns to scale, even from the macroeconomic viewpoint. This also facilitates the resolution of one rigid assumption incorporated in studies based on industry-level data, namely that the markups are either time-invariable or directly related to the business cycle. Using this type of data some studies have not only attempted to estimate markup ratios but have also tried to assess the impact of competitive pressure on their formation (Dobrinsky, Markov and Nikolov, 2001; Halpern and Kőrösi, 2001b; Konings, Van Cayseele and Warzynski, 2003). In a similar vein, Konings, Van Cayseele and Warzynski (2001b) seek to identify whether competition policy matters in shaping the firms' pricing behaviour.

3.2 Competitive pressure and firms' productive efficiency: a modelling framework

Firm level productive efficiency defines the capacity of different firms to convert the same mixes of input quantities into different quantities of output. Traditional empirical research on the productive efficiency of firms and it determinants has largely been based on the notion of total factor productivity (TFP) and TFP change in the broad sense. The adoption of this notion as a working assumption and its practical elaboration allows to distinguish between the variation in output which is caused by variation in factor inputs and those changes in the level of output that are assumed to be attributed to the efficiency of resource transformation *per se*, i.e. the efficiency of the underlying production technology. The objective of empirical research is then to fit a production function on the observed data and to filter out the above two components of output variation. Although there are varieties of empirical approaches, conceptually most of them fall in the framework developed in the seminal works of Nickell, Wadhwani and Wall (1992) and Nickell (1996).

Depending on the assumptions about the properties of the production technology various techniques have been suggested for the quantitative evaluation of efficiency per se. One of the more traditional approach has been to define a pre-determined functional form for the production technology in which total factor productivity is treated a separable factor and estimate this function as the average function that fits the observed data.

$$(9) \qquad q_j = f(A, \boldsymbol{X}_j, \boldsymbol{\beta}) \exp(\varepsilon_j)$$

where q_j is output of firm j, $f(.)$ is a suitable functional form, $\boldsymbol{X}_j$ is a vector of firm j's inputs, A is the total factor productivity index, $\boldsymbol{\beta}$ is a vector of parameters to be estimated and ε_j is a normal random term with zero mean. The time index is omitted in all variables for simplicity.

This approach has numerous variations arising form the possible assumptions regarding the way total factor productivity is treated in the production function as well as its own functional form. The treatment of the residual term ε_j adds another source of variation: thus on the one side it may be assumed that ε_j merely reflects factors that are not captured by the production function but which are not necessarily related to TFP; on the other side one can believe that ε_j is an integral element of TFP due to the existence of factors that are not explicitly captured by A. For example such an assumption in the case when T is an autonomous component of A (multiplicably separable in f(.)) would imply that the true TFP is:

(10) $TFP = T\ exp\ (\varepsilon_j)$

The assumption regarding the time variability of TFP ($A(t) \neq$ const) also can result in different models and hence measures of efficiency. Actually the time derivative(s) of TFP are regarded as important dimensions of firm efficiency.

Relatively recently, with the elaboration of more sophisticated econometric approaches, the main focus of research has shifted to the attempts to estimate production frontiers which are closer to the theoretical definition of the production function as the function expressing the maximum amount of output obtainable with a given technology from a given mix of input quantities (Aigner, Lovell and Schmidt, 1977). The underlying assumption in empirical applications is that within a sample of firms (say, within an industry), the frontier defines the maximum level of output which is feasible at the given level of technological efficiency. The production frontier is usually assumed to be stochastic and hence, the positioning of firms *vis-à-vis* this frontier (the "distance" from the frontier) is considered to reflect the relative level of technical efficiency in individual firms:

(11) $q_j = f(\boldsymbol{X}_j, \boldsymbol{\beta})\ exp\ (v_j - u_j)$

where v_j is assumed to be a normal random variable with zero mean and u_j is an asymmetric non-negative random term which is assumed to be independently distributed (usually with a truncated normal distribution). In this specification the term $f(\boldsymbol{X}_j, \boldsymbol{\beta})$ defines the production frontier which reflects the "best practice" within the sample while the last term u_j represents the firm-specific (in)efficiencies vis-à-vis the production frontier.

Again, similarly to the above, in the case of stochastic production frontiers there can be a different treatment of the symmetric random term v_i in the sense whether it reflects or not components of efficiency that are not captured by other factors in the specification (Coelli, Prasada Rao and Battese, 1998). An assumption analogous to the one reflected in (2) would imply that the whole random term in (11) "exp $(v_j - u_j)$" represents firm (in)efficiency; an alternative hypothesis is that only u_j reflects technical (in)efficiency in its pure form. Also, the relative inefficiencies among subsets of firms can be treated in different ways. If the frontier is estimated over the whole sample of firms, then one can simply compute the resulting mean inefficiencies for any subset of firms; on the other hand it is also possible to estimate production frontiers for each subset of firms separately.

The next step in analyzing productivity is to seek for clues as to the determinants of the efficiency component of the variation of output. Most often this is done through augmenting the production function into a functional form that contains exogenous "determinants" of productive efficiency which allows to treat the latter as quasi factor inputs and estimate their effect in the context of the augmented production function.

In the case of the conventional production function this takes the form:

(12) $q_j = f[A(\boldsymbol{Z}_j), \boldsymbol{X}_j, \boldsymbol{\beta}]\ exp\ (v_j)$,

where $\boldsymbol{Z}_j$ is a vector of factors that are assumed to determine or affect firm level efficiency. The methodology is similar in the case of a stochastic production frontier. However, in the case of production frontiers there are two possible versions of augmenting the frontier. In the first approach, the functional form of the production frontier is augmented directly, by including additional variables to the main function:

(13) $q_j = f(\boldsymbol{X}_j, \boldsymbol{\beta}, \boldsymbol{Z}_j, \boldsymbol{\gamma})\ exp\ (v_j - u_j)$.

With a reference to the research goals of analyzing firms' responses to changing competitive pressure, $\boldsymbol{Z}_j$ will be again a vector of competition related variables factors. In this case they are assumed to determine or affect directly the level of the frontier but not the distance of the firm from this frontier (or inefficiency term) u_j. $\boldsymbol{\gamma}$ is a vector of estimable parameters.

The second possible approach is to estimate so called "inefficiency effects models". In this case it is attempted to explain the distance from the frontier (or inefficiency term) u_j through a set of augmenting variables:

(14) $q_j = f(\boldsymbol{X}_j, \boldsymbol{\beta}) \exp [v_j(\boldsymbol{Z}_j, \boldsymbol{\gamma}) - u_j]$

In order to operationalize these approaches for empirical purposes it is necessary to designate concrete functional specifications for the production technology and its extensions. The empirical work undertaken within the context of this workpackage has relied on some of the widely used functional specifications such as the Cobb-Douglas production function. However, we have used different modifications of this function such as two-factor and three factor specifications (defined over value-added or gross output, respectively). Omitting the fir index j, these specifications are as follows:

(15) $Y = A\ L^{\alpha_L} K^{\alpha_K}$,
(16) $Z = A\ L^{\alpha_L} M^{\alpha_M} K^{\alpha_K}$,

where Y, Z, L, M and K stand for real value added, real gross output (real sales), labor, intermediate and capital inputs, respectively, and A is the measure of productive efficiency (technical progress).

Apart from the above static specifications (which imply instantaneous adjustment over time), we have also used dynamic specifications (implying a gradual adjustment over time, which may be a more appropriate assumption for the conditions of imperfect markets):

(17) $Y = A\ (Y\text{-}1)^{\sigma} L^{\beta_L} K^{\beta_K}$,
(18) $Z = A\ (Y\text{-}1)^{\sigma} L^{\beta_L} M^{\beta_M} K^{\beta_K}$,

Furthermore, the specified production functions are augmented with variables that are supposed to capture the effect of competitive pressure on firm adjustment. There can also be different approaches to analyzing these effects. Thus by augmenting the production function and estimating it in levels (actually, log-levels) one we could seek to capture the effect of the augmenting factors on the level of technical efficiency. Alternatively if we estimate the PF in log differences we could try to capture the effect of the augmenting factors on the rate of change of technical efficiency.

3.3 The effect of competitive pressure on firms' pricing behaviour in imperfect markets

Some of the important results of the neoclassical production theory are derived under the standard assumptions of perfect competition in product and factor markets, sometimes coupled with that of constant returns to scale. In particular, under perfect competition in efficient product and factor markets, firms producing homogeneous products set their prices at their marginal costs which, under constant returns to scale, also equal their average costs.

Put differently, under perfect competition firms adjust their output level and cost structure so that to set their marginal costs equal to the exogenous price level.

The assumptions of perfect competition and constant returns to scale – as well as the theoretical results derived in a framework that incorporates them – are often applied in empirical studies as well, including microeconomic studies based on firm-level data. However, perfect competition in efficient markets is a purely theoretical notion that hardly matches reality even in mature market economies. This is even more so when considering economies that are still undergoing a fundamental transition from planned to market economic systems. Given the legacies of the past and the difficulties experienced during the transition period, domestic product and factor markets in these economies are still marred by numerous deep-seated imperfections.

Recent theoretical advances as well as the related empirical research have shown that the departure from the standard assumptions of perfect competition and constant returns to scale may have important implications with respects to the derived theoretical behavioural characteristics of representative firms and the validity of the conclusions based on the related empirical analysis. Relaxing some of the assumptions of perfect competition and constant returns to scale has led to various extensions of the standard neoclassical results related to the pricing behaviour of firms endowed with monopolistic power (see, among others, Hall, 1988 and Roeger, 1995).

The acceding post-transition economies are mired by market imperfections by their nature: they started from a non-market economy, where institutional settings were specifically designed to substantially constraint market competition and to block some of the most important consequences of the competitive adjustment process. Market structure at the onset of transition was almost entirely the outcome of previous centrally planned and directed investment decisions. Centrally planned economies were over-industrialized and the industrial structure was heavily concentrated in large state-owned firms that often enjoyed monopolistic position. Domestic markets were further protected by non-convertible exchange rates that amplified the firms' monopoly power. Prices were as a rule set centrally by the planning authorities (the extent of price controls differed from country to country) and had no market clearing properties; as a result shortages were endemic (Kornai, 1980). Financial markets were virtually non-existent or only existed in a rudimentary form; the allocation of bank credit was to a large extent directed by the planning authorities. The labour market was deeply distorted; the artificially low wages produced the appearance of labour shortages. The resultant structure of relative prices, in particular factor prices (relatively cheap labour and relatively expensive capital equipment) induced a distorted production structure and factor mix, deterring the introduction of modern technologies.

Transition was indeed the process of implementing institutional reforms for removing these obstacles, and the adjustment process in which economic agents gradually adjust their behaviour to the norms of a functioning market economy. Reforms undertaken during the transition have undoubtedly contributed to the evolution of the market environment in these countries; nevertheless, deep-seated market imperfections – inherited from the past or related to the difficult process of economic transformation – are still endemic. One of the important specificities of the market environment of economies in transition is that some of the ongoing changes (especially those involving structural and institutional transformation) involve a long adjustment process during which the functioning of markets is affected by carryover effects and inertia, often leading to significant distortions (to name just a few of the typical distortions of transitional markets).

Restructuring of firms (often involving de-monopolization measures), subsequent privatization of state-owned firms as well as the removal of entry barriers to the domestic market have contributed to major changes in market structure. Nevertheless, a number of

firms retained dominant positions on the domestic market for a sufficiently long period after the start of market reforms. Transition-specific corporate governance problems have had a major impact on enterprise behaviour and performance, especially during the earlier phases of transition. Prior to privatization, state-owned firms were often left in a governance vacuum; soft budget constraints were endemic leading to the emergence of distorted and perverse managerial incentives (Dobrinsky et al., 2001a). The emerging financial markets (in the first place, the market for commercial credit) performed under considerable information asymmetries as firms had no proper track record of creditworthiness; this resulted in considerable distortions in the allocation of financial flows to the corporate sector. The housing market was slow to develop, reducing the mobility of labour and giving rise to a segmentation of the labour market. The deep transformational recession experienced by all transition economies (Kornai, 1993) implied a lasting period of excess capacity for most firms, due to sunk capital that surfaced as a result of the knock-on effect of economic liberalization. The problem was further compounded by the inherited distortions in the capital structure. All these specificities suggest that markets in transition economies are marred by much deeper imperfections than those in well functioning mature market economies.

Importantly, the extent to which such transition-specific distortions are still present in the market environment of individual countries largely depends on their progress in economic transformation and market reforms. For example, while the acceding post-transition countries are similar in the sense that they are all former centrally planned economies that embarked on a process of economic and political transformation in 1989, during the transition countries followed very different policies, which in effect produced divergent outcomes in terms of their economic performance and path of institutional change.

It is a well-established result in production theory that under perfect competition in efficient product and factor markets, firms producing homogeneous products set their prices at their marginal costs. In addition, if the production technology is characterized by constant returns to scale, and there are no dynamic effects, average costs equal marginal costs and hence the output price. These conditions do not necessarily hold in a world of imperfect competition, as typical of the economies in transition. In particular, the incidence of a monopolist endowed with market power may result in a shift of the equilibrium point away from its would-be position under perfect competition. If the demand curve faced by a monopolist producing product y is downward sloping, the equilibrium price p_y will exceed the marginal cost μ by a mark-up θ ($\theta > 1$) which depends on the price elasticity of demand η:

$$(19) \qquad \theta = p_y / \mu = 1/(1 + 1/\eta)$$

In other words, monopolistic firms may use their market power to set prices above their marginal costs.

While price markups over marginal costs are considered to be important characteristics of firms' behaviour in imperfect markets, they are not directly observable. Apart from the theoretically justifiable expectation that $\theta > 1$ (as the elasticity of demand η for a downward sloping demand curve is negative) there are no other priors as to the values of the markups. Their actual measurement has long interested empirical economists and various approaches to their indirect estimation have been suggested in the literature. The differences in approaching the measurement issue stem both from the underlying theoretical methodology and from the specific objective of the measurement exercise (e.g. to quantify the markups charged by individual firms on individual products, or to measure the average markups of individual firms, or to estimate the average markups across specific industries).

The definitional identity (19) offers two possible straightforward approaches to the measurement of the firm's markups: one of them requires relevant data on the firm's output prices and marginal costs; the second necessitates the quantification of the price elasticity of demand faced by the firm. Roberts and Supina (1996, 2000) have applied the first of these approaches to analyze the price markups charged by different producers on a set of 13 homogeneous products. Morrison (1992) uses a similar method to analyze the markup behaviour of U.S. and Japanese firms. The second approach has been explored in Justman (1987) and Shapiro (1987), among others. The main practical problem of these two approaches is that they require detailed firm-level price and cost information which, in general, is not readily available and may be difficult to obtain.

Another strand in the empirical literature originates in the seminal paper by Hall (1988) who analyzed the implications of market power on productive efficiency, factor demand and pricing behaviour. Using a two-factor production function, Hall showed that under imperfect competition the primal Solow residual is not solely attributed to autonomous technical change, but may partly reflect monopolistic pricing behaviour. Hall's approach was tested and extended in a number of subsequent studies (Shapiro, 1987; Domowitz, Hubbard and Petersen, 1988, among others). Roeger (1995) established that in the presence of market power (violating the conditions for perfect competition), the dual Solow residual can also be decomposed into two such components: one attributed to autonomous technical change and another one – to the markup charged by the monopolistic firm. One of the most attractive features of Roeger's approach is the fact that it is based on easily accessible data.

Hall's work and, especially, Roeger's result inspired a series of empirical studies, mostly based on longitudinal sectoral data (time series of aggregated sectoral data), rather than firm data proper. Thus Oliveira Martins, Scarpetta and Pilat (1996) and Oliveira Martins and Scarpetta (1999) estimated sectoral markup ratios on the basis of longitudinal data for the OECD economies. Several studies related variations in markup ratios to the business cycle (Bloch and Olive, 2001; Linnemann, 1999; Weiss, 2000; Wu and Zhang, 2000). In a cross-country study, Hoekman, Kee and Olarreaga (2004) analyzed the impact of import competition and domestic market regulation on the formation of industry-level markups. Kee (2002) used an extension of Roeger's approach for the case of non-constant returns to scale (both Hall and Roeger assume constant returns to scale) to compute markups for Singapore's manufacturing industries, again on the basis of longitudinal sectoral data for 1974-90.

More recently the same method has been applied to firm-level data (using either cross-sectional or pooled enterprise data), which in principle opens wider opportunities to analyze micro behaviour. Basu and Fernald (1997) emphasize the importance of inter-sectoral heterogeneity when analyzing the relationship of markups and returns to scale, even from the macroeconomic viewpoint. This also facilitates the resolution of one rigid assumption incorporated in studies based on industry-level data, namely that the markups are either time-invariable or directly related to the business cycle. Using this type of data some studies have not only attempted to estimate markup ratios but have also tried to assess the impact of competitive pressure on their formation (Dobrinsky, Markov and Nikolov, 2001b; Halpern and Kőrösi, 2001a; Konings, Van Cayseele and Warzynski, 2005). In a similar vein, Konings, Van Cayseele and Warzynski (2001) seek to identify whether competition policy matters in shaping the firms' pricing behaviour.

Both the main theoretical results and most of the empirical studies refer to the case of a two-factor production technology with output defined as value added. However, Norrbin (1993) pointed out that defining the markup over value added may induce an upward bias in estimations. Basu and Fernald (1997) emphasize that value added can only be interpreted as an output measure under perfect competition, and its use suffers from omitted variable bias under imperfect competition. Noting this, Oliveira Martins, Scarpetta and Pilat (1996)

proposed an extension of Roeger's model for a production function defined over sales and incorporating material inputs as well (but preserving the assumption of constant returns to scale). In this extension the main features remain intact while the data requirements only rise slightly to include nominal material costs.

Most related empirical studies so far have neglected one specific aspect of markup pricing, namely the existing link between the markup ratio and the returns to scale index in the case of non-constant returns to scale. We illustrate this link in the following simplified theoretical setup. Assume that the production technology of a representative firm is characterized by a production function $y = f(\mathbf{x})$, where $\mathbf{x}$ is the vector of inputs. Alternatively, it can also be defined by the dual cost function $C = C(y,\mathbf{p})$, where $\mathbf{p}$ is the vector of factor prices. It is assumed that both f and C possess all the conventional properties that validate the duality theorems. Let the production technology be characterized by a returns to scale index λ which in accordance with the theory of production duality (see, e.g. Fare and Primont, 1995) can be expressed as:

$$(20) \qquad \lambda = [\Sigma\, x_i(\partial f/\partial x_i)]/f(\mathbf{x}) = (C/y)/\mu\ ,$$

where C/y is the average cost of producing one unit of output and μ, as before, denotes the marginal production cost $\mu = \partial C/\partial y$. From eq. (20) the marginal cost can be determined as $\mu = (C/y)/\lambda$. Substituting the latter in eq. (19) establishes a direct relationship between the markup and the returns to scale indices:

$$(21) \qquad \theta/\lambda = p_y y/C\ .$$

The right-hand side of this expression is nothing else than the firm's average profit margin. Hence eq. (21) suggests that a monopolist operating a production technology characterized by a returns to scale index λ will achieve an average profit margin which equals the markup over marginal costs θ divided by the returns to scale index. From a theoretical point of view eq. (21) establishes a direct structural relationship between (the unobservable) returns to scale and markup indices and the (observable) average profit margin.

It should be pointed out that while eq. (21) is established as a structural relationship, it does not imply anything as regards the direction of causality between the two structural parameters. Besides, the non-linear nature of this relationship prevents its direct use for empirical purposes: thus one and the same average profit margin may be consistent with an infinite number of combinations of λ and θ. Hence, while this relationship sets up an issue, it offers little help in resolving the problems associated with it.

Similarly to the measurement of the price markup, the actual quantification of the returns to scale index is essentially an empirical issue. The empirical literature dealing with returns to scale is very extensive (for a comprehensive overview of issues and problems see Quinzii, 1992). The mainstream approach starts with an assumption about the functional form of the underlying production technology and seeks to estimate the resultant production function (characterized by a specific returns to scale index). Alternatively, the starting point can be the dual cost function: assuming a functional form of the cost function and estimating it also yields the returns to scale index on the basis of the duality property (2).

The returns to scale index is present (explicitly or implicitly) in all empirical estimations of price markups. However, most of these studies do not take into account the relationships between returns to scale and markups, often assuming constant returns to scale

(including those based on Hall's and Roeger's models).[1] The assumption of constant returns to scale may be a rather restrictive assumption for empirical applications, especially as regards economies in transition. However, the departure from the assumption of constant returns to scale not only invalidates some of the widely used theoretical results but may involve an important estimation bias and may lead to erroneous empirical conclusions.

Note that assumption of constant returns to scale (i.e. equiproportional changes in factor inputs and output) is consistent with the neoclassical theoretical framework, implying perfect markets and instantaneous adjustment. Conversely, real life phenomena such as imperfect markets and adjustment lags make more likely the deviations from constant returns to scale. For example, firms equipped with excess production capacity are more likely to operate with increasing returns to scale, while firms experiencing production bottlenecks can be expected to operate with decreasing returns to scale. On the other hand, production shocks such as the sudden disruption of traditional supply chains may translate into decreasing returns to scale while x-efficiency gains may show up in the form of increasing returns to scale.

As discussed, theory suggests that the markup and the returns to scale index are two elements of a broader, structural relationship. Given the existing structural link between these two parameters, the most natural approach to their estimation would be their joint estimation in a system of structural equations where, on the one hand, the returns to scale index is treated as a parameter of the production technology and, on the other hand, the relation between markup and returns to scale is specified as a structural characteristic of the system.[2] Kee (2002) is among the few authors who address the structural nature of the relationship between returns to scale and markups. He proposes a framework for their joint simultaneous estimation using the derived log differences of the underlying production and cost functions (both of which contain the markup and the returns to scale index) by assuming a functional form for the technical progress term and by imposing cross-equation restrictions on the estimated parameters.

The main practical problem in the empirical application of Kee's approach is that it is rather data demanding: its implementation at the firm level would imply the use of firm-level price data which, as a rule, are very difficult to obtain.[3] For this purpose we suggest a simplified multi-step approach based on a reduced form of the structural relationship between the markup ratio and the returns to scale index (21).

The theoretical underpinning of this approach is the assumption that the structural relationship (21) does not necessarily imply simultaneous interdependence of the two characteristics that goes in the two directions. In particular, we assume that the returns to scale index is an autonomous feature of the production technology employed by the representative firm which is not affected by the firm's pricing policy and behaviour.[4] Under

[1] Roberts and Supina (2000) estimate a cost function that is characterized by a returns to scale factor and the latter, in turn, is implicitly present in their estimates of price markups. Among the problems associated with this approach they note that unobserved efficiency differences may lead to upward biased estimates of returns to scale and hence may cause an upward bias in the markups.

[2] In principle, it would seem appealing to use directly for this purpose the structural identity (3) which not only establishes a direct and straightforward link between the markup and the returns to scale index but also relies on easily observable firm performance variables. However, the specific non-linear character of this relationship precludes its direct practical use in estimations.

[3] Kee applies his approach at the industry level using sectoral price data.

[4] If adjustment is instantaneous, this may appear as a too strong assumption. Thus if firm chooses to charge a very high price markup, it may effectively price itself out of the market, resulting in excess capacity. In turn, this may show up in increasing returns to scale. However, in the presence of considerable adjustment lags, this causal link will not necessarily involve a simultaneous relationship. Also, the firm may meanwhile choose to correct its pricing policy.

this assumption the returns to scale index can, without loss of generality, be estimated separately, in the context of the implied production technology (20). This is the first step of our estimation procedure. In a second step we estimate a markup equation of Roeger's type, without a prior conjecture regarding the returns to scale index. In a third step, we compute an adjusted markup ratio, by superimposing the computed returns to scale index onto the price markup. This three-step procedure is in fact equivalent to a reduced form solution of the structural relationship (21). Its details are illustrated below.

For example, assume that the production technology is defined by a Cobb-Douglas production function:

(22) $Z = AL^{\alpha_L} M^{\alpha_M} K^{\alpha_K}$,

where *Z, L, M* and *K* stand for real sales, labour, material and capital inputs, respectively, and *A* is the measure of productive efficiency (technical progress). As well known, the returns to scale index $\lambda = \alpha_L + \alpha_M + \alpha_K$, so its value will be directly derived from the estimated production function.

For the estimation of price markups we apply Roeger's approach, which for the case of a three-factor production function of the type (22) comes to the estimation of the following simple regression:

(23) $v^* = B\, q^* + \varepsilon$,

where

(24) $v^* = d\,z^* - s_L\,(d\,l^*) - s_M\,(d\,m^*) - (1 - s_L - s_M)\,(d\,k^*)$,

(25) $q^* = d\,z^* - d\,k^*$.

In these notations, *d* denotes differences, lower case indicates the logarithm of the corresponding variable and asterisk (*) stands for nominal values. Thus *dz** is the logarithmic difference of nominal sales, *dl** is the logarithmic difference of labour costs, *dk** is the logarithmic difference of capital costs and *dm** is the logarithmic difference of material costs. s_L and s_M denote the shares of labor and intermediate inputs in gross output, respectively.

The estimable parameter *B* in eq. (23) is the so-called Lerner index, which in the case of constant returns to scale is linked to the markup ratio as follows:

(26) $B = 1 - 1/\theta$

Similarly to the approach discussed in section 3.2 we can analyze the effect of competitive pressure of firms' pricing behaviour by augmenting the markup equation. By its theoretical definition, the markup ratio reflects the pricing behaviour of firms endowed with market power and using that power to set prices higher than their marginal costs. Hence, looked from the opposite angle, if the markup ratios are measurable, then they themselves can be regarded as reflecting the degree of competition that firms face in the market. Such a conjecture suggests that the measured sectoral markups are shaped under the impact of competitive pressure. In other words, different levels of price markups (say, at the sectoral level) should be associated with varying nature and levels of competitive pressure (within each sector).

To test this conjecture, similarly to the approach applied in analyzing productive efficiency, we extend the models of markup formation (23) with variables defining and

measuring competitive pressure within manufacturing sectors. The main goal of this exercise is to analyse to what extent competition and market structure affect the firms' pricing behaviour. As the markup is just a transformed value of the Lerner index, which is a single parameter estimated in the model, we rather assume that this parameter is not constant over the entire sample. We employ a simple varying coefficient panel model:

$$(27) \qquad v^*_j = B_j(\boldsymbol{Z}_j)\, q^*_j + \varepsilon_j,$$

where $\boldsymbol{Z}_j$ is a vector of variables reflecting market structure and competition, such as market share, firm concentration within sectors, import penetration, exposure to export markets, firm's governance, etc., and B_j is a linear function of its arguments. This approach provides an opportunity to analyze the competition-related determinants of the markup ratios.

Hylleberg and Jørgensen (1998) and Oliveira Martins and Scarpetta (1999) showed that in the case of non-constant returns to scale, the estimable equation (23) retains its form but the estimated parameter B' has a different interpretation:

$$(28) \qquad B' = 1 - \lambda / \theta,$$

where λ is the returns to scale index.

Accordingly, our estimation procedure, which seeks to quantify the firms' markup ratios in the case of non-constant returns to scale, is organized as follows:

1) First we estimate the production function (4) for groups of firms and compute their average returns to scale index λ.

2) As a second step we estimate Roeger's equation for the case of a three-factor production function: equations (23) to (25). From eq. (26) we also compute the implied average markup ratio θ for the same group of firms for the case of constant returns to scale.

3) In a third step, from eq. (28) we compute the implied markup ratio θ for the case of non-constant returns to scale. This corresponds to the introduction of a measurement adjustment to price markup, reflecting the value of the computed returns to scale index λ for the corresponding group of firms.

The structural relationship between the returns to scale index and the markup ratio (eq. (21)) suggests that they are related to each other through the firm's average profitability ratio. Obviously, profitability varies across firms and thus the structural equation does not establish a direct relationship between sectoral returns to scale and markup ratios at the firm level. However, if estimated at the level of industries, the sectoral returns to scale and markup ratios are averaged over time; thus we analyse their long-run relationship, irrespective of the actual phase of the business cycle. In the presence of arbitrage, average sectoral profitability over time will tend to equalize across sectors, unless substantial institutional constraints paralyse this arbitrage process.[5] Hence, if profitability in eq. (21) is kept constant, then the estimated values of the returns to scale and markup ratios should be linearly related. This is a testable hypothesis on the validity of our theoretical model.

3.4 Cross-country analysis of firms' responses to competitive pressure, institutional interactions and change

The intensity of competitive pressure faced by the firms operating in a given market is the complex outcome of the interactions of numerous agents. While it arises from the direct

[5] Our empirical analysis uses manufacturing sectors only, where such institutional constraints should normally be irrelevant. Other sectors, e.g, agriculture or finance may be subject to strong institutional and policy interventions inhibiting the arbitrage.

interaction of firms with their competitors on the marketplace, these interactions also reflect the indirect effect of the actions of other stakeholders such as government bodies entrusted with the implementation of public policy (in particular, the institutions with delegated authority to implement competition policy), creditors and other financial institutions, suppliers and customers, organized labour unions, business associations, etc. Following the strand of literature that came to be known as institutional economics (or new institutional economics), the agents that exert such indirect influence on the level and intensity of competitive pressure, can be broadly associated with the notion of institutions and institutional environment (Williamson, 2000).

In the broader sense (North, 1990) institutions are the norms and rules, including the incentive systems that govern and structure the interactions of economic agents. In particular, they define a system of property rights, regulations that curb fraud and anti-competitive behaviour, the rule of law and socio-political arrangements that mitigate risk and manage social conflicts. Together, the rules form a hierarchic structure of mutually supporting directives that influence jointly and can impact the development of nations (Bhattacharya and Patel, 2004).

Furthermore, it is often argued that institutions function to protect society from two potential dangers that are at the two extremes of societal organization: disorder and dictatorship (Djankov, Glaeser, Lopez de Silanes and Shleifer, 2003). The main instruments of such institutional control are market discipline, private legal action through courts, public enforcement through regulation and state ownership. Depending on history and cultural traditions, different societies are characterised by a different institutional environment based on different combinations of these instruments of institutional control. Moreover, while some of these types of instruments are complementary, others may act as substitutes and, in a democracy, the choice of the mix of instruments will reflect the majority preference in a society. Thus, for example, governments may chose to internalise the requirement of regulatory oversight of private monopolies by assuming ownership of infrastructure utilities, or vice versa (Bhattacharya and Patel, 2004).

In a more narrow sense, the institutional environment refers to the system of public institutions that sets the “rules of the game” for the behaviour and performance of economic agents in the different markets. In our research exercise we shall mostly refer to the second, narrower interpretation of the institutional environment. We shall seek to identify and eventually quantify, the relationship(s) between the evolving formal rules and norms governing competition (which were analysed in detail during the first phase of the project) with the behaviour and performance of firms in the emerging markets of the east European countries.

The interactions between all stakeholders involved, including firms, shape the institutional dynamics and institutional change. Apart from “revolutionary” changes that involve a complete overhaul of the institutional order, institutional change is overwhelmingly incremental and path-dependent (North, 1991). The reason for this is that stakeholders interact within an existing “institutional matrix” which produces a bias in favour of choices that are consistent with the existing framework. In turn, institutional change does affect in a similar manner the behaviour and performance of stakeholders, including firms.

In the specific framework of our empirical analysis, which deals with Central and Eastern European economies during the late 1990s and the beginning of the 2000s, we are dealing with the aftermath of a deep systemic (“revolutionary”) change in the institutional order that took place with the dismantling of the communist system. Compared to the normal institutional dynamics of in mature market economies, this was still a period of rapid and radical institutional change, reinforced by the preparation for EU accession. Public policy in CEE countries typically had an activist stand, in particular in propelling rapid legislative and

regulatory changes in harmonizing the domestic regulatory environment with EU's *acquis communautaires*. These ongoing institutional changes undoubtedly were having a strong effect on enterprise behaviour and performance and provoked various interactions between institutional and economic agents.

The observed behaviour of firms reflects, among other things, the reaction and adjustment of the firms to the acting rules and regulations and changes therein, including the credibility and enforcement of the latter (the degree to which firms abide by the rules and comply with regulations). If rules and regulations (or their credibility and enforcement) do not change, there will be no changes in firm behaviour and performance associated with them either. Conversely, changes in rules and regulations (or their credibility and enforcement) can be expected to provoke changes in firm behaviour and performance associated with the evolution in these institutional arrangements.

However, the identification of changes in firm behaviour and performance directly associated with changes in rules and regulations may be difficult as there exists no "pure" empirical evidence of such responses. In fact observed firm performance reflects the combination of numerous intertwined factors, of which institutional interactions and change only constitute a part. Hence, in investigating this type of firm level responses, utmost care must be taken to control for all factors that are not directly related to the institutional environment.

Apart from controlling for this type of "noise" one has to bear in mind the possible heterogeneity in firms' responses. Thus for example rules and regulations dealing with the market environment (such as competition policy) seek to establish a level playing field not only among the firms competing in one and the same product market but also among firms in different industries. However, the reactions by firms in different market segments may be systematically affected by industry-specific factors. Hence in designing an empirical experiment it is necessary also to control for the possible interference of some industry-specific factors. Moreover, even firms within the same market segments may have different responses, depending on various idiosyncratic characteristics.

Finally, in cross-country comparative assessments (as is our case) we have to take into account that the same or similar rules and regulations (for example those dealing with competition) are applied in a different context and business environment. The observed behaviour and performance of firms in different countries may also reflect the effect of a myriad of other country-specific factors such as macroeconomic situation and prospects, different phase in the business cycle, political situation, etc. Consequently, the same or similar rules and regulations may have a different effect on the behaviour and performance of firms in different countries due to the influence of such country-specific factors. The empirical experiment should also carefully control for these factors; otherwise they may affect and distort the accurateness of the analysis.

A possible empirical methodology that would eliminate some of the technical difficulties outlined above is to apply a two-tier approach:

1) As a first step, we use firm level data for different countries to derive secondary, meso-level (e.g. at the level of NACE sectors) indicators, in which, in view of the arguments outlined above, we seek to eliminate – to the extent possible – the effect of firm-specific, time-varying factors that are not directly related to institutional interactions and change. By contrast, the time-varying, industry specific meso-indicators by design would incorporate the effects of institutional change (such as changing rules and regulations) at the level of the corresponding industries (sectors), averaged over the participating firms.

2) As a second step, we use these meso-level indicators to analyse the effect of institutional interactions and change on their formation and dynamics, in conjunction with other relevant factors. Moreover, if the meso-level indicators for different countries are

compiled on the basis of identical methodology, we can also pool them together in order to undertake a cross-country analysis of the effect of institutional interactions and change.

In order to be usable for the purpose of this empirical experiment the meso-level indicators should incorporate both the effect of competitive pressure on the performance of representative firms (as reflected in the sectoral averages) and the effects of institutional change on average firm performance.

We can apply the two-tier approach outlined above for two meso- (sectoral) level variables: average markups by NACE sectors and average productive efficiency by NACE sectors, both computed for different countries. As noted above, we construct these variables so that they incorporate the effects of both competitive pressure and institutional change on average firm performance.

A. Average sectoral markup ratios (annual ratios for individual countries).

We use annual estimates of the average sectoral markups (at NACE-2 level), applying a correction to adjust for the bias induced by non-constant returns to scale, as discussed in the first part of the paper. More specifically, we apply the procedure described in section 3.3 to firm level data for different countries. The main specificity is that in this case we modify the approach in order to compute annual values for the sectoral markup ratios (rather than period averages). The reason is that we shall seek to identify how the combined effect of competitive pressure and institutional change (such as changing rules and regulations) reflects in changes in the markups over time.

In principle, if one assumes that the production technology changes significantly over time, one could apply directly the approach described in section 3.3 to annual data. In this case we would get time variant values for the sectoral returns to scale λ_t. While this is probably a theoretically consistent approach, it suffers from some drawbacks when applied to actual empirical data. Thus, in the presence of economywide shocks in certain years, their effect may distort the estimated values for the sectoral returns to scale λ_t. By contrast, if we estimate the average sectoral returns to scale λ over a period of years, the effect of economywide shocks in certain years can be taken care of by time dummies during the estimation of the production function.

Due to this reason we use a slightly simplified approach based on the assumption that the production technology is relatively stable and the sectoral returns to scale index λ does not change significantly over the period of years that we estimate. In this case we just estimate the sectoral production functions once for the whole period to compute the sectoral returns to scale index λ.

As to the markups, we compute annual sectoral values θ_{it} using the procedure (23) to (28), on the basis of annual firm-level data. We thus compute annual values for B_{it}' from (23) and apply the average sectoral returns to scale index λ_i to adjust the results for each year, as defined in (28).

This empirical procedure makes it possible to compute country sets of time variant sectoral (say, at the NACE 2-digit level) markup ratios θ_{it}, computed over a period of time. By their construction, these markups incorporate the effects of both competitive pressure and institutional change on average firm performance, as required.

B. Average (sectoral) efficiency level (annual values for individual countries).

The second suggested meso-variable is the average firm efficiency level computed at the sectoral level (for NACE 2-digit sectors) for different countries, annual estimates. These can be computed on the basis of production frontiers, as described below.

The underlying assumption of the production frontier approach (Aigner, Lovell and Schmidt, 1977) is that within a sample of firms, the frontier defines the maximum level of output, which is feasible at the given level of technological efficiency. The production frontier is stochastic and the "distance" from the frontier reflects the relative level of technical efficiency in individual firms (11).

Variables capturing competitive pressure, institutional interactions and other factors affecting productive efficiency can be incorporated by augmenting the corresponding functions. Thus for example the functional form of the production frontier can be augmented directly, by including additional variables to the main function:

(29) $q_j = f(\boldsymbol{X}_j, \boldsymbol{\beta}, \boldsymbol{Z}_j, \boldsymbol{\gamma}) \exp(v_j - u_j)$.

$\boldsymbol{Z}_j$ is a vector of factors that are assumed to determine or affect firm level efficiency (competition related variables and other exogenous factors). In this case they are assumed to determine or affect directly the level of the frontier but not the distance of the firm from this frontier (or inefficiency term) u_j. $\boldsymbol{\gamma}$ is a vector of estimable parameters.

For the purpose of our exercise, we compute and use the average sectoral inefficiency levels, as measured by u_{ij}.

The important detail here is that, in accordance with the theoretical background outlined above, the estimated (in)efficiency levels should only reflect industry-specific and economywide factors (incorporating the effects of competitive pressure and institutional change) but be net of firm-specific factors. To achieve this, we divide the two types of effects (firm-specific and industry-*cum*-economywide effects) by choosing an appropriate specification of the augmented production frontier. In doing so, by design only one type of effects will go directly into the specification, while the remaining effects will be reflected in the residual inefficiency level.

More specifically, we use an augmented production frontier of the type (29), incorporating only firm-level factors into the vector $\boldsymbol{Z}_j$. That is the vector that directly explains firm efficiency includes only time-varying, firm-specific factors, not directly related to external competitive pressure or institutional change, whereas the effects of the latter will be passed onto the residual (in)efficiency term.

4. Firms' responses to competitive pressure: empirical results

In this section we present some of the main empirical results obtained on the basis of the methodological modelling framework described above.

4.1 The effect of competitive pressure on firms' productive efficiency

In the practical implementation of any of the theoretical models from (11) to (14) one has to address the issue of specifying the actual augmenting factors. Within the context of WP1, we have utilized – to the extent possible –the set of quantitative measures of competitive pressure defined in section 2. However, competitive pressure is not the only factor that affects firm level efficiency. Unless we model the determinants of productive efficiency in a broader context, we may face the problem of omitted variables. To address this issue, in addition to the set of indicators measuring competitive pressure and market structure, we have also employed in the extensions other, mostly firm-level variables (e.g. variables reflecting governance, financial pressure, restructuring, etc.) that are considered as relevant factors in shaping firms' production efficiency. In effect, by considering the two sets

of variables in conjunction, we analyze the effect of competitive pressure within a broader model of productive efficiency.

The set of augmenting factors we used to extend the production function includes the following variables (see also section 2):

1) MP_i – the import penetration ratio in sector i (defined over NACE 2- or 3-digit sectors). The expected sign of this coefficient is ambiguous. If higher level of import penetration is interpreted as higher level of import competition leading to restructuring, then the expected sign of the coefficient is positive. However, an excessive level of import competition may have negative spillovers (Carlin, Schaffer and Seabright, 2004), implying a negative coefficient.

2) MS_{ij} – the firms' market share, within the firm's own market (the firm's share in total sales in the corresponding NACE sector, including imports). This variable reflects the impact of firm size on efficiency and in this sense has a dual interpretation. If we regard size as an indication of market power (which would probably reflect the main strand in the competition literature), then the coefficient should be expected to be negative as market power reduces the external pressure on the firms to achieve higher productive efficiency. However, there is also another strand in the literature, that of "efficient market strictures" (Demsetz, 1993) which assumes that "revealed" market structure reflects the growth of more efficient firms. According to this view, more efficient firms can be expected to grow faster than less efficient ones and hence have a higher market share. This duality leaves the determination of the market share as an empirical issue. Besides, there is a practical econometric implication: when estimating efficiency on the basis of an augmented production function, both the market share and the measures based on it (such as concentration) become endogenous.

3) C_i – a measure of the concentration of firms in sector i. It can be defined in various ways as: a) the Herfindhal index measured at different sectoral levels; b) the combined share of the several largest firms in the sector or c) the relative standards deviation of firms' sales in the sector. Again, there can be a dual interpretation of the impact of concentration on efficiency. The core strand in the competition literature would suggest that if a higher concentration measure reflects the incidence of monopolistic market power then the coefficient should be expected to be negative for the reasons mentioned above. In turn, the interpretation based on "efficient market structures" would suggest that an observed level of high concentration may reflect the growth of more efficient firms. Such an assumption adds considerable ambiguity as the expected sign of the market share coefficient.

4) F_i – a measure of foreign presence in sector i (the share of foreign-controlled firms in the sector's total sales). Similarly to import penetration, the expected sign of this coefficient is ambiguous. If higher level of foreign presence is interpreted as higher level of competition leading to restructuring, then the expected sign of the coefficient is positive. However, an excessive level of foreign dominance may have negative spillovers on domestic firms (Carlin, Schaffer and Seabright, 2004), implying a negative coefficient.

5) FO_{ij} – a measure of foreign ownership in firm j (the share of foreign capital in the firm's statutory capital) (alternatively, dummy for foreign-controlled firms). In general, the expected coefficient is positive because it is assumed that foreign

dominated firms employ more productive, modern technologies and are subject to better governance.

6) E_{ij} – a measure of the export activity of firm j (the share of exports in the firm's total sales) (alternatively, dummy for "actively exporting" firms). The expected coefficient is positive because it is assumed that exporting firms are exposed to (admittedly) higher competitive pressure on the international markets which forces them to restructure. It is expected that this would yield higher productivity than in firms that operate predominantly on the domestic market. On the other hand, it can be conjectured that the causality goes in the other direction; it is the more efficient firms that operate in foreign markets as well.

7) IA_{ij} – a measure of the investment activity of firm j (the share of fixed investment in a given year to the firm's total fixed assets in the same year) (alternatively, dummy for "actively investing" firms). High level of investment activity mirrors active restructuring which is assumed to lead to higher efficiency; assuming that this is associated with an effort to achieve a competitive edge, then the expected sign would be positive. Again, this interpretation implies possible endogeneity of this variable.

8) D_{ij} – the firm's long-term debt ratio (the share of long-term debt in total assets). For transition economies, the Millier-Modigliani notion of the neutrality of the firm's capital structure is not expected to hold due to the numerous market imperfections and the inherent inefficiencies of the financial systems. Rather this leverage indicator is expected to mirror financial pressure on heavily indebted firms and, eventually, the incidence of soft budget constraints reducing competitive pressure (Dobrinsky et al., 2001c). In this interpretation, the expected sign is negative.

9) SD_i – sectoral dummy for sector i. By including this dummy in the specification we seek to capture the effect of sector-specific effects not captured by other variables.

10) TD – time dummy for years. By including this dummy in the specification we seek to capture the effect of economy-wide shocks.

The augmenting variables fall into four categories:

- time-varying, industry-specific factors: 1), 2), 3).
- time-invariant, industry-specific factors: 9).
- time-varying, firm-specific factors: 4), 5), 6), 7), 8).

In choosing the actual set of explanatory variables, one needs to take into account both the availability of data and considerations regarding the possible endogeneity (in this regard, the most obvious suspects are E_{ij} and IA_{ij})

In addition, by using fixed-effects techniques in estimation, it is possible to capture also the effect of time-invariant, firm-specific factors.

Accordingly, the estimable form of the augmented production function in the case of gross output (real sales) will be specified as:

(30) $$z_j = a_0 + a_1 l_j + a_2 m_j + a_3 k_i + a_4 mp_i + a_5 c_i + a_6 f_i + a_7 ms_{ij} + a_8 fo_{ij} + a_9 e_{ij} + \\ + a_{10} ia_{ij} + a_{11} d_{ij} + a_{12} SD_i + a_{13} TD + \varepsilon_j ,$$

where lower-case letter denote the natural logarithms of the corresponding variables.

It is possible to further enrich the specification by including interaction variables. One obvious candidate for interacting is the sectoral dummy(s). By interacting the sectoral dummies with all, of some of the, variables of competitive pressure it is possible to differentiate the effect of competitive pressure on firm-level efficiency across sectors.

The specification of the production frontier models for the case when the underlying production technology is defined by a Cobb-Douglas production function is identical to (30) with the exception of the error term which is defined in accordance with (11) to (14).

The models outlined above have been tested on the basis of enterprise data for four central and east European countries: Bulgaria, Hungary, Romania and Slovenia. A brief description of the datasets used for this exercise is presented in the Part A of the Annex. It also presents some selected descriptive statistics for the manufacturing firms in the four countries, in particular, some indicators of competitive pressure used in the current study.

Some selected estimation results on the effect of competitive pressure on the firms' productive efficiency are presented in Part B1 of the Annex. The tables in the annex are ordered by country, in alphabetical order. Within each country, the tables present the estimation results for different specifications of the production function and production frontiers.

The estimations for Bulgaria and Hungary have been performed using exactly identical specifications and estimation periods which allow direct cross-country comparisons of the results. In the case of Romania, the specifications and methodology used were exactly the same, but the estimation period differed due to availability of data. Due to data availability, but also to the specifications used in the case of Slovenia are slightly different; nevertheless, they follow broadly similar methodology and variables and also allow cross-country comparisons.

Below we present some specific characteristics of the estimation procedures and results for the three countries.

Bulgaria:

The augmented production functions (as specified in (9)) for Bulgarian firms were estimated on the basis of an unbalanced panel of enterprise data for the period 1995-2001. Various techniques were tested for these estimations, including OLS, fixed effects (FE) and random effects model. In the main, the results obtained on the basis of different estimation techniques produced broadly similar results as regards the effect of competitive pressure on firm level efficiency. For this reason we report here only the results obtained using OLS techniques, presented in tables B1-B1 and B1-B2 (for output defined as value added or sales, respectively).

The estimations have been performed in log-levels suggesting that the results only allows to measure the impact of the augmenting factors, including competitive pressure, on the level of total factor productivity, but not on the changes in the level of productive efficiency over time. To reduce the effect of a possible simultaneity bias related to the investment variable, the latter has been taken with a one year lag.

The specification of the augmented stochastic frontier production functions is analogous to that of the production function except for the fact that the zero-mean, normally distributed error term ε_j in both cases is replaced by $(v_j - u_j)$ which are distributed as spelled out above. The estimated frontier models were defined in accordance with the model specification suggested by Battese and Coelli (1995) are expressed as:

(31) $y_{jt} = x_{jt}\beta + (v_{jt} - u_{jt})$, $i=1,...,N$, $t=1,...,T$,

where y_{jt} is (the logarithm of) the production of the *j-th* firm at time *t*; x_{jt} is a $k \times 1$ vector of (transformations of the) input quantities of the *j-th* firm in the *t-th* time period; β is a vector of unknown parameters; and $v_{jt} - u_{jt}$ are the random variables as defined above

The u_{jt} terms which account for the technical (in)efficiency in production are non-negative random variables which and are assumed to be independently distributed as truncations at zero of the $N(m_{it}, \sigma_u^2)$ distribution:

(32) $m_{it} = z_{it}\delta,$

where z_{it} is a $k \times 1$ vector of variables which may influence the efficiency of a firm; and δ is an $1 \times k$ vector of parameters to be estimated. We have used the parameterisation suggested by Battese and Corra (1977), replacing σ_v^2 and σ_u^2 with $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2/(\sigma_v^2 + \sigma_u^2)$. The parameters of the stochastic frontier production function model were estimated using maximum-likelihood estimates using the FRONTIER 4.1 software package (Coelli, 1994).

It should be noted that the stochastic frontiers estimated on the basis of pooled enterprise data are in general extremely sensitive to the presence of outliers in the upper range of the productive efficiency. As the technique seeks to establish the "best practice" among the data, an efficiency outlier results in shifting of the frontier which is equivalent to shifting of the estimated efficiency of the remaining firms in the sample. Since the quality of our data is somewhat dubious (it is not possible to verify the reliability of the source data) we have chosen to truncate the sample during the estimation procedure by removing the most extreme cases of efficiency outliers.

Hypothesis test based on the generalized likelihood-ratio (LR) test were conducted to check the functional form and to determine the presence of inefficiencies. The likelihood test statistic: $LR = -2*(LLF_R - LLF_U)$, (where LLF_R – is the loglikelihood function for restricted model LLF_U – the loglikelihood function for unrestricted model) has approximately χ^2_q distribution with q equal to the number of restrictions. It has been shown that any LR test involving a null hypothesis that includes the restriction that $\gamma = 0$ has a mixed χ^2 distribution with appropriate critical values (Kodde and Palm, 1986).

The third column from the right in tables B1-B3 and B1-B4 presents the results of LR tests of the hypothesis that the technical efficiency effects are not simply random errors. The key parameter is $\gamma = \sigma_u^2/(\sigma_v^2 + \sigma_u^2)$, which takes values in the interval (0,1). If $\gamma = 0$, it means that the model does not detect technical efficiency; hence, the null hypothesis is that of $\gamma = 0$, indicating that the OLS estimation of equation (30) is adequate representation of the data. The closer γ to unity, the more likely the frontier model is appropriate. The final column reports the estimated average level of efficiency for each sector in the sense of the distance from the estimated "best practice" production frontier. (The reported values are computed as one minus the average inefficiency effect, based on the results for each sector).

The estimation results for the two types of production functions (with output defined as value added or sales, respectively) produce broadly similar results as regards the effects of competitive pressure on productive efficiency. In the production function based on value added the competition effects are slightly more pronounced than in the case of sales. Probably the most important general result – based on the specific features of the estimation results for Bulgaria – is that during the estimation period competitive pressure (as measured by our competition variables) does <u>not</u> seem to have played a major role in driving the changes in productive efficiency of Bulgarian firms. This can be traced by analysing the estimated coefficients for each individual variable of competitive pressure.

Import penetration has been estimated with different signs for different sectors, but negative signs prevail (although not always significant). This suggests that the effect of

opening through foreign competition through trade liberalization leading to increased foreign presence on domestic markets in the majority of cases has affected negatively the productive efficiency of local manufacturers. Such an outcome is more in line with the conjecture that an excessive level of import competition may have negative spillovers (Carlin, Schaffer and Seabright, 2004) (rather than the hypothesis that higher level of import competition would lead to restructuring). It may also suggest that the speed of trade liberalisation in Bulgaria has been excessive preventing local firms to adjust.

The coefficients of the market concentration variable in most cases are statistically insignificant suggesting relatively little effect on productive efficiency. Among the few cases when it is statistically significant, there are positive as well as negative coefficients, hinting at divergent directions of impact. Anyway, there are more negative coefficients which are in line with the prior that larger dispersion of production (equivalent to weaker monopolistic market power within the corresponding segments of the product markets) should be associated with higher productive efficiency.

The majority of the coefficients of the dummy variable indicating foreign control are positive but they are not always statistically significant, hinting at a relatively limited effect of foreign ownership on firm performance in Bulgaria in this period. Anyway, the positive coefficients are in line with the prior that foreign presence (interpreted as higher level of competition) should leading to efficiency-enhancing restructuring.

The coefficients of the market share variable in most cases are positive and statistically significant. These results (suggesting that larger firms tend to have higher efficiency) are in discord with the hypothesis that market power reduces the external pressure on the firms to achieve higher productive efficiency. By contrast, they are to some degree consistent with the "efficient market strictures" hypothesis mentioned above. One possible interpretation for that is that the immature Bulgarian markets are characterised by very dynamic changes of entry and exit in which the more efficient firms tend to gain larger market shares.

The coefficients of the export variable are also estimated with different signs but in the prevailing number of cases it is positive; in many cases when it is positive, it is also statistically significant. While these coefficients probably provide the strongest evidence that competitive pressure tends to be associated with higher efficiency (although, as argued above, the direction of causality is unclear).

The lagged investment variable has also been estimated with different signs. Nevertheless, in a prevailing number of cases when it is statistically significant, the coefficient is positive, which is in line with the prior that active restructuring which should lead to higher efficiency. Debt does not seem to exert a systematic effect on firms' efficiency.

The estimation results regarding the determinants of productive (in)efficiency as given in tables B1-B3 and B1-B4 are basically rather similar to those in the case of the conventional production functions: in both cases the signs of most coefficients indicate a broadly similar direction of impact. Among the more specific outcomes one could point out that the production frontiers suggest a somewhat stronger positive impact of foreign control on productive efficiency but a somewhat lower impact of the exposure to export markets.

Hungary:

The Hungarian estimations were performed for the period 1995-2001 on the basis of an unbalanced panel of manufacturing firms. The specification of the estimated equations as well as the estimation techniques were identical to those applied in the case of Bulgaria to ensure full comparability of the results. Accordingly, the methodological comments made above apply to the case of Hungary, as well. The actual estimation results for the Hungarian manufacturing firms are presented in tables B1-H1 to B1-H4 of the Annex.

The augmented Cobb-Douglas production function gives a good description of the production process in Hungary. The production process was largely characterised by constant return to scale after 1995. (Halpern and Kőrösi (1998) and (2001a) showed that diminishing returns prevailed in the earlier transition period.) Material costs dominate the production function when the dependent variable is sales; these production functions fit extremely well. Obviously, the same absolute distance from the production frontier appears to be a larger relative inefficiency when the dependent variable is the value added. However, the two functions also give a substantially different efficiency ranking of the sectors, which indicates that the production frontier depends on the materials, thus, material input may not be fully exogeneous.

Investment activity and indebtness play little direct role in the production. Variables, representing the overall market environment of the firm (market concentration and import penetration, both measured at the 4 digit sectoral level) have a rather uncertain effect. They are frequently significant, but their sign is ambiguous, indicating, that the effect of competitive pressure also depends on the technology used in the sectors.

The three important qualifying variables: market share, foreign ownership and export performance, are all measured at the firm level. They are significant for the majority of the sectors, and typically play a positive role, when significant, contributing to the higher efficiency of the resource allocation. Notably, compared to the results for Bulgaria, the positive association between governance related competitive pressure and competitive pressure related to the exposure to export markets is much more pronounced in the case of Hungary. Similarly to the Bulgarian results larger firms tend to display higher productive efficiency.

Romania:

The Romanian estimations were performed for the period 1998-2001 on the basis of an unbalanced panel of manufacturing firms. The specification of the estimated equations as well as the estimation techniques were similar to those applied in the case of Bulgaria and Hungary, in order to ensure full comparability of the results. Accordingly, the methodological comments made above apply equally to the case of Romania; however, due to the specificity of the period under investigation, we preferred to run annual estimations instead of using cross-panel estimations over firms and years. The Romanian economy started later than most of the transition countries the “big” privatisation and the restructuring of its most concentrated industries. Therefore, it was particularly during 1998-2000 when most of the changes occurred at least within industry sectors. The statistical data show important breaks in the time course of the economic variables in 1999 and 2000. The results presented in the tables (see Annexes) confirm this statement. Consequently, we show estimations of technical efficiency levels and mark-ups coefficients for each year separately, as the cross-section regressions produced statistically weaker results than the year-by-year regressions. The data shown is reporting only on the estimation of turnover (sales) in the Cobb-Douglas production function form, as this was statistically more significant than the estimation of the value added. Due to the reduced number of years in the time series and to the structural breaks, we didn’t perform sectoral cross-panel estimations, neither in the case of technical efficiency levels, nor in the case of mark-ups. All the other tables tried to follow the same pattern as the one used for Bulgaria and Hungary.

The actual estimation results for the Romanian manufacturing firms – related to the estimation of augmented production functions and efficiency levels - are presented in tables B1-R1 to B1-R2 of the Annex. Unfortunately, due to the constraints induced by the availability of data, the only two firm specific variables that were used in regressing the augmented production frontiers are the export share (direct exports of firms, in contrast to the sectoral corresponding indicator, which reports the total export, summing up direct exports

and re-exports) and the debt ratio (total debt as a percentage of firm's assets). The regressions in different years show that export share is not a very significant factor in influencing the technical efficiency (or inefficiency) of a firm; however, in the large majority of those cases in which export share seems to be relevant in various sectors and for specific years, the sign of the respective coefficient is negative, proving a global negative correlation between the export activity of firms and their overall efficiency. A possible explanation could reside in the fact that, in times of restructuring combined with economy's troughs and sudden changes in the price system – including the exchange rate – the firms gain more from the game of prices than from attempts of increasing productivity and technology levels, at least in the short run.

The level of indebtness seems to play a more important role in driving one firm's efficiency. The sign of the debt ratio coefficient is positive in almost all cases and quite often statistically significant. This may seem counter-intuitive at a first sight, as we would expect firms having large debts to be more inefficient from the technological point of view. However, it was shown that indebtness became a rule of behaviour in the Romanian economy, in the case of many sectors, during the last decade of the 20th century and the enforcement of tougher fiscal and financial regulations in 1999-2001 may have forced the indebted firm to take severe measures in order to improve their productivity and competitiveness in their attempt to survive to the increasing competitive pressure.

All the other variables were tested at sectoral level, using cross-sectoral panel estimations, and the results are reported in Table D2 and analysed in a further chapter

If we compute year by year the average level of technical efficiency across sectors (after eliminating the cases for which the gamma indicator resulted close to zero), we observe the potential existence of an increasing trend (from 0.924 in 1999 to 0.944 in 2001). The values of the gamma coefficients are varying a lot from one year to another and by sectors, being significantly different from zero in most of the cases.

Slovenia:

The empirical analysis of the productive efficiency of Slovenian firms in general follows the approach outlined in the previous section which incorporates the underlying idea that, given imperfect markets, higher competition and competitive pressure tend to enhance firms' productivity and efficiency. At the same time, there are some specificities, related to the availability of data and some specific characteristics of Slovenia's economic environment.

The econometric estimation is also based on a production function approach and both static and dynamic estimation technique have been used. The model had the following general specification:

$$(33) \qquad y_{it} = \alpha k_{it} + \beta l_{it} + \delta_t + (\eta_i + v_{it} + m_{it}), \qquad r = \alpha+\beta \neq 1$$
$$v_{it} = \rho v_{i,t-1} + \mathbf{a}_{it} + e_{it} \qquad |\rho| < 1$$
$$e_{it}, m_{it} \approx MA(0)$$

where:

y_{it}, k_{it}, l_{it} are log value added, log capital stock and log labor inputs, respectively.

v_{it} is an autoregressive part of productivity shock, $\mathbf{a}_{it}$ is identified productivity shock and m_{it} represent serially uncorrelated measurement errors.

Inputs are potentially correlated with firm-specific effects, and with both productivity shocks ($\mathbf{a}_{it}$, e_{it}) and measurement errors (m_{it}).

Given the AR(1) process in v_{it}, a firm's response to positive productivity shock in the past ($v_{it} > 0$) by using more inputs in the period t clearly violates the OLS assumption on strict

exogeneity between inputs and the error term, i.e. $E(\mathbf{z}_{it}'u_{it}) \neq 0$ (where $\mathbf{z}_{it}$ is a matrix of inputs).

In order to resolve the problem of simultaneity of investment decisions and productivity shocks, one should estimate a dynamic version of the model (12):

$$(34) \quad y_{it} = \rho y_{i,t-1} + \alpha k_{it} - \rho\alpha k_{i,t-1} + \beta l_{it} - \rho\beta l_{i,t-1} + (\delta_t - \rho\delta_{t-1}) + \gamma \mathbf{a}_{it} + \eta_i(1-\rho) + e_{it} + m_{it} - \rho m_{i,t-1})$$

Where firm's productivity shocks $\mathbf{a}_{it}$ are determined as:

$$\mathbf{a}_{it} = f^i(\mathbf{G}_{it}, \mathbf{Z}_{jt})$$
$$(35) \quad (IFDI_{it}, OFDI_{it}, Exsh_{it}, MS_{it}) \in \mathbf{G}_{it}$$
$$(RStd_{jt}, MP_{jt}, No\_im_{jt}, Tar_{jt}) \in \mathbf{Z}_{jt}$$

where $\mathbf{G}_{it}$ accounts for technology determinants internal to the firm, and $\mathbf{Z}_{it}$ accounts for competitive pressure factors external to the firm.

More specifically, the firm-level variables used to take into account for firms' capability to respond to outside competitive pressures were:

1) $IFDI_{it}$ – a dummy whether a firm i is foreign owned,
2) $OFDI_{it}$ – a dummy whether a firm i has affiliates abroad. The rationale for including this additional variable to the specification is based on the findings by some authors that more productive firms tend to expand their activity through outward FDI. In fact this type of internationalization of business activity through outward FDI has been increasing in Slovenia in recent years.
3) $Exsh_{it}$ –share of exports in the firm's total sales,
4) MS_{it} – the firms' home market share (the firm's share in total sales in the corresponding NACE sector).

The variables accounting for competitive pressure factors external to the firm were:

5) MP_{jt} – the import penetration ratio in sector j,
6) $RStd_{jt}$ – a measure of the concentration of firms in sector j (relative standard deviation of firms' sales in the sector),
7) No_im_{jt} – number of imported products within sector j. This is another indicator that measures competitive pressure faced by local firms.
8) Tar_{jt} – average import duty rate in sector j. The reason for including this additional variable is the fact that import tariffs in Slovenia have decreased dramatically over the period 1994 – 2002 in all sectors except in food industry (15), leading to higher competitive pressures within sectors.

There are several ways to deal with the endogeneity problem. Olley and Pakes (1996) suggest to use investment expenditure serve as a proxy for unobservable technological shocks. Levinsohn and Petrin (2003) have used expenditure for materials serve as a proxy for unobservable technological shocks. Blundell and Bond (2000) argue about the need to apply a system-GMM estimator, which in addition to lagged levels uses also lagged first differences as instruments for equations in levels. In this case the model is estimated in first differences, so the corresponding instruments for ΔX_{it-1} are (X_{it-2}, X_{it-3}, …) and (ΔX_{it-2}, ΔX_{it-3}, …)

In the estimations for Slovenia the basis specification has been estimated by OLS and fixed effects (FE) panel techniques. In addition, the Blundell-Bond sys-GMM technique has been used in order to deal with the endogeneity problem. The Olley-Pakes approach does not

seem to be a robust technique when dealing with sectors with less important capital investment, while the Levinsohn-Petrin estimations in the case of sector-wide estimations may lead to quite noisy and not sustainable results. The latter serves also as a way of robustness check of results obtained by applying OLS and FE estimations.

The estimation results shown in tables B1-S1 to B1-S3 indicate that firms dominated by foreign ownership and firms with larger market shares tend to exhibit higher productive efficiency. This pattern is almost generally valid for firms in all sectors and is robust to different econometric methods (system-GMM which helps to deal with the simultaneity problem does not alter this pattern). Somewhat counterintuitively, more internationalized firms (i.e. firms with larger export orientation and with affiliates abroad) in general do not seem to gain specific advantages from this strategy. Positive productivity gains can be observed only in selected sectors, such as metal processing (27), machinery (29) and electrical appliances (30). Among external competitive pressures, import penetration seem to contribute to productivity especially in textiles (15), wood processing (20), plastics and non-minerals (25, 26) and transport equipment (35). On the other hand, high tariff protection leads generally to lower productivity in almost all sectors.

4.2 The effect of competitive pressure on firms' pricing behaviour

We analyze the effect of competitive pressure of firms pricing behaviour through the augmented varying coefficient markup equation (27). In this equation $\boldsymbol{Z}_j$ may in principle comprise a broad set of variables. However, in the context of the overall analysis of enterprise adjustment under competitive pressure and in view of ensuring cross-country comparability of the estimates, we have restricted our choice to the competition-related variables evaluated during the previous phase of the project (see D8) and such used in in analysis of production efficiency. The actual set of augmenting variables includes:

1) M_{ik} is the import penetration ratio in sector *i*. If the estimations are performed at the NACE 2-digit level, then the import penetration variable should be defined at a lower level of disaggregation - NACE-3 or NACE-4 digit levels. The sign of the coefficient of this variable is undefined. If the degree of import penetration is assumed to indicate higher competition, then the coefficient should have a negative sign. However, if importers themselves are endowed with market power, the sign may be positive. Notably, these effects can also change over time.

2) O_{ij} is an ownership variable associated with foreign ownership. It can be defined either as the share of foreign ownership in the firms' statutory capital, or as a dummy taking the value of 1 for foreign controlled firms and 0 otherwise (this was the preferred definition in estimations). As foreign firms optimise their behaviour globally, not in the local market, thus their pricing behaviour may differ from domestic firms, we can expect that ownership structure had strong effect on markup ratios. However, the sign of this variable is ambiguous. On the one hand, if foreign ownership is assumed to be associated with better governance and proper incentive structures (and hence higher competitive pressure), then the expected sign of the coefficient of this variable is negative. However, if foreign firms use their market power to extract rents from the local market, the sign will be positive.

3) C_{ik} is a measure of the concentration of firms in sector *i*. It can be defined in various ways as: a) the Herfindhal index measured at different sectoral levels; b) the combined share of the several largest firms in the sector or c) the relative standards

deviation of firms' sales in the sector. After experimenting with different definitions of concentration, in the estimations reported below we have used the third definition. Again, if the estimations are performed at the NACE 2-digit level, then the relative standard deviation of sales should be defined at a lower level of disaggretation - NACE-3 or NACE-4 digit levels. The prior is that higher concentration results in larger market power in the hands of fewer firms who will be more likely to exercise it in price setting, hence the expected sign of the coefficient is positive.

4) MS_{ij} is the firms' market share, within the firm's own market (the firm's share in total sales in the corresponding NACE sector, including imports). The market share is intended to capture market power and the prior is that monopolistic firms endowed with market power would tend to exercise this power resulting in higher price markups. This would suggest a positive sign of the respective coefficient.

5) E_{ij} is the firm's ratio of exports to sales (alternatively, a dummy for exporting firms taking values of 1 if the ratio exports/sales" is larger that a pre-defined threshold and 0 otherwise). Assuming that larger exposure to the international markets is indicative of higher competitive pressure, the coefficient of this variable can be expected to be positive. However, what we observe in our data is the aggregate pricing policy of these firms (covering exports as well as domestic sales) and since exporting firms may have discriminating pricing policies on these two segments of their market, there may be more ambiguity as to this aggregate outcome.

6) D_{ij} is the firm's long-term debt ratio (the share of long-term debt in total assets). We assume that this indicator mirrors financial pressure on heavily indebted firms and, possibly, the incidence of soft budget constraints reducing competitive pressure. In this interpretation, the expected sign is positive.

7) LD_{ij} is a dummy for firms with a low quick ratio. It takes a value of 1 if the firm's quick ratio (the ratio between the sum of accounts receivable and liquid assets to the firm's current liabilities) is smaller than 1 (the critical level of the quick ratio) in year t and is 0 otherwise. We assume that this indicator mirrors financial pressure on firms and also, possibly, the incidence of soft budget constraints reducing competitive pressure. In this interpretation, the expected sign is positive.

The varying coefficient model seeking to capture the effect of competitive pressure on the firms' pricing behaviour was tested on enterprise data for Bulgaria and Hungary using the enterprise datasets described in Annex A. Again in the case of this empirical assessment we employed an exactly identical specification for the two countries and estimated it for exactly the same time period which allows direct cross-county comparisons of the results.

Similarly to the assessment of productive efficiency, in studying the effect of competitive pressure on firms' pricing behaviour, we employed different specifications (e.g. with output defined as value added or sales) and tested different estimation techniques. Most of the results from these tests pointed towards broadly similar directions of impact and for this reasons we have limited the selection of estimation results for presentation in part B2 of the Annex, tables B2-B and B2-H to two representative estimations. The estimations reported here were performed on panels of manufacturing sectors grouped at the NACE-2 digit level and refer to output defined as sales.

The estimation results clearly indicate different behavioural patterns with respect to price formation in the two countries. The most conspicuous case of difference is the effect of

foreign ownership on price formation. In the case of Hungary, ownership was the most powerful factor shaping pricing behaviour, significantly influencing markups in most sectors. In general, as indicated by various empirical studies, during the period of estimation, foreign direct investment has been one of the most important factors shaping market structure in the case of Hungary but not so much so in Bulgaria. In the case of Hungary its effect on prices is almost always positive and statistically significant, suggesting that foreign controlled firms tend to charge larger price markups than local firms. In turn the higher markups of the foreign-owned firms indicate that foreign owned firms seem to have a larger chance for exploiting market imperfections and can collect larger rents than domestic firms in the same apparent market position. As many foreign-owned firms are Hungarian subsidiaries of multinationals, this may just indicate that their true market power cannot be correctly assessed from the balance sheets of this Hungarian subsidiary. In the case of Bulgaria, in the majority of sectors foreign ownership is not estimated as a statistically significant determinant of pricing behaviour. Moreover, when it is statistically significant, its coefficient in most cases is negative (with a few exceptions in the value added based estimations). This hints at the other interpretation of the impact of foreign ownership outlined above, namely the governance effect, and the absence of pricing mechanisms similar to those in Hungary. Indeed, at least in the period that we cover, there was no massive influx of multinationals to Bulgaria and foreign controlled firms were often small stand-alone businesses.

Similarly, there are differences between the estimates for the two countries with respect to import penetration. As noted, import penetration may well have an ambiguous and time dependent effect: on the one hand it may measure foreign competition, which should limit the ability of firms for charging prices with high markups. However, especially in sectors dominated by multinationals, the measured level of import penetration may just be the natural consequence of the internationally organised production process of multinational firms, in which case it will not have a negative effect on price markups. Both of these can be more often observed in the case of Hungary. In Bulgaria, due to the reasons outlined above, it is unlikely that the measured degree of import penetration results from the involvement in international production networks; it rather reflects the effect of the ongoing liberalisation of foreign trade. Hence the estimated coefficients should reflect the impact of import competition on the pricing behaviour of local producers. The results, however, suggest different directions of this impact: there are both positive and negative, statistically significant coefficients. This suggests divergent direction of impact in different manufacturing sectors. In some sectors higher competition induced by import penetration has led to the shrinking of profit margins (negative coefficients). In other cases, importers endowed with market power may have themselves take advantage of it (positive signs).

The effect market concentration on price formation is more or less in line with the prior, especially in the case of Bulgaria. A negative coefficient for the market concentration variable suggests that larger dispersion of production (equivalent to weaker monopolistic market power within the corresponding segments of the product markets) are associated with relatively lower price markups (which is our prior). According to the estimation results for Bulgaria, this is indeed the case for the majority of the manufacturing sectors. There are also cases with positive coefficients but they are often statistically insignificant. In Hungary the pattern is broadly similar, but the tendency of large dispersion of production being associated with lower markups is not so well pronounced and is far from uniform.

One of the surprising empirical outcomes is that our estimation results do not provide strong evidence suggesting that market power (as measured by market share) tends to be associated with higher price markups (as implied by the conjecture of monopolistic price formation). These results are mixed for both countries and there are cases of positive as well as negative association between market share and price markups.

Similarly, there is no uniform pattern in the effect of the exposure to export markets on price formation: the specificities prevailing in each individual sector of the two countries seem to be shaping different directions of impact.

There are notable differences between Bulgaria and Hungary with respect to the estimated coefficients of the debt variable. In Bulgaria, in the majority of cases the estimated coefficients are positive and statistically significant. This is in line with the prior that financially distressed firms, moreover when not subject to hard budget constraints (high leverage may be interpreted as revealing soft credit constraints), both of which effectively reducing competitive pressure, may show up in monopolistic price formation. Indeed, as Bulgaria has been lagging behind in enterprise restructuring in this period, this is an outcome that is consistent with the general pattern of enterprise behaviour in this period (see Dobrinsky et al., 2001c). In the case of Hungary, with enterprise and bank restructuring more advanced, budget constraints on firms in this period were significantly hardened. Accordingly, we do not find much evidence of the effect of debt on price formation.

4.3 Competitive pressure and firms' pricing behaviour in imperfect markets

As argued in section 3.3, there is an important link between the markup ratio and the returns to scale index in the case of non-constant returns to scale and deviation from the conditions of perfect market competition. We test our theoretical results on a sample of Bulgarian, Romanian and Hungarian manufacturing firms. Given the market environment in these economies, discussed above, we subsume substantial market distortions, facilitating a meaningful test of our theoretical conclusions. In fact, as these distortions are considerably larger than in a well-functioning, mature market economy, it also provides us with the opportunity to test the robustness of our findings.

Earlier studies provide further hints with respect to some of our priors. Thus when studying the performance of manufacturing firms during the early to middle transition process in Hungary, Halpern and Kőrösi (1998) found that in the initial phase of transition the effect of market power substantially diminished, as the former socialist behemoths were exposed to competition. Their size and market power were frequently based on administrative decisions rather than on efficient use of resources, and initially many found difficult to adjust to the new realities of the emerging market. After the restructuring and privatisation phase market power again became an important determinant of corporate performance. Another relevant finding by Halpern and Kőrösi (2001b) was that returns to scale also characteristically varied with the progress of the transition: early transition was characterised by decreasing returns to scale. Later, as reorganisation increased the efficiency of the resource allocation, returns to scale first moved into the neighbourhood of 1, later to increasing returns to scale regime. Based on these findings we expect that the timing differences of the two transitions will show up as characteristic differences between returns to scale and markup indices estimated for Bulgaria and Romania, on the one hand, and Hungary, on the other hand. We expect lower returns to scale for Bulgaria and Romania, as it was in an earlier transition phase in our sample period. Also, we may expect lower mark-ups for Bulgaria and Romania, as dominant firms cannot utilise their market power effectively in extracting rents.

The empirical exercise reported here follows the approach outlined above. Our preferred definition of output is gross revenue (sales) and, accordingly, we assume a three-

factor production function of the type (16).[6] In estimating the production function we assume that the efficiency term *A* is time dependent and has the following functional form:

(36) $A(T) = A_0 e^{aT} \varepsilon$.

A series of estimations of this standard markup model was performed including both single-year and panel estimates. As could be expected, the sectoral markups based on single year estimates tended to display some time variability, which could largely be attributed to cyclical factors but also to a changing level of competitive pressure within the sectors.[7] Thus we decided to proceed with using panel methods, but as these yield average markups for the estimation period, we also included in this specification of *A(T)* time dummies to take care of time-specific macroeconomic shocks and other time variable macroeconomic factors. However, in the case of Romania, due to the small number of years available in the sample, we performed single year estimations, thus not taking into account the time trend in the mark-up equations.

In the panel estimations we tried different estimation techniques (OLS, fixed and random effects) which produced rather similar results. As material inputs may be endogenous in the production functions, we also experimented with the instrumental variables G2SLS estimator proposed by Balestra and Varadharajan-Krishnakumar (1987), using several different sets of instrumental variables (this test was done only on Bulgarian and Hungarian data). Generally, the different estimation techniques produced rather similar results, which could also be taken as an evidence of their robustness. In tables C-1, C-2 and C-R1-4 (Part C of the Annex) we report some of the panel estimation results[8] (for Bulgaria, Hungary and Romania, respectively) for the production functions and the markup equations performed at the NACE 2-digit sectoral level for the period 1995-2001, and the corresponding values for the sectoral price markups.[9] We apply a completely identical methodology to the data for the three countries and thus these results are fully comparable: production functions were estimated by instrumental variables, assuming random effects, while the markup equation by OLS.[10]

As a first observation, these results suggest that while the returns to scale index in most sectors is close to one, the assumption of constant returns to scale in general cannot be taken for granted.[11]

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[6] In our own experience, similarly to the observation by Oliveira Martins, Scarpetta and Pilat (1996), the markups estimated from the definition of output as value added were often excessively high, say in the order of 50% to 100% over marginal costs (mostly likely due to the inherent estimation bias), a range that seems implausible in terms of their interpretation as a real life phenomenon.

[7] Single year estimates for the markups are available from the authors upon request.

[8] Stata and TSP were used for estimation.

[9] In the case of Hungary and Romania, in several sectors the elasticity of capital was estimated with a negative sign which is in principle an implausible value as it does not have an adequate economic interpretation. However, the statistical significance of these coefficients (as well as of most capital elasticities in the case of Hungary) was also rather low suggesting that in the statistical sense they are not significantly different from zero. This may reflect the persistence of transition-related excess capacity in Hungarian manufacturing.

[10] Instrumental variables were: indicators for state and foreign ownership, competitive pressure variables: Hirschman-Herfindhal index of sectoral concentration of output, and relative standard deviation of sectoral output, both at the NACE 4-digit or 3-digit level, import penetration, again at the NACE 4-digit or 3-digit sectoral level, and time dummies. We also experimented with alternative sets of instrumental variables, such as lagged differences of model variables, etc. We chose the above instrumental set on two grounds. First, it closely corresponds to the second equation of the model as these are the variables possibly influencing market power, and thus markup. Second, while various estimates usually gave qualitatively similar results, this set of instruments seemed to yield estimates with smaller noise.

[11] The constant returns to scale hypothesis (H0: $\alpha_L + \alpha_M + \alpha_K = 1$) was rejected for most manufacturing sectors in Bulgaria and Romania, and approximately for half of the cases for Hungary.

In the middle panels of Tables C-1,C-2 and C-R1-C-R4 we present the computed sectoral markup ratios under the assumption of constant returns to scale (equation (8)). In the right-hand panel (the last two columns of the tables) we show the implied markup ratios in the case when we ease the assumption of constant returns to scale as well as the percentage difference between the two estimates of the price markup (equation (9)) which is in fact the estimation bias induced by the assumption of constant returns to scale. Generally, the bias is not very large (MAPE of 5.2% in the case of Bulgaria, 3.8% in Hungary and between 6.3% and 4.3% in Romania, decreasing during the period under investigation). These results are in line with the simulation results in Hylleberg and Jørgensen (1998). However, the bias correction still has important theoretical consequences for Bulgaria and Hungary: the correlation between the estimated sectoral returns to scale and the biased markup ratio was statistically 0 (–0.17 for Bulgaria, -0.16 for Romania, and –0.01 for Hungary), while it is significantly positive with the correct one: 0.61 for Bulgaria, and 0.49 for Hungary. In the case of Romania, both correlation coefficients are negative, with -0.49 the one computed for un-biased mark-ups. The relationship of the sectoral returns to scale and markup ratios is also clearly visible on the scatter plots of Figure C-1.

The three graphs in Figure C-1 also highlight some dissimilarities in the three countries. Clearly, the estimated returns to scale indices have different tendencies: they are always below unity, if significantly different from the constant returns to scale for Bulgaria, while typically above one, if different from unity for Hungary. The average of the sectoral returns to scale is 0.94-0.95 for Bulgaria and Romania, and 1.03 for Hungary. This conforms to our assessment of the difference in transition phase of the two countries. However, we do not see such difference in the markup ratios between Bulgaria and Hungary. The average is slightly higher for Hungary, but the difference is negligible. And that small difference can fully be attributed to one single sector (NACE 16: tobacco products), which is highly concentrated in Hungary (much more so than in Bulgaria), and where government regulation plays an extraordinary role in price setting. Thus this extremely large markup may well reflect the very specific conditions of this sector in Hungary. But that also means that the empirical evidence did not support our expectation for higher average markups for Hungary. The Romanian average non-adjusted mark-up is very close to the Hungarian one, with the same type of regulatory framework in the case of tobacco industry, which drove down artificially the mark-ups despite the high degree of concentration. However, the adjusted mark-ups for Romania are significantly lower than those for Bulgaria and Hungary (1.08 as compared to 1.18-1.24), which may mean a stronger impact of competition on the Romanian manufacturing industry in recent years; the empirical evidence actually supports the latest development in the Romanian economy, where the manufacturing sector performances outpaced expectations (continuous and sustained growth of imports and exports and smooth transition/landing into the Single market – at least after total trade opening and before full integration). Romania is the only country among the three for which it seems to exist a negative correlation between mark-ups (regardless the presence of bias/adjustment to returns to scale) and return-to-scale coefficients (see third graph of Figure C-1).

At a first glance, the bias introduced by the assumption of constant returns to scale may appear as minor (within the acceptable margin of error in econometric estimation). However, one problem in this exercise is that we in fact assume that firms in each NACE 2-digit sector are characterized by the same returns to scale index. This in itself may be a too rigid assumption, potentially introducing its own estimation bias. To check this, we performed another series of estimations, which seek to reduce this distorting effect.

In principle, under the assumption of perfect markets, firms operating in the same market should employ very similar, qualitatively identical production technologies (hence identical returns to scale) and should be characterized by identical levels of productive

efficiency as competitive pressure will drive out of the market less efficient firms. Obviously, as the output of firms is heterogeneous, and we use the rather aggregated 2 digit sectoral classification, sectors are not fully homogeneous by their technology, but still, sectoral heterogeneity should be much smaller than economy wide. Deviation from the assumption of perfect market implies a possible additional heterogeneity in production technologies and, respectively, varying returns to scale across the same markets. However, as noted, the identification of the returns to scale index is essentially an empirical issue and there are no clear priors as to the classification of firms into groups featuring the same (or at least similar) returns to scale.

We attempted several possible breakdowns of the firms in the samples for two of the countries, Bulgaria and Hungary, and the one that did reveal differences in the returns to scale index was the breakdown by size.[12] In tables C-3 and C-4 we present a selection of some of the main results (for Bulgaria and Hungary, respectively) for three size categories of firms: 1) "small firms" (firms with less than 20 employees); 2) "medium-sized firms" (firms with more than 20 but less than 200 employees) and 3) "large firms" (firms with more than 200 employees).[13]

One of the important empirical outcomes of this exercise is the finding that small firms in many manufacturing sectors on average tend to display decreasing returns to scale.[14] This is especially pronounced in the case of Bulgaria where the sample includes a considerable number of small-sized firms in all manufacturing sectors (basically the full population of incorporated small firms). The same situation is not as straightforward in Hungary. This may be due to the fact that the Hungarian dataset excludes micro firms (those with less than 10 employees), which sometimes also leads to lower sample sizes. However, it may just be the consequence of faster Hungarian transition: Halpern and Kőrösi (2001b) found that small firms were characterised by strongly decreasing returns prior 1995 in Hungary, but it approached the constant returns to scale regime afterwards.

On the other hand, both medium-sized and large manufacturing firms (both in Bulgaria and in Hungary) were in most cases found to operate at close to constant returns to scale.[15] It is thus the category of small firms for which the non-adjusted estimation of the price markups will contain the biggest, upward measurement bias. To illustrate this we present in tables 3 and 4 both the markup ratios computed with constant returns to scale, and those with the adjustment for non-constant returns, as well as the corresponding percentage difference (measurement bias). Indeed, in the case of Bulgarian small firms this difference is in most cases between 10 and 20%, sometimes even larger, which can already be considered as a strong bias. In the case of Hungary the difference is somewhat smaller, but there are a few cases of double-digit biases. But also among the size categories of medium-sized and large firms, firms in some manufacturing sectors were found to operate with returns to scale deviating substantially from 1, which also leads to a notable measurement bias in the corresponding price markups.

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[12] In a mature market economy firm size reflects past performance, thus it may well be the outcome of the production decisions of the firm. However, that was certainly not true in the socialist economy. Thus, firm size can be treated as an exogenous characteristic feature of the firm, especially in a relatively early transition phase. As capital markets are strongly distorted in transition economies, successful firms cannot easily raise capital. This rigidity conserves the pre-existing size distribution during transition.

[13] The full estimation results by size categories are available from the authors upon request.

[14] This finding is in line with the empirical literature on small firms, which generally finds that such firms tend to operate with decreasing returns to scale. One of the reasons is that (in the conditions of imperfect markets and assuming adjustment lags) small firms willing to expand their output are likely to face production bottlenecks in the short run.

[15] Interestingly, as can be seen in Tables C-3 and C-4, medium-sized firms both in Bulgaria and in Hungary on average display slightly higher returns to scale than large firms, although that difference really is negligible.

Average markups are somewhat smaller for Bulgaria than for Hungary for all size categories, and the difference actually is larger for the size categories than for the entire sample estimates. However, these differences still remain small: the Bulgarian average price markups are between 15-18% for the size categories, while they all are around 20% for Hungary. This conclusion is not valid in the case of the average mark-ups computed for Romanian sectors. Nonetheless, the structure of sectoral markups is very different in all three countries, no matter whether we look at the overall picture or at size categories: the correlation between the Bulgarian and Hungarian markup structures was always found to be close to 0.

The three panels of Figures C-2 and C-3 display scatter diagrams illustrating the relationship between sectoral returns to scale and markups for the three size categories of firms (for Bulgaria and Hungary, respectively). These diagrams confirm the existence of a strong positive correlation between returns to scale index and price markups. Indeed, in the case of Bulgaria, the coefficient of correlation between returns to scale index and price markup ratio for small firms is 0.78, for medium-sized firms 0.63 and for large firms 0.82. In Hungary, the corresponding correlation coefficients are: 0.60, 0.61 and 0.86. The importance of correcting markup estimates by the returns to scale factor is highlighted by the fact that this positive relationship is not observable for the unadjusted markups: the correlation coefficients are close to zero for Hungary for all size categories, and they are negative for Bulgaria in all cases. Even though the differences between adjusted and non-adjusted markups seem to be small in many cases, the proposed correction restores the theoretically important relationship.

4.4 Empirical analysis of firms' responses to competitive pressure, institutional interactions and change

As outlined in section 3.4, we use an augmented production frontier of the type (29), incorporating only firm-level factors into the vector $\boldsymbol{Z}_j$. A sample (obviously non exhaustive) list of such variables includes:

MS_{ij} – the firms' market share, within the firm's own market (the firm's share in total sales in the corresponding NACE sector, including imports).

FO_{ij} – a measure of foreign ownership in firm j (the share of foreign capital in the firm's statutory capital) (alternatively, dummy for foreign-controlled firms).

E_{ij} – a measure of the export activity of firm j (the share of exports in the firm's total sales) (alternatively, dummy for "actively exporting" firms).

IA_{ij} – a measure of the investment activity of firm j (the share of fixed investment in a given year to the firm's total fixed assets in the same year) (alternatively, dummy for "actively investing" firms).

D_{ij} – the firm's long-term debt ratio (the share of long-term debt in total assets).

The estimable form of the augmented production frontier, for the case of a three-factor Cobb-Douglas production function of the type specified in equation (16) and the above sample list of augmenting variables will take the form (in logarithms):

$$(37) \qquad z_j = a_0 + a_1 l_j + a_2 m_j + a_3 k_i + a_4 mp_i + a_5 ms_{ij} + a_6 fo_{ij} + a_7 e_{ij} + a_8 ia_{ij} + a_9 d_{ij} + \varepsilon_j,$$

where lower case indicates the logarithm of the corresponding variables.

By construction, in this case the effect of industry specific and economy-wide factors of competitive pressure and institutional change will be incorporated in the measured firm inefficiency level u_{ij}, as required. These inefficiency levels, possessing the necessary

properties, will be directly derived in the estimation of the production frontier as specified in (37). As a result of this estimation we obtain time-varying values of the inefficiency levels u_{ijt} for individual firms in individual countries.

To derive average sector-level, time-varying inefficiencies u_{it}, we then compute averages (non-weighted or weighted by firm size) by NACE 2-digit sectors. As in the case of the markups, in accordance with the goals of our exercise, we need annual values for the average sectoral inefficiencies u_{it}, in order to analyse how the combined effect of competitive pressure and institutional change is reflected in changes in efficiency over time. For this purpose we either estimate the production frontier by sectors for every year of the available data period, or estimate it for the whole period and use that to "predict" annual values.

The final outcome of this exercise consists of country sets of time variant sectoral (at the NACE 2-digit level) inefficiency levels u_{it}, computed over a period of time.

In a second step, we mix the country data sets in an attempt to analyze the effect of the institutional environment itself on competition-related firm performance.

Let Ω_{it} denote a sectoral level, time-varying meso-variable which is net of firm-level effects. We assume that it reflects, among other things, the effects of industry level competitive pressure and of nationwide competition policy, and, possibly, country-specific, time-variant economywide shocks. In our case Ω_{it} denotes either the sectoral markup ratios θ_{it}, or the sectoral inefficiency levels u_{it}, computed in accordance to the procedures described above at the NACE 2-digit level.

Assume also that we have pooled Ω_{ikt} data for several countries, where k is the country index. In accordance with these conjectures, we could try to identify, in statistical terms, the effects of industry level competitive pressure and of nationwide competition policy by regressing the pooled Ω_{ikt} data on data of these determinants. The estimation results concerning these regressors based on pooled cross-country data can be expected to highlight, and generate new results, concerning both behaviour of institutional agents and competition-related interactions of firms and institutions.

As to the actual variables, for the first set of regressors we can use the time-varying, industry-specific measure of competitive pressure.

A sample list of such variables includes:

MP_{ik} – the import penetration ratio in sector i of country k.

E_{ik} – export ratio in sector i of country k. It is defined as the share of exports in the sector's total sales.

C_{ik} – a measure of the concentration of firms in sector i of country k. It can be defined in various ways as: a) the Herfindhal index measured at different sectoral levels; b) the combined share of the several largest firms in the sector (three in the case of Bulgaria and Hungary, and five in the case of Romania); or c) the relative standards deviation of firms' sales in the sector.

F_{ik} – a measure of foreign presence in sector i of country k (the share of foreign-controlled firms in the sector's total sales).

D_{ik} – average long-term debt ratio in sector i of country k. It is defined as the share of total long-term debt in the sector's total assets.

SD_{ik} – sectoral dummy for sector i of country k.

For the second set of regressors, we can use the following:

PT_k – the EBRD indicator on progress in transition in country k (the average overall measure, also compiled on an annual basis by EBRD using identical methodology for all countries). The EBRD index of progress in transition is a composite measure of

institutional change and progress in market reforms, and is comprised, *inter alia*, of core indicators such as enterprise governance and restructuring, competition policy, banking reforms and financial markets, progress in privatization, price liberalization. As such a composite measure of institutional change, the EBRD index captures exactly the types of institutional interactions that we seek to investigate.

PE_k – an indicator of policy enforcement indicator in country k. It should reflect the credibility of the enforcement threat with respect to competition policy. This could be defined, e.g. as the share of enforcement decisions taken by the National Body for the protection of competition in a particular year relative to the number of cases brought to it in that year.

We didn't use the second set of regressors in the case of Romania, but we added some more sector-specific indicators that may be related to the degree of competition: the total number of firms registered in one sector and the average investment-to-sales ratio.

We shall also include time dummies for years (TD_t) and country dummies (CD_k) in the specification; alternatively, we can use country-specific time dummies (TD_{tk}).

Accordingly, we estimate the following equation (the time subscript is omitted):

$$(38) \qquad \Omega_{ik} = a_0 + a_1 MP_{ik} + a_2 E_{ik} + a_3 C_{ik} + a_4 F_{ik} + a_5 D_{ik} + a_6 PT_k + a_7 PE_k + a_8 TD_k + a_9 CD_k + \varepsilon_i$$

The specification can be enriched further by including interaction variables. Obvious candidate for interacting are the sectoral and country dummy(s). As in the previous case, we could interact the sectoral dummies with all, of some of the, variables of competitive pressure. In this way, we could differentiate the effect of competitive pressure on firm-level efficiency across sectors. In addition, we could interact the country dummies with the time dummy, with all or some of the country-specific variables and with all or some of the sector-specific variables.

The model specified above was estimated on empirical data for Bulgaria, Hungary and Romania. As described, the empirical procedure contains two steps. In the first step we estimate the two sectoral level variables: the average markups by NACE sectors and the average productive efficiency by NACE sectors for the three countries. For the same time periods we also compute the values of the relevant regressors as specified above. Due to data constraints, we had to exclude from the empirical testing some of the variables described in the theoretical specification (38). In table D-1 (Part D of the Annex) we report the corresponding descriptive statistics for the model variables for the three countries.

In this second step, we pool the data for the three countries and perform panel regressions of the cross-country model separately for the two sectoral level variables. Given the limited number of countries, and the absence of lagged dependent variables in the specification, we used OLS techniques on pooled data rather than panel estimation techniques proper. In tables D-2 to D-5 we report some of the estimation results for the technical efficiency equation and for the markup equation, accordingly. As the Romanian dataset doe not include all variables in the specification we performed two types of pooled regressions: one based on the full specification, pooling only data for Bulgaria and Hungary (tables D-2 and D-4) and another one, based on a reduced specification but pooling data for the three countries (tables D-3 and D-5)

These estimation results highlight some of the important determinants and driving mechanisms of firm's adjustment to competitive pressure, institutional interactions and change in a cross-country perspective. Moreover, the two different equations that we use to analyse these adjustments suggest important differences in the driving factors of the two variables.

First, the effect of competitive pressure, institutional interactions and change on technical efficiency (tables D-2 and D-3). The theoretical literature generally maintains that when markets are imperfect, higher competitive pressure enhance productive efficiency, through different channels (see, e.g. Nickell, 1996 and Djankov and Murrell, 2002). One of these channels is x-efficiency gains associated with competitive pressure. When competitive pressure is low, managerial and worker effort if undersupplied which shifts the firm's production schedule away from the production frontier expressing the maximum amount of output obtainable with a given technology from a given mix of input quantities. Competitive pressure increases incentives for better performance, including through the threat of exit. Higher efficiency in individual firms will then translate into higher productivity within the whole industry. Another strand in the literature asserts that high competition within an industry brings about high overall productivity due to rationalization of the industry entailing reallocation of resources across firms: when firms compete for market share, resources move from less efficient to more efficient firms which grow faster and increase their market share.

At the same time, it can be pointed out that empirical research does not fully support these conjectures. Thus Carlin, Schaffer and Seabright (2004) and Carlin, Fries, Schaffer and Seabright (2001) find evidence that firms in the transition economies may still be not fully prepared to face the full power of transboundary competitive pressure: due to the weakness of local firms too strong a competitive pressure may even possibly have a destructive impact on local markets (drain on firm performance). They also emphasize the danger of the incidence of unchallenged monopoly of single firms in these nascent markets.

Our results, which also incorporate the effects of institutional interactions and change, are more or less in line with the theoretical arguments with respect to the direction of the effect of competitive pressure on industry level efficiency but at the same time highlight some specificities. We use two different indicators of market concentration to represent competitive pressure: the Herfindhal index of concentration by NACE 2-digit and the share of the three largest firms by NACE 2-digit sectors. These reflect different facets of market concentration: the Herfindhal index is based on the whole family of firms within a sector and measures overall concentration, whereas the second one is an indicators of the level of monopolization or oligopolization of the market. Thus, in line with theory, one would expect positive coefficients for the first variable and negative for the second one. The results presented in the first column of tables D-2 and D-3 are in line with the theoretical arguments outlined above: they indicate a strong positive statistical association between overall market concentration (which also stands for higher overall competitive pressure) and technical efficiency. At the same time, the results in the second column of the table show that there is no statistically significant association between monopolization/oligopolization and technical efficiency.

The coefficients on the variable measuring the level of foreign control of the markets (table D-2 based on data for Bulgaria and Hungary) are positive but weakly statistically significant. This confirms that the degree of foreign penetration in the ownership structure is generally associated with higher efficiency; however at the level of average sectoral indicators this links is not strongly manifested.

Two of the regressors, the import penetration ratio and the debt ratio (the latter only in the pooled regression for Bulgaria and Hunagry – table D-2), were systematically estimated with negative coefficients and these coefficients are always statistically significant. The first result is in fact at odds with the theoretical argument: the higher import penetration signifies more competition on local markets exercised by foreign competitors and - according to theory - this should translate into higher efficiency. At the same time, this result is consistent with the results with the empirical studies quoted above (Carlin, Schaffer and Seabright, 2004, and Carlin, Fries, Schaffer and Seabright, 2001), which argue that due to the weakness

of local firms too strong a competitive pressure (in this case from foreign firms) may act as a drain on local firm performance. For all three countries, the correlation is statistically significant at less than 3% probability. As to the debt ratio, we consider that this indicator mirrors financial pressure on heavily indebted firms and, possibly, the incidence of soft budget constraints reducing competitive pressure. Thus the negative coefficient of the debt ratio is in line with the prior.

In the pooled regression for the three countries (table D-3) the estimated coefficients of the EBRD index of "progress in transition", which is a composite measure of institutional change and progress in market reforms, was positive and statistically significant, in line with the prior. However, in the regression covering only Bulgaria and Hungary this coefficient was not statistically significant. These ambivalent results suggest some caution in interpreting the outcomes of the regression (see below).

Second, the effect of competitive pressure, institutional interactions and change on average sectoral markup ratios (tables D-4 and D-5, based on pooled data for two and three countries, respectively). In table D-4 we present the results for two versions of the markup model: based on the unadjusted values of the estimated markup ratios (the first two columns) and based on their adjusted values (the last two columns). Table D-5 uses adjusted values only. Our priors are that the higher the level of competitive pressure, the lower the chances for firms to extract rents through monopolistic pricing (higher markup ratios). Institutional interactions and market reforms should facilitate the working of these mechanisms.

In general, the estimation results indicate that the explanatory power of the model is not very strong suggesting that there are also other factors that play a role for the shaping of the firms' pricing policy. In any case, the coefficients of two of the explanatory variables were estimated to be strongly statistically associated with the markup ratios: the intensity of export activity of the firms – the export ratio (in the case of adjusted markups), and the level of monopolization or oligopolization of the market (the share of the three largest firms by NACE 2-digit sectors). The coefficients of both these variables are positive which in the case of the concentration variable is fully in line with the prior: the higher the degree of monopolization or oligopolization of the market, the more likely it is that the firms occupying such a dominant position would tend to extract monopolistic rents through higher prices. The fact that the export ratio is also estimated with a positive coefficient could have a dual interpretation. In the first place, it can be interpreted in terms of the existing global market imperfections which prevent trans-boundary marginal cost equalization in the international markets even if prices do equalize. In this case firms that are competitive in terms of quality but originating in low-cost countries enjoy higher monopolistic markups over marginal costs compared to their competitors originating in high-cost countries. Secondly, this outcome can be interpreted in terms of quality differentials. At a given level of marginal costs, exporting firms are capable of producing goods of superior quality compared to their counterparts that can only sell on the domestic market and this quality differential is reflected in higher markup ratios.

Both the import penetration ratio and the Herfindhal index were always estimated with negative coefficients (in line with the priors) but their coefficients are not statistically significant. In the case of the variables of foreign participation and indebtedness the signs of the coefficients varied in different estimations and the coefficients are not statistically significant.

Finally, as in the first equation, the estimated coefficients of the EBRD index of "progress in transition" were not statistically significant. One possible interpretation of this outcome is that the institutional environment in these countries is still immature and the policy and institutional changes that are being introduced nominally do not actually translate into motivational driving forces for the firms. It may also be a sign of weak enforcement of

policy and regulation by the public bodies and other regulatory institutions entrusted with the implementation of policy and regulation.

5. Conclusions and policy implications

Firms in the Central and Eastern European countries that just joined (such as Hungary and Slovenia), or are about to join the EU (like Bulgaria and Romania) are facing growing competitive pressure, especially in the single EU market. At the same time, product, capital and labour markets in these economies are still immature markets and are characterized by numerous imperfections. Within the COMPPRESS project, WP1 focuses on the effect of the growing competitive pressure faced by firms in the new EU members and acceding countries from Central and Eastern Europe on their behaviour and performance.

In this report we develop a research methodology for the analysis of different aspects of enterprise behaviour and adjustment to competitive pressure in an environment of imperfect markets. We apply this methodology on empirical data comprising large enterprise datasets to analyze, in a comparative perspective, the adjustment of firms in some of these economies to the growing competitive pressure. The analyses of enterprise adjustment in these countries are based on identical or similar methodology, which provides an opportunity for a comparative study of the mechanisms of firm's behavior in a transitional environment.

The theoretical and empirical results presented in this report highlight some of the specificities of the ongoing restructuring of the corporate sectors in the emerging market economies of Central and Eastern Europe.

Market structure and competitive pressure

The COMPPRESS project as a whole and WP1 in particular, employ different quantitative indicators to measure the level and intensity of competitive pressure in the manufacturing sectors of the Central and Eastern European economies. The results of our study highlight some specific features of market structure and competitive pressure in the corporate sectors of the four acceding countries. Being methodologically consistent across countries they also allow direct cross-country comparisons of this aspect of corporate performance in these countries.

One of the important general finding about the evolution of the corporate sectors in the acceding countries is that the ownership transformation in these countries is nearly complete: at present the overwhelming share of output in their corporate sectors is produced in firms which are not controlled by the state. This is indeed a revolutionary change which has been accomplished in a historically very short period of time and which has dramatic consequences for the functioning of all markets and, in particular, for the rising competitive pressure in the corporate sectors. The withdrawal of the state from the running of business entities is a basic and necessary (though not sufficient) condition for the establishment of a genuine market environment.

Another the important and interesting result at this stage of research is the finding about the high levels of market concentration of the corporate sectors of these countries. The causes for this, however, may differ from country to country: while in Bulgaria, Slovenia and Romania, this high level of concentration is mostly a legacy of the past (when industries were dominated by industrial giants specialized in production for the Soviet and other east European markets), in Hungary it also reflects the entry into the local markets of some large multinationals which managed to seize considerable market shares.

It is also interesting to point out that the high level of concentration has been preserved despite the ongoing entry into the markets of large numbers of de novo firms. This can be traced clearly in the case of Bulgaria where the enterprise data set is most comprehensive in terms of the coverage of small de novo firms (in the rest of the countries the available data sets do not have the same level of completeness).

The entry to the local markets of foreign capital and firms (most pronounced in Hungary, but recently accelerating in the other countries as well) has had important implications for competitive pressure in the corporate markets. Notably, this the direction of the impact has been ambiguous: in the cases when FDI firms have been able to seize considerable share of local markets (often facilitated by various incentives offered by national policies), they have in fact sought to establish strong market positions, even monopolistic ones (Hungary is probably the most conspicuous example). As a result they have often driven local firms out of their traditional markets; while in most cases this was likely related to efficiency superiority, the strengthening of the market positions of FDI firms can be at least partly attributed to unfair incentives granted by domestic policy (in disfavour of local firms). In these circumstances the impact of FDI firms on market competition may be dubious, and in fact negative. In other countries (e.g. Bulgaria), the inflow of FDI has been scattered in numerous small investments and did not lead to the establishment of new, foreign monopolies. In this case, FDI firms have likely contributed to the increase of market competition in local markets.

Measuring competitive pressure arising from trade is mostly relevant for the tradables sector; due to this we have devoted more attention to the corporate performance in the manufacturing sector. As discussed noted in the methodological sections of the paper, such competitive pressure can arise from two sources: from the import activity of foreign firms in the local markers and from the export activity of local firms in foreign markets. Both of these factors have been assessed for the countries participating in the project (to the extent that the data allow doing this). The quantification of these indicators for the acceding countries confirms that openness to trade plays an increasingly important role in shaping the competitive environment of their corporate sectors, both in terms of import penetration and in terms of exposure to foreign markets. These economies have thus been already exposed to strong competitive pressure coming from trade. In fact, during the past more than a decade of economic transformation, there has been a continuous adjustment by their corporate sector to the competitive pressure stemming from trade.

The estimated mark-up ratios for some of the acceding countries confirm the growing competitive pressure in their domestic markets. The absolute level of the mark-up ratios is relatively small and compares well to mark-up ratios for developed market economies reported in other studies (Oliveira Martins, Scarpetta and Pilat (1996); Oliveira Martins and Scarpetta (1999)). As argued by Nickell (1996) monopolistic rents (mark-ups) can be equalized with the level of competition in an industry (or a market); hence lower levels of mark-ups are an indication of more competitive markets (industries). According to our research plan, in the next phases of the project there will be further and more elaborate analysis of this form of price competition in the acceding countries.

Firms' responses to competitive pressure in imperfect markets

The analysis of the changes in firms' productive efficiency was undertaken within the modelling framework of production functions and production frontiers. To assess the impact of competitive pressure on total factor productivity, the production/frontier functions were augmented into a functional form that contains exogenous "determinants" of productive efficiency. This allows to distinguish between the variation in output which is caused by

variation in factor inputs and those changes in the level of output that are assumed to be attributed to the efficiency of resource transformation per se, i.e. the efficiency of the underlying production technology. In the augmented production functions we have utilized the set of quantitative measures of competitive pressure defined and computed during the first stage of the project. These models have been tested on the basis of enterprise data for all four central and east European countries: Bulgaria, Hungary, Romania and Slovenia.

The analysis of the changes in firms' pricing policy was performed in the context of models of monopolistic pricing behaviour. By its theoretical definition, the markup ratio reflects the pricing behaviour of firms endowed with market power and using that power to set prices higher than their marginal costs. Looked from the opposite angle, the markups can be regarded as reflecting the degree of competition that firms face in the market. In other words, different levels of price markups (say, at the sectoral level) should be associated with varying nature and levels of competitive pressure (within each sector). To assess the impact of competitive pressure on firms' markups, we use varying coefficients models augmented with variables measuring competitive pressures. In the augmented equations we have utilized again the set of quantitative measures computed during the first stage of the project. These models were been tested on the basis of enterprise data for Bulgaria and Hungary and, partially, for Romania.

One specific feature of the countries we are studying is the existence of numerous market imperfections that distort firms' behaviour as well as their responses to competitive pressure. We have devoted special attention to this aspect both in terms of its theoretical and empirical implications. In this paper we discuss in particular the relationship between price markups and returns to scale in imperfect markets and the implications of this relationship for the empirical estimation of these two parameters. We propose an approach for the empirical estimation of markup ratios with an adjustment for the case of non-constant returns to scale. The idea of this approach is first to determine the average returns to scale index for a group of firms and then to use it in order to make an adjustment to the markup ratio for the same category of firms. The suggested approach was tested on balance sheet data for Bulgarian, Hungarian and Romanian manufacturing firms. The use of identical methodology allows us to produce fully comparable results for the two countries. Using the suggested approach, we estimate for both countries sectoral markups and returns to scale indexes with and without the adjustment for non-constant returns.

We show that adjusting for non-constant returns to scale is essential in the presence of considerable market distortions, as is the case in these transition economies. The application of standard procedures for estimating average price markups based on the assumption of constant returns to scale may lead to serious biases. This may occur if the markup is estimated for a group of firms, which is heterogeneous with respect to the actual returns to scale index at which different firms operate. In particular, we find in our empirical analysis that small manufacturing firms tend to operate with decreasing returns to scale. Ignoring this fact in the estimation of their markup ratios will result in a considerable upward measurement bias in their estimated price markups. Moreover, this will also be the case when markups are estimated for groups of firms, which lump together small and larger firms. One of the general practical conclusions of our exercise is that empirical research in this area should devote special attention to the relationship between returns to scale and price markups and the related implications.

We also analyse empirically the relationship between returns to scale and their price markups. We find the existence of a strong positive correlation between the estimated sectoral returns to scale and price markups indices, which is in line with the theoretical prior. The importance of correcting markup estimates by the returns to scale factor is highlighted by

the fact that this positive relationship is not observable for the unadjusted markups. The proposed correction in the markups helps to restore this theoretically important relationship.

We found a characteristic difference between the returns to scale estimates for the three economies, which largely corresponds to our prior knowledge on the transition path the three countries took. On average, returns to scale in Hungarian manufacturing sectors were found to be higher than those in Bulgaria and Romania; besides, Bulgarian and Romanian manufacturing firms were found to operate at decreasing returns to scale much more often than Hungarian firms, which typically operated at increasing returns to scale. These outcomes are consistent with the fact that Hungary is more advanced in the process of establishing a functioning market economy. This result reinforces our previous finding that the actual enterprise responses to competitive pressure may differ in the stages of economic transformation in these countries. Indeed, the in-depth empirical analysis based on micro data is a valuable (and probably remains unique) source of information in investigating these specificities of the adjustment process in these emerging market economies.

While the differences in average markup estimates are negligible, the sectoral structures of markup ratios are very different, reflecting differences in the market structure of the three economies. This means that after the strongly concentrated socialist market structures were dismantled through liberalisation and corporate restructuring in the early phases of transition, the subsequent evolution of concentration and market power in the two countries followed different paths; it also means that the country specialisation inside the former COMECON led to different sectoral mixes in the formerly communist European countries. Note that we apply identical methodology to firm level data for three countries showing some important differences in their market conditions and business environment, and come up with qualitatively similar empirical results. We consider this as further evidence of the robustness of the results and of the conclusions that we draw from them.

Competitive pressure and enterprise restructuring

The empirical results presented in the paper highlight some important specificities of the ongoing restructuring of the corporate sectors in the emerging market economies of Central and Eastern Europe. In particular, while the empirical results do confirm that competitive pressure affects the firms' adjustment process, the actual adjustment is not always in line with theoretical priors. This may be the result of both the existing market imperfections mentioned above but also may be related to the dramatic overall structural changes that are still underway in these economies. One specific feature that emerges from the empirical findings is that the actual enterprise responses to competitive pressure may differ in the stages of economic transformation in these countries. For all these reasons the in-depth empirical analysis based on micro data is a valuable (and probably remains unique) source of information about the specificities of the actual adjustment process.

According to the empirical results presented in the paper, the most powerful competitive pressures, pressures that have triggered the most discernible and strong responses by firms in Central and Eastern Europe, are those generated by foreign firms on the local markets. This occurs both through the emergence of foreign-dominated manufacturing firms that operate in the domestic manufacturing sectors, and through the competition effects induced through trade liberalisation, resulting in increasing import penetration of the domestic markets. As to the actual direction of these effects, the results are equivocal, suggesting the incidence of both positive and negative spillovers of foreign induced competitive pressure. On the one hand, there is strong evidence, suggesting that in some cases this type of competitive pressure is associated with active restructuring of the domestic firms that face it, leading to higher productive efficiency and welfare enhancing changes in

pricing policies. On the other hand, there is also statistically significant evidence of the opposite outcomes: for example, in some cases higher (probably excessive) levels of import competition tend to be associated with declining efficiency of the domestic firms subject to this type of pressure; in other cases foreign controlled firms tend to exploit local market imperfections and to collect larger monopolistic rents than domestic firms.

The empirical results provide systematic evidence of the recurrence of one specific, and somewhat counterintuitive, feature of enterprise performance in the three Central and Eastern European countries. This is the empirical finding that market power per se (in terms of individual market share) does not seem to be associated with the emergence of monopolistic deadweight such as excessive overpricing or efficiency losses. Rather, at this stage of economic transformation, Central and Eastern European firms tend to employ their market power to grow aggressively and to gain even larger market shares. On the other hand, we find relatively strong evidence that the sheer number of competitors in the segments of the product markets of these countries tends to have a healthy effect on enterprise performance, inducing efficiency gains and reducing price markups.

The empirical results for these Central and Eastern European countries suggest that enterprise behaviour and performance changes with the stages of economic transformation. There are notable differences in the nature of enterprise responses in countries that were less advanced in market reforms (at least in the period that we analyse, 1995-2001) such as Romania and Bulgaria, compared to the more advanced Hungary and Slovenia. Advance in market reforms tends to strengthen the positive spillover effects associated with growing competitive pressure and to reduce the initial gaps. Often, the competitive behaviour of the Romanian manufacturing firms shows higher similitude with the behaviour of Hungarian companies than with the one characterising Bulgarian firms.

The role of public policy

The proclaimed purpose of EU competition policy is to ensure that firms do not endanger the overall aim of a unified common market by means of anticompetitive practices that hinder trade in goods and services between Member States. One of the prominent specificities – and objectives – of Community competition policy is to facilitate the integration of European markets. Institutional independence and operational autonomy in implementation and enforcement also ensure that national authorities are able to perform an advocacy role for the promotion of competition in their respective countries. At the same time, in some circumstances, this approach has induced conflicts with more specific goals dictated by a strict application of criteria of economic efficiency.

In advanced market economies the immediate aim of competition policy is to foster efficient allocation of resources in the traditional economic sense, and therefore such policies stress market behaviour of firms and control of mergers. However, in emerging market economies the immediate goal of competition policy may be bound to be somewhat broader, because there may be less consensus about the desirability of competition policy; economic, legal, social or political institutions are less appropriate for the development of a free market economy; and the public may attribute greater importance to the short term disruptions a market economy can provoke than to its long term benefit, with the result that the immediate objective of competition policy appears to be the emergence of economic opportunities and entrepreneurship in a context in which more attention must be paid to establishing the political acceptance of a market economy. Competition policy therefore appears to have a more regulatory character, thereby allowing it to play an active role in the transformation of economic structures and behaviours.

Our empirical analysis covers a period which falls in the aftermath of a deep systemic change in the institutional order in Central and Eastern Europe. This was still a period of rapid and radical institutional change, reinforced by the preparation for EU accession. Public policy in CEE countries typically had an activist stand, in particular in propelling rapid legislative and regulatory changes in harmonizing the domestic regulatory environment with EU's *acquis communautaire*. These ongoing institutional changes were having a strong effect on enterprise behaviour and performance and provoked various interactions between institutional and economic agents.

We develop a methodology for cross-country analysis of firms' responses to competitive pressure and policy-related institutional interactions and change and apply this methodology to empirical data for the countries concerned. The proposed methodology is a two-step approach: in the first step, we derive meso-level, sectoral indicators, in which we eliminate the effect of firm-specific, time-varying factors that are not directly related to institutional interactions and change; in the second step, we use these meso-level indicators for a cross-country analysis of the firms' responses to competitive pressure, institutional interactions and change, in conjunction with other relevant factors. We apply this two-tier approach for two meso- (sectoral) level variables: the average markups by NACE sectors and the average productive efficiency by NACE sectors computed for different countries.

The estimation results based on firm-level data for three countries, Bulgaria, Hungary and Romania, make it possible to gain further insights into the effects of competitive pressure on firm behaviour and performance and highlight some of its transmission mechanisms, taking into account institutional interactions and change. Most of our empirical results are consistent with the theoretical priors. Thus our results presented indicate a strong positive statistical association between higher overall competitive pressure in the corresponding market and the average technical efficiency of the firms operating in this market. We also find that a higher degree of monopolization or oligopolization of the market is associated with higher markup ratios, suggesting that firms with a dominant position are more likely to extract rents through higher monopolistic prices. An increasing investment ratio seems to be a positive factor in driving mark-ups down and efficiency up. The degree of foreign penetration in the local ownership structure is generally associated with higher average efficiency in these sectors. In turn, financial pressure (related to high indebtedness and, possibly, soft budget constraints reducing competitive pressure) tends to be negatively associated with firm efficiency, except for the cases when debt is inherited and fought against using strengthened fiscal and financial policies.

At the same time some of our findings suggest that excessive competition on the local markets can be detrimental to the domestic firms of these immature market economies, possibly due to the weakness of local firms to withstand competitive pressure. This is especially the case with competitive pressure generated by high import penetration in the domestic markets. Our empirical results indicate some destructive effect of excessive import penetration: it tends to be associated with lower average productive efficiency of domestic firms in the same sector.

Finally, we did not find a statistically significant association between the indicator of institutional change and progress in market reforms used in the model (the EBRD index of "progress in transition") and the meso-level variables measuring firms' responses. On the one hand, this outcome may suggest that the policy and institutional changes that are being introduced nominally do not actually translate into motivational driving forces for the firms. It may also be a sign of weak enforcement of policy and regulation by the public bodies and other regulatory institutions entrusted with the implementation of policy and regulation. On the other hand, this outcome may be due to impreciseness in our data, calling for further research into the refinement of the methodology and its empirical application.

References

Aigner, D., Lovell, C and Schmidt, P. (1977), "Formulation and Estimation of Stochastic Frontier Production Function Models", *Journal of Econometrics*, 6(1), pp. 21-37.

Angelucci , M., Estrin, S., Konings, J. and Zólkiewski, Z. (2001), "The Effect of Ownership and Competitive Pressure on Firm Performance in Transition Countries: Micro Evidence from Bulgaria, Romania and Poland", Centre for Economic Policy Research, Discussion Paper No. 2985, October.

Balestra, P. and Varadharajan-Krishnakumar, J. (1987), "Full information estimations of a system of simultaneous equations with error component structure", *Econometric Theory*, 3, pp. 223-246.

Basu, S., and Fernald, J.G. (1997). "Returns to Scale in US Production: Estimates and Implications." *Journal of Political Economy*, 105(2), p. 249-283.

Battese, G. and Coelli, T. (1995), "A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel data", *Empirical Economics*, 20(2), pp. 325-332.

Battese, G. and Corra,G. (1977), "Estimation of a Production Frontier Model: With Application to the Pastoral Zone of Eastern Australia", *Australian Journal of Agricultural Economics*, 21(3), pp. 169-179.

Bhattacharya S, and Patel, U. R. (2004), "Markets, Regulatory Institutions, Competitiveness and Reform", Paper presented at the workshop on Understanding Reform organized by the Global Development Network, Cairo, 16-17 January 2003.

Bloch, H and Olive, M (2001), "Pricing over the Cycle", *Review of Industrial Organization*, 19(1), pp. 99-108.

Blundell, R. and Bond, S. (2000), "GMM Estimation with Persistent Panel Data: An Application to Production Functions", *Econometric Reviews*, 19(3), pp. 321-40.

Boone, J. (2000), "Competition", Centre for Economic Policy Research, Discussion Paper No. 2636, December.

Bresnahan, T. (1989), "Empirical Studies of Industries with Market Power," In: Schmalensee, R. and Willig, R. (eds.), *Handbook of industrial organization. Volume 2. Handbooks in Economics, No.10*, Amsterdam, Oxford and Tokyo: North-Holland, pp. 1011-1157.

Brown, A. and Brown, J.D. (1998), "Does Market Structure Matter? New Evidence from Russia", CEPR Discussion Paper No. 1946, August 1998.

Brown, D. and Earle, J. (2000), "Competition And Firm Performance: Lessons From Russia", CEPR Discussion Paper No. 2444, May 2000.

Carlin, W., Schaffer, M. and Seabright, P. (2004), "A Minimum of Rivalry: Evidence from Transition Economies on the Importance of Competition for Innovation and Growth", WDI Working Paper No. 670, March 2004.

Carlin, W., Fries, S., Schaffer, M. and Seabright, P. (2001), "Competition and Enterprise Performance in Transition economies: Evidence from a Cross-Country Survey", CEPR Discussion Paper No. 2840, June 2001.

Carroll, G. and Teece, D. (eds.) (1999), *Firms, Markets, and Hierarchies: The Transaction Cost Economics Perspective*, New York and Oxford: Oxford University Press.

Coelli, T. (1994), "FRONTIER Version 4.1: Computer Program for Stochastic Frontier Production and Cost Function Estimation", Armidale, Australia: University of New England, Department of Econometrics.

Coelli, T., Prasada Rao, D. and Battese, G. (1998), *An Introduction to Efficiency and Productivity Analysis*, Kluwer Academic Publishers.

Demsetz, H. (1973), "Industry Structure, Market Rivalry and Public Policy", *Journal of Law and Economics*, 16(1), pp. 1-9.

Djankov, S., Glaeser, E.L., Lopez de Silanes, F. and Shleifer, A. (2003), "The New Comparative Economics", *Journal of Comparative Economics*, 31(4), pp. 595-619.

Djankov, S. and Murrell, P. (2002), "Enterprise Restructuring in Transition: A Quantitative Survey", *Journal of Economic Literature*, 40(3), pp. 739-792.

Djankov, S. and Hoekman, B. (2000), "Market Discipline and Corporate Efficiency: Evidence from Bulgaria", *Canadian Journal of Economics*, 33(1), pp. 190-212.

Djankov, S. and Hoekman, B. (1996), "Fuzzy Transition and Firm Efficiency: Evidence From Bulgaria, 1991-4", Centre for Economic Policy Research, Discussion Paper No. 1424, July 1996.

Dobrinsky, R. (2000), "The Transition Crisis in Bulgaria", *Cambridge Journal of Economics*, 24, pp. 581-602.

Dobrinsky, R, Dochev, N. and Markov, N. (2002), "Labor Adjustment, Wage Formation and Corporate Efficiency in Bulgarian Manufacturing", Paper presented at the Final Workshop on "Labor Adjustment, Wage Policy and Corporate Efficiency towards EU Accession" (PHARE- ACE Project P98-1150-R), Paris, 12 April 2002.

Dobrinsky, R, Dochev, N. and Markov, N. (2001a), "Productivity and the Sources of Firm Level Efficiency in Bulgarian Manufacturing", Paper presented at the Workshop on "The determinants of firm level production efficiency in Poland, Romania and Bulgaria: ownership effects, competition effects and implications for EU enlargement", Poiana Brasov, 19-20 January 2001.

Dobrinsky, R, Markov, N. and Nikolov, B. (2001b), "Mark-up Pricing in Bulgarian Manufacturing, WDI Working Paper No. 389, June 2001.

Dobrinsky, R., Dochev, N., Markov, N. and Nikolov, B. (2001c). "Corporate Financial Flows and Access to Bank Finance under Distorted and Perverse Incentives: Bulgarian Firms in the Eve of the Financial Crisis", *Russian and East European Finance and Trade* 37(2), pp. 78-114.

Domowitz, I., Hubbard, R. G. and Petersen, B.C. (1988), "Market Structure and Cyclical Fluctuations in U.S. Manufacturing", *Review of Economics and Statistics*, 70, pp. 55-66.

Eichner, A. S. (1973), "A Theory of the Determination of the Mark-up Under Oligopoly", *Economic Journal*, 83(332), pp. 1184-1200.

Estrin, S., Konings, J. , Zolkiewski, Z. and Angelucci, M. (2001), "The Effect of Ownership and Competitive Pressure on Firm Performance in Transition Countries: Micro Evidence from Bulgaria, Romania and Poland", LICOS Discussion Paper No. 104, May 2001.

Geroski, P. (1995), "What Do We Know About Entry?", *International Journal of Industrial Organization*, 13(4), pp. 421-440.

Gibrat, R. (1931), *Les Inégalités Ecomoniques*, Paris: Librairie du Recueil Sirey.

Grosfeld, I. and Tressel, T (2002) "Competition and Corporate Governance: Substitutes or Complements? Evidence from the Warsaw Stock Exchange", *Economics of Transition*, 10(3), pp. 525-551.

Grossman, S. and Hart, O. (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration", *Journal of Political Economy*, 94(4), pp. 691-719.

Fare, R. and Primont, D. (1995), *Multi-Output Production and Duality: Theory and Applications*. Kluwer Academic, Boston/ Dordrecht.

Hall, R. (1988), "The Relation between Price and Marginal Cost in U.S. Industry", *Journal of Political Economy*, 96(51), pp. 921-947.

Halpern, L. and Kőrösi, G. (2001a), "Markups in Hungarian Corporate Sector", Working Paper No. 411. William Davidson Institute at the University of Michigan Business School, Ann Arbor, Michigan.

Halpern, L. and Kőrösi, G. (2001b), "Efficiency and Market Share in Hungarian Corporate Sector", *Economics of Transition*, 9, pp. 559-592.

Halpern, L. and Kőrösi, G. (1998), "Corporate Performance in Transition (Econometric Analysis of Hungarian Exporting Firms, 1985-1994)". In: Halpern, László, Wyplosz, Charles (Eds.): *Hungary: Towards a Market Economy.* Cambridge University Press, Cambridge/New York/ Melbourne, pp. 192-212.

Halpern, L. and Wyplosz, C. (1998), "The Hidden Hungarian Miracle", In: Halpern, László, Wyplosz, Charles (Eds.): Hungary: Towards a Market Economy. Cambridge University Press, Cambridge/New York/ Melbourne, pp. 1-19.

Hanousek, J., Kocenda, E. and Svejnar, J. (2004), "Ownership, Control and Corporate Performance after Large-Scale Privatization", WDI Working Paper No. 652, January 2004.

Hoekman, B., Kee, H. L. and Olarreaga, M. (2004), "Tariffs, Entry Regulation and Markups: Country Size Matters", *Contributions to Macroeconomics*, 4, pp. 1-22.

Hylleberg S. and Jørgensen, R. (1998), "A Note on the Estimation of Markup Pricing in Manufacturing", University of Aarus Working Paper No. 1998-6.

Jones, D.C. and Miller, J. (Eds.) (1997), *The Bulgarian Economy: Lessons from Reform during Early Transition*. Ashgate, Aldershot/Brookfield/ Sydney.

Jones, D., Klinedinst, M. and Rock, C. (1998), "Productive Efficiency during Transition: Evidence from Bulgarian Panel Data", *Journal of Comparative Economics*, 26(3), pp. 446-464.

Justman, M. (1987), "An Extension of Lerner's Monopoly Index for Markets with a Disparity between Long- and Short-run Demand Elasticities", *Economic Inquiry*, 25, pp.681-694.

Kee, H. L. (2002), "Markups, Returns to Scale, and Productivity: A Case Study of Singapore's Manufacturing Sector", Policy Research Working Paper No. 2857. The World Bank, Washington, D.C.

Kattuman, P. and Roberts, B. (2000), "Strategy Choices of Firms and Market Structure", University of Leicester, Discussion Papers in Economics No. 00/10.

Klette T.J. (1999), "Market Power, Scale Economies and Productivity: Estimates from a Panel of Establishment Data", *Journal of Industrial Economics*, 47(4), pp. 451-476.

Kodde, D., and Palm, F. (1986), "Wald Criteria for Jointly Testing Equality and Inequality Restrictions", *Econometrica*, 54(5), pp. 1243-1248.

Konings, J. (1997), "Competition and Firm Performance in Transition Economies: Evidence from Firm Level Surveys in Slovenia, Hungary and Romania", CEPR Discussion Paper No. 1770, December 1997.

Konings, J. and Repkine, A. (1998), "How Efficient Are Firms in Transition Countries? Firm-Level Evidence from Bulgaria and Romania", Centre for Economic Policy Research, Discussion Paper No. 1839, March 1998.

Konings, J., Van Cayseele, P. and Warzynski, F. (2005), "The Effects of Privatization and Competitive Pressure on Firms' Price-Cost Margins: Micro Evidence from Emerging Economies", *The Review of Economics and Statistics* 87, pp. 124 – 134.

Konings, J., Van Cayseele, P. and Warzynski, F. (2001a), "Market Power, Competition and Ownership in Emerging Economies", LICOS Centre for Transition Economics, Discussion Paper No. 110, November 2001.

Konings, J., Van Cayseele, P. and Warzynski, F. (2001b), "The Dynamics of Industrial Mark-ups in Two Small Open Economies: Does National Competition Policy Matter?" *International Journal of Industrial Organization*, 19, pp. 841-859.

Konings J, Van Cayseele P and Warzynski F (2001), "The Dynamics of Industrial Mark-ups in Two Small Open Economies: Does National Competition Policy Matter?", *International Journal of Industrial Organization*, 19 (5), pp. 841-859.

Kornai, J. (1980), *Economics of Shortage*. North-Holland, Amsterdam/New York.

Kornai, J. (1993), "Transformational Recession: General Phenomenon Examined through the Example of Hungary's Development", Economie Appliquée, 46, pp. 181-227.

Kumar, K., Rajan, R. and Zingales, L. (2001), "What Determines Firm Size?", Center for Research in Security Prices, University of Chicago, Working Papers No. 496.

Lavoie, M. (1996), "Mark-Up Pricing versus Normal Cost Pricing in Post-Keynesian Models", *Review of Political Economy*, 8(1), pp. 57-66.

Levinsohn, J. and Petrin, A. (2003), "Estimating Production Functions Using Inputs to Control for Unobservables", *Review of Economic Studies*, 70(2), pp. 317-341.

Linnemann L (1999), "Sectoral and Aggregate Estimates of the Cyclical Behavior of Markups: Evidence from Germany", *Weltwirtschaftliches Archiv*, 135(3), pp. 480-500.

Lotti, F. and Santarelli, E. (2001), "Is Firm Growth Proportional? An Appraisal of Firm Size Distribution", *Economics Bulletin*, 12(6), pp. 1-7.

Morrison, C. J. (1992), "Markups in U.S. and Japanese Manufacturing: A Short-run Econometric Analysis", *Journal of Business and Economic Statistics*, 10, pp. 51-63.

Nickell, S. (1996), "Competition and Corporate Performance", *Journal of Political Economy*, 104(4), pp. 724-746.

Nickell, S., Wadhwani, S. and Wall, M. (1992), "Productivity Growth in U.K. Companies, 1975-1986", *European Economic Review*, 36(5), pp. 1055-1085.

Norrbin, S. C. (1993), "The Relation between Price and Marginal Cost in U.S. Industry: A Contradiction", *Journal of Political Economy*, 101, pp. 1149-1164.

North, D. C. (1991), "Towards a Theory of Institutional Change", Quarterly Review of Economics and Business, 31(4), pp. 3-11.

North, D. C. (1990), *Institutions, Institutional Change and Economic Performance*, Cambridge: Cambridge University Press, 152 pp.

Olley, S. and Pakes, A. (1996), "The Dynamics of Productivity in the Telecommunications Equipment Industry", *Econometrica*, 64(6), pp. 1263-1297.

Oliveira Martins, J. and Scarpetta, S. (1999), "The Levels and Cyclical Behaviour of Mark-ups across Countries and Market Structures", OECD Economics Department Working Papers No. 213.

Oliveira Martins, J., Scarpetta, S. and Pilat, D. (1996), "Mark-up Ratios in Manufacturing Industries. Estimations for 14 OECD Countries", OECD Economics Department Working Papers No. 162.

Orazem, P. and Vodopivec, M. (2003), "Do Market Pressures Induce Economic Efficiency? The Case of Slovenian Manufacturing, 1994-2001", WDI Working Paper No. 621, October 2003.

Paquet, A and Robidoux, B (2001), "Issues on the Measurement of the Solow Residual and the Testing of its Exogeneity: Evidence for Canada", *Journal of Monetary Economics,* 47(3), pp. 595-612.

Piesse, J. and Thirtle, C. (2000), "A Stochastic Frontier Approach to Firm Level Efficiency, Technological Change and Productivity during the Early Transition in Hungary", *Journal of Comparative Economics*, 28(3), pp. 473-501.

Quinzii, M. (1992), Increasing Returns and Efficiency. Oxford University Press, Oxford/ New York/Toronto/ Melbourne.

Raper, K., Love, H., and Shumway, C. (2000), "Determining Market Power Exertion Between Buyers and Sellers", *Journal of Applied Econometrics*, 15(3), pp. 225-252.

Roberts, M. J. and Supina, D. (1996), „Output Price, Markups, and Producer Size", *European Economic Review*, 40, pp. 909-921.

Roberts, M. J. and Supina, D. (2000), „Output Price and Markup Dispersion in Micro Data: The Roles of Producer Heterogeneity and Noise". In: Baye, Michael R. (Ed.) *Industrial Organization. Advances in Applied Microeconomics*, Vol. 9. Elsevier Science, Amsterdam/New York/ Tokyo, pp. 1-36.

Roeger, W. (1995), "Can Imperfect Competition Explain Differences between Primal and Dual Productivity Measures? Estimates for US Manufacturing", *Journal of Political Economy*, 103(2), pp. 316-330.

Schumpeter, J. (1934), *The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, Cambridge, Mass., Harvard University Press.

Shapiro, M. D. (1987), "Measuring market power in U.S. industry", Working Paper No. 2212. National Bureau of Economic Research, Cambridge, MA.

Simon, H. and Bonini, C. (1958), "The Size Distribution of Business Firms", *American Economic Review*, 58(4), pp. 607-617.

Sutton, J. (2001a), "Rich Trades, Scarce Capabilities: Industrial Development Revisited", London School of Economics, STICERD Discussion Paper Series EI/28, September.

Sutton, J. (2001b), "The Variance of Firm Growth Rates: The "Scaling" Puzzle," LSE Economics of Industry Group Discussion Paper EI/27, September.

Sutton, J. (1998), *Technology and Market Structure*, Cambridge: MIT Press.

Sutton J. (1991), *Sunk Costs and Market Structure: Price Competition, Advertising and the Evolution of Concentration*, Cambridge: MIT Press.

Van Dijks, M. and Van Bergeijk, P. (1997), "Resource Misallocation and Markup ratios: An Alternative Estimation Technique for Harberger Triangles", *Economics Letters*, 54(2), pp. 165-167.

Weiss C. (2000), "Mark-ups, Industry Structure and the Business Cycle", *Applied Economics Letters,* 7(3), pp. 189-191.

Williamson, O. E. (200), "The New Institutional Economics: Taking Stock, Looking Ahead", *Journal of Economic Literature*, 38(3), pp. 595-613.

Wu Y. and Zhang J. (2000), "Endogenous Markups and the Effects of Income Taxation: Theory and Evidence from OECD Countries," *Journal of Public Economics*, 77(3), pp. 383-406.

APPENDIX

Part A. Enterprise datasets used in the study and selected descriptive statistics for the manufacturing firms in Bulgaria, Hungary, Romania and Slovenia

ENTERPRISE DATASETS

Bulgaria

The empirical analysis of the Bulgarian corporate sector has been based on a comprehensive enterprise data base that has been compiled at the Centre for Economic and Strategic Research for more than 10 years. It consists of annual balance sheet data for individual enterprises and covers all Bulgarian enterprises that report to the National Statistical Institute in accordance with the "double entry" accounting method. The time period covered is from 1994/95 to 2002.

The main components of the individual enterprise records are the annual "Balance sheet" and "Income statement" of the enterprise. In addition to that the individual enterprise records contain are some supplementary documents with additional annual data. The most important of these are:

- Income and expenditure (contains a more detailed breakdown of individual income and expenditure items);
- Fixed assets (describe changes in the course of the year);
- Receivables and payables (a more detailed breakdown);
- Cash flow (describes all incoming and outgoing payments in the course of the year);
- Personnel (by categories) and labour costs (a more detailed breakdown);
- Investment expenditures;
- Taxes paid (a more detailed breakdown, including tax arrears);
- Export earnings (by major currencies);

While consisting of un-identified entities (in accordance with the Law on Statistics) the enterprise data set contains identifiers that allow to categorize the firms by different parameters such as:

- *ownership*. In the tables in the Annex have identified four major ownership categories: SOEs, firms privatized to domestic investors, other domestically owned private firms and firms with foreign participation.
- *sector/branch* of economic activity (at different level of aggregation). For the purposes of this study we have used mostly the NACE classification (from NACE 1-digit to NACE 3-digit levels).
- *location*, etc.

The full data set is an unbalanced panel as different number of enterprises have reported in different years. The actual number of enterprises increases from some 20000 in 1995 to more than 80000 in 2002. Some parts of the empirical analysis were performed on the subset of Bulgarian manufacturing firms. The total number of manufacturing firms in the dataset ranges from some 4,000 in 1994 to more than 12,000 in 2002.

Hungary

The Hungarian corporate dataset covers mostly large corporate entities and this prevents the computation of some of the indices directly from firm-level data. Due to this, some of the indices are computed from reported sectoral aggregates, based on all incorporated firms which, in turn, limits to some extent the coverage of the measurement effort. The dataset is thus based on balance sheet information for Hungarian manufacturing firms supplemented with sectoral data. The actual enterprise dataset consists of the profit and loss statements and balance sheets of a sample of firms for the same period. The total number of firms ranges from around 3,000 in 1994 to more than 5,000 in 2003. Compared to Bulgaria, the Hungarian dataset only covers part of the manufacturing sector. The sample includes at least 15%, and usually more than 20%, of all manufacturing firms in every year. However, with respect to sales volume the sample accounts for least 70% of all manufacturing sales in Hungary in every year. Another difference is that the Hungarian dataset covers only firms employing at least 10 people. Thus, the sample selection in Hungary is biased towards the large firms.

The most important tendency which can be observed from the Hungarian indices is the gradual privatisation of state-owned enterprises, very frequently to foreign owners. Even though the number of firms increased more or less steadily in almost all sectors, sectoral concentration, measured by the Hirshman-Herfindahl index of output, or by the share of the largest firms in output or exports, did not substantially diminish in most sectors. There are sectors where concentration actually increased, as major multinational firms moved production to Hungary, and immediately became dominant players in their sectors. (For example, NACE 32 - Electronic products and components.)

Import penetration increased substantially in several sectors; however, that may also be related to the increasing market share of multinationals: they may import large amount of components for their assembly lines. That will not increase competitive pressure, as that basically represents within firm allocation of resources.

Romania

The empirical analysis of the Romanian corporate sector has been based – similarly to the Bulgarian case - on a comprehensive enterprise data base that has been compiled at the Romanian Centre for Economic Modelling (RCEM) during 1998-2002. It consists of annual balance sheet data for individual enterprises and covers more than 14,000 enterprises that report to the National Institute for Statistics in accordance with the “double entry” accounting method. Unfortunately, the data for 2002 lack the form assets among the indicators, thus not allowing for the computation of any production function in that year.

Like in the case of Hungary, the enterprise dataset is complemented with reported sectoral aggregates, for those categories where data was not available in the company data set. The actual sample of companies covers approximately 80% of the total turnover in the corporate sector; the same coverage ratio is representative for the manufacturing sector (76% without considering 4 sectors with high intrinsic concentration). The data are not equally representative on sections, subsections and divisions. However, for most sectors, available data cover between 75% and 99% of the sectoral turnover. In only one case, the coverage is below 60%. The lowest coverage rates are in services sectors, therefore the dataset is perfectly suitable for an analysis of the Romanian manufacturing sector. The exports reported in the companies balance-sheets are only the direct exports. The share of direct exports in total exports also varies from one branch to any other. Data on direct exports are not requested in the balance sheet after 2000. Consequently, sectoral aggregates were used for export shares

and import penetration rates. Compared to the Bulgarian dataset and its list of reported categories (see above), the other missing item/category is the investment expenditure for all companies, thus forcing us to use already-compiled sectoral aggregates (National Institute for Statistics).

Slovenia

The Slovenian estimations are based on the comprehensive firm-level dataset on trade and capital flows for 1994-2002 compiled by the Bank of Slovenia. It is focused on the manufacturing sector where it covers the overwhelming part of the country's corporate sector (apart from small firms with less than 10 employees). Thus the data used in the empirical analysis are collected from balance sheets and income statements for the Slovenian manufacturing firms. The number of firms in the datasets ranges from some 1000 in 1994 to around 1400 in 2002. These firms have been selected out of total 6,400 manufacturing firms according to following criteria:

– firms with more than 10 employees and more than €1 million of net sales

– in some cases the analysis was based on a balanced panel for the period 1994-2002, thus limiting the number of firms to around 1000.

In addition, a selection was applied in order to preserve the adequate quality of the data and consistency of results.

The dynamics of the sectoral composition of output in Slovenia suggests a notable decline of traditional sectors, such as food, wood, paper and rubber industry. At the same time, there is notable and expansion of chemicals (pharmaceuticals), metal processing, machinery, electric appliances and transport equipment. In the period 1994-2002, one can observe increased pressures from foreign firms in the domestic market in almost all industries. Increased foreign competition is particularly evident in chemicals, rubber, non-metal, metal and machinery, where market shares of foreign affiliates reach some 20%.

Table A1-B. Number of firms by NACE-2: Bulgaria

NACE 2-digit sectors	1995	1996	1997	1998	1999	2000	2001
15 : Manufacture of food products and beverages	942	1530	1776	2014	2198	2331	2530
16 : Manufacture of tobacco products	25	31	27	31	30	31	32
17 : Manufacture of textiles	187	246	251	273	322	328	357
18 : Manufacture of wearing apparel; dressing and dyeing of fur	423	726	853	999	1153	1239	1431
19 : Tanning and dressing of leather; manufacture of luggage and footwear	98	144	167	199	229	243	250
20 : Manufacture of wood and wood products, except furniture; articles of straw	187	443	527	522	622	619	650
21 : Manufacture of pulp, paper and paper products	78	121	129	171	182	216	239
22 : Publishing, printing and reproduction of recorded media	379	580	641	680	729	778	820
23 : Manufacture of coke, refined petroleum products and nuclear fuel	8	8	9	9	12	12	14
24 : Manufacture of chemicals and chemical products	148	278	317	345	377	417	428
25 : Manufacture of rubber and plastic products	129	335	389	381	439	454	488
26 : Manufacture of other non-metallic mineral products	192	279	299	311	360	372	398
27 : Manufacture of basic metals	85	114	111	119	134	150	168
28 : Manufacture of fabricated metal products, except machinery and equipment	351	698	723	759	872	914	967
29 : Manufacture of machinery and equipment n.e.c.	453	727	772	817	937	976	1024
30 : Manufacture of office machinery and computers	53	78	98	84	83	81	86
31 : Manufacture of electrical machinery and apparatus n.e.c.	137	255	263	294	337	362	387
32 : Manufacture of radio, television and communication equipment and apparatus	91	150	154	145	141	125	132
33 : Manufacture of medical, precision and optical instruments, watches and clocks	107	162	175	206	231	415	473
34 : Manufacture of motor vehicles, trailers and semi-trailers	38	63	64	71	76	76	83
35 : Manufacture of other transport equipment	43	74	75	84	130	144	146
36 : Manufacture of furniture; manufacturing n.e.c.	262	417	470	476	561	625	656
37 : Recycling	4	4	7	9	8	9	16
All manufacturing firms	4420	7463	8297	8999	10163	10917	11775

Table A1-H. Number of firms by NACE-2: Hungary

NACE 2-digit sectors	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
15 : Manufacture of food products and beverages	1510	1996	2224	2377	2508	2663	2773	2818	2923	3178
16 : Manufacture of tobacco products	5	6	6	6	7	7	7	7	7	7
17 : Manufacture of textiles	420	501	518	582	656	755	805	787	761	842
18 : Manufacture of wearing apparel; dressing and dyeing of fur	707	796	791	847	957	1042	1166	1217	1280	1489
19 : Tanning and dressing of leather; manufacture of luggage and footwear	259	296	289	307	328	363	373	378	380	411
20 : Manufacture of wood and wood products, except furniture; articles of straw	599	739	779	860	1000	1141	1232	1283	1340	1551
21 : Manufacture of pulp, paper and paper products	110	134	158	176	195	219	246	257	276	318
22 : Publishing, printing and reproduction of recorded media	1367	1596	1685	1866	2148	2495	2662	2771	3022	3521
23 : Manufacture of coke, refined petroleum products and nuclear fuel	2	6	8	11	7	8	9	9	9	9
24 : Manufacture of chemicals and chemical products	346	400	404	445	471	518	516	532	553	576
25 : Manufacture of rubber and plastic products	558	678	706	762	861	979	1026	1087	1133	1231
26 : Manufacture of other non-metallic mineral products	415	482	511	540	616	691	738	775	825	952
27 : Manufacture of basic metals	146	176	181	192	215	220	241	242	243	254
28 : Manufacture of fabricated metal products, except machinery and equipment	1365	1591	1709	1867	2140	2432	2647	2795	3055	3466
29 : Manufacture of machinery and equipment n.e.c.	1399	1555	1577	1621	1798	1967	2038	2040	2029	2199
30 : Manufacture of office machinery and computers	85	95	95	102	124	144	160	168	184	198
31 : Manufacture of electrical machinery and apparatus n.e.c.	388	463	479	525	587	672	703	722	715	768
32 : Manufacture of radio, television and communication equipment and apparatus	295	342	364	389	445	499	519	530	542	609
33 : Manufacture of medical, precision and optical instruments, watches and clocks	420	494	545	588	665	735	792	815	858	955
34 : Manufacture of motor vehicles, trailers and semi-trailers	131	165	164	185	193	215	230	243	258	259
35 : Manufacture of other transport equipment	70	73	78	85	104	120	131	129	144	171
36 : Manufacture of furniture; manufacturing n.e.c.	517	609	634	702	838	949	1035	1111	1187	1464
37 : Recycling	32	41	48	54	73	93	104	114	127	132
All manufacturing firms	11146	13234	13953	15089	16936	18927	20153	20830	21851	24560

Table A1-R. Number of firms in manufacturing by NACE-2: Romania

	Number of firms in sample					Total number of registered firms				TR*
NACE 2-digit sectors	**1998**	**1999**	**2000**	**2001**	**2002**	**1998**	**1999**	**2000**	**2001**	**1998**
15 : Manufacture of food products and beverages	1116	947	900	920	819	9263	8997	8571	8631	62%
16 : Manufacture of tobacco products	12	12	11	12	10	103	48	34	30	n.a.
17 : Manufacture of textiles	344	321	321	330	243	3005	2919	2814	2895	70%
18 : Manufacture of wearing apparel; dressing and dyeing of fur	168	199	222	291	361	2797	2895	3037	3251	58%
19 : Tanning and dressing of leather; manufacture of luggage and footwear	140	150	183	219	212	1346	1343	1384	1526	71%
20 : Manufacture of wood and wood products, except furniture; articles of straw	259	263	320	280	270	5586	5794	6157	6225	83%
21 : Manufacture of pulp, paper and paper products	58	65	71	75	68	389	414	459	500	89%
22 : Publishing, printing and reproduction of recorded media	164	145	155	158	144	1959	2143	2218	2355	73%
23 : Manufacture of coke, refined petroleum products and nuclear fuel	14	15	13	12	15	34	28	28	31	n.a.
24 : Manufacture of chemicals and chemical products	200	184	179	182	171	1106	1103	1088	1088	88%
25 : Manufacture of rubber and plastic products	137	139	155	161	169	1723	1657	1607	1607	86%
26 : Manufacture of other non-metallic mineral products	158	167	185	192	194	1243	1302	1378	1488	75%
27 : Manufacture of basic metals	105	104	115	117	108	445	471	466	475	99%
28 : Manufacture of fabricated metal products, except machinery and equipment	343	308	315	321	309	2642	2840	3019	3153	77%
29 : Manufacture of machinery and equipment n.e.c.	155	170	169	191	225	392	449	506	608	77%
30 : Manufacture of office machinery and computers	45	44	36	30	49	173	185	185	238	66%
31 : Manufacture of electrical machinery and apparatus n.e.c.	78	83	91	95	101	570	575	572	627	83%
32 : Manufacture of radio, television and communication equipment and apparatus	34	32	33	27	20	162	170	162	174	76%
33 : Manufacture of medical, precision and optical instruments, watches and clocks	44	43	50	51	56	300	334	343	404	74%
34 : Manufacture of motor vehicles, trailers and semi-trailers	68	64	70	75	85	260	288	304	312	n.a.
35 : Manufacture of other transport equipment	53	59	60	67	70	155	193	231	276	98%
36 : Manufacture of furniture; manufacturing n.e.c.	151	165	195	220	233	2262	2463	2654	2900	n.a.
37 : Recycling	58	68	118	101	118	523	673	806	742	62%
All manufacturing firms	3904	3747	3967	4127	4050	36438	37284	38023	39536	76%

Note: * TR is the turnover ratio, i.e. the ratio between the total turnover of firms in the sample and the total turnover of Romanian firms, in a given sector. The ratio doesn't vary with more than 3% from one year to another, thus we reported only the computations for 1998.

Table A1-S. Number of firms by NACE-2: Slovenia

NACE 2-digit sectors	1994	1995	1996	1997	1998	1999	2000	2001	2002
15 : Manufacture of food products and beverages	91	98	103	114	118	118	111	101	101
16 : Manufacture of tobacco products	53	63	67	75	74	73	73	73	71
17 : Manufacture of textiles	53	56	59	65	67	66	63	54	55
18 : Manufacture of wearing apparel; dressing and dyeing of fur	16	20	22	26	23	24	22	19	17
19 : Tanning and dressing of leather; manufacture of luggage and footwear	64	73	85	85	84	86	84	89	83
20 : Manufacture of wood and wood products, except furniture; articles of straw	21	24	26	28	30	32	33	32	32
21 : Manufacture of pulp, paper and paper products	59	69	73	79	87	88	88	83	83
22 : Publishing, printing and reproduction of recorded media	2	2	2	3	3	3	3	3	3
23 : Manufacture of coke, refined petroleum products and nuclear fuel	49	54	57	53	55	55	52	53	53
24 : Manufacture of chemicals and chemical products	53	65	70	71	84	87	85	89	91
25 : Manufacture of rubber and plastic products	52	53	56	60	62	62	64	61	66
26 : Manufacture of other non-metallic mineral products	18	22	23	26	28	31	33	32	31
27 : Manufacture of basic metals	121	145	160	183	185	207	207	211	217
28 : Manufacture of fabricated metal products, except machinery and equipment	102	116	131	130	133	136	134	135	138
29 : Manufacture of machinery and equipment n.e.c.	15	17	16	20	20	18	19	19	20
30 : Manufacture of office machinery and computers	55	61	63	67	75	74	78	80	80
31 : Manufacture of electrical machinery and apparatus n.e.c.	23	28	34	36	37	38	39	36	36
32 : Manufacture of radio, television and communication equipment and apparatus	41	51	51	53	55	57	59	54	55
33 : Manufacture of medical, precision and optical instruments, watches and clocks	29	32	36	34	39	36	34	32	32
34 : Manufacture of motor vehicles, trailers and semi-trailers	5	6	6	6	6	6	4	5	7
35 : Manufacture of other transport equipment	65	72	83	90	96	102	99	96	98
36 : Manufacture of furniture; manufacturing n.e.c.	8	9	11	12	11	11	12	12	13
37 : Recycling	91	98	103	114	118	118	111	101	101
All manufacturing firms	**995**	**1136**	**1234**	**1316**	**1372**	**1410**	**1396**	**1369**	**1382**

Table A2-B. Herfindahl index by NACE sectors (%): Bulgaria

NACE 2-digit sectors	1995	1996	1997	1998	1999	2000	2001
15 : Manufacture of food products and beverages	0.006	0.006	0.006	0.006	0.006	0.006	0.006
16 : Manufacture of tobacco products	0.090	0.093	0.133	0.119	0.157	0.175	0.201
17 : Manufacture of textiles	0.020	0.022	0.022	0.020	0.023	0.021	0.029
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.016	0.016	0.012	0.009	0.007	0.006	0.005
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.050	0.060	0.046	0.034	0.027	0.032	0.028
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.048	0.059	0.048	0.048	0.037	0.045	0.032
21 : Manufacture of pulp, paper and paper products	0.067	0.064	0.071	0.061	0.054	0.054	0.053
22 : Publishing, printing and reproduction of recorded media	0.132	0.120	0.125	0.056	0.045	0.046	0.041
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.804	0.942	0.949	0.480	0.908	0.956	0.812
24 : Manufacture of chemicals and chemical products	0.062	0.068	0.061	0.043	0.041	0.051	0.051
25 : Manufacture of rubber and plastic products	0.091	0.084	0.078	0.052	0.040	0.038	0.038
26 : Manufacture of other non-metallic mineral products	0.035	0.038	0.045	0.032	0.035	0.042	0.044
27 : Manufacture of basic metals	0.254	0.226	0.275	0.132	0.216	0.230	0.186
28 : Manufacture of fabricated metal products, except machinery and equipment	0.049	0.028	0.063	0.031	0.018	0.023	0.033
29 : Manufacture of machinery and equipment n.e.c.	0.034	0.025	0.037	0.028	0.027	0.025	0.023
30 : Manufacture of office machinery and computers	0.110	0.112	0.102	0.096	0.083	0.089	0.077
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.060	0.055	0.056	0.047	0.046	0.060	0.037
32 : Manufacture of radio, television and communication equipment and apparatus	0.056	0.037	0.035	0.045	0.045	0.078	0.175
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.078	0.086	0.041	0.026	0.035	0.028	0.032
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.095	0.127	0.102	0.100	0.069	0.084	0.067
35 : Manufacture of other transport equipment	0.325	0.232	0.284	0.395	0.086	0.114	0.088
36 : Manufacture of furniture; manufacturing n.e.c.	0.015	0.016	0.015	0.015	0.016	0.016	0.014
37 : Recycling	0.391	0.565	0.516	0.245	0.301	0.359	0.693

Table A2-H. Herfindahl index by NACE sectors (%): Hungary

NACE 2-digit sectors	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
15 : Manufacture of food products and beverages	0.006	0.006	0.006	0.006	0.007	0.008	0.008	0.008	0.008	0.008
16 : Manufacture of tobacco products	0.268	0.278	0.263	0.270	0.244	0.276	0.275	0.272	0.272	0.315
17 : Manufacture of textiles	0.023	0.024	0.025	0.024	0.029	0.024	0.018	0.017	0.040	0.017
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.011	0.009	0.011	0.013	0.014	0.013	0.012	0.030	0.042	0.061
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.039	0.033	0.029	0.025	0.025	0.025	0.038	0.041	0.037	0.039
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.021	0.024	0.025	0.026	0.026	0.028	0.028	0.026	0.024	0.026
21 : Manufacture of pulp, paper and paper products	0.114	0.089	0.083	0.082	0.073	0.077	0.078	0.077	0.086	0.087
22 : Publishing, printing and reproduction of recorded media	0.011	0.009	0.008	0.009	0.008	0.008	0.008	0.007	0.007	0.007
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.000	0.899	0.898	0.939	0.913	0.940	0.944	0.947	0.875	0.904
24 : Manufacture of chemicals and chemical products	0.064	0.053	0.054	0.060	0.055	0.060	0.053	0.053	0.067	0.062
25 : Manufacture of rubber and plastic products	0.074	0.018	0.017	0.016	0.015	0.015	0.014	0.013	0.012	0.011
26 : Manufacture of other non-metallic mineral products	0.019	0.018	0.017	0.019	0.017	0.019	0.020	0.019	0.022	0.021
27 : Manufacture of basic metals	0.129	0.143	0.146	0.115	0.117	0.122	0.118	0.118	0.132	0.114
28 : Manufacture of fabricated metal products, except machinery and equipment	0.011	0.009	0.009	0.011	0.009	0.008	0.007	0.006	0.006	0.005
29 : Manufacture of machinery and equipment n.e.c.	0.023	0.020	0.018	0.018	0.017	0.020	0.016	0.022	0.025	0.024
30 : Manufacture of office machinery and computers	0.100	0.111	0.129	0.115	0.384	0.544	0.534	0.556	0.810	0.709
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.096	0.079	0.097	0.094	0.076	0.079	0.077	0.076	0.087	0.162
32 : Manufacture of radio, television and communication equipment and apparatus	0.051	0.050	0.065	0.070	0.105	0.185	0.154	0.118	0.138	0.201
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.045	0.039	0.027	0.033	0.032	0.025	0.020	0.016	0.018	0.017
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.217	0.170	0.174	0.199	0.170	0.167	0.255	0.312	0.315	0.283
35 : Manufacture of other transport equipment	0.093	0.087	0.089	0.092	0.081	0.075	0.077	0.089	0.092	0.085
36 : Manufacture of furniture; manufacturing n.e.c.	0.014	0.014	0.013	0.014	0.012	0.012	0.011	0.012	0.012	0.013
37 : Recycling	0.237	0.175	0.187	0.158	0.117	0.105	0.122	0.135	0.110	0.122

Table A2-R. Herfindahl index by NACE sectors (%): Romania

NACE 2-digit sectors	1998	1999	2000	2001	2002
15 : Manufacture of food products and beverages	0.00464	0.00479	0.00537	0.00682	0.00746
16 : Manufacture of tobacco products	0.38675	0.45904	0.29940	0.18044	0.24198
17 : Manufacture of textiles	0.00785	0.00777	0.00875	0.00967	0.01284
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.01396	0.01637	0.01166	0.01350	0.02581
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.02578	0.01713	0.01004	0.00845	0.00943
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.01081	0.00905	0.00787	0.01146	0.01486
21 : Manufacture of pulp, paper and paper products	0.05119	0.04788	0.04783	0.04484	0.05003
22 : Publishing, printing and reproduction of recorded media	0.01933	0.02606	0.02592	0.02129	0.02470
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.25877	0.17019	0.24884	0.27332	0.28339
24 : Manufacture of chemicals and chemical products	0.04118	0.04325	0.04544	0.04425	0.04144
25 : Manufacture of rubber and plastic products	0.04205	0.03559	0.03042	0.02549	0.03232
26 : Manufacture of other non-metallic mineral products	0.03160	0.03078	0.02461	0.02664	0.02979
27 : Manufacture of basic metals	0.17180	0.17273	0.17488	0.13957	0.17377
28 : Manufacture of fabricated metal products, except machinery and equipment	0.01034	0.00981	0.01039	0.00930	0.00902
29 : Manufacture of machinery and equipment n.e.c.	0.02727	0.02250	0.02260	0.02007	0.01668
30 : Manufacture of office machinery and computers	0.05211	0.05619	0.06963	0.08602	0.10277
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.03952	0.04329	0.04325	0.03913	0.04940
32 : Manufacture of radio, television and communication equipment and apparatus	0.09606	0.10657	0.19850	0.21251	0.25510
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.04837	0.04282	0.04281	0.04354	0.03974
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.14077	0.14746	0.13229	0.11469	0.11730
35 : Manufacture of other transport equipment	0.04055	0.04448	0.04673	0.04570	0.05162
36 : Manufacture of furniture; manufacturing n.e.c.	0.01667	0.01519	0.01190	0.01289	0.01083
37 : Recycling	0.03936	0.03741	0.02529	0.02207	0.02233

Table A2-S. Herfindahl index by NACE sectors (%): Slovenia

NACE 2-digit sectors	1994	1995	1996	1997	1998	1999	2000	2001	2002
15 : Manufacture of food products and beverages	0.031	0.031	0.032	0.032	0.031	0.030	0.035	0.039	0.039
16 : Manufacture of tobacco products	0.040	0.050	0.061	0.071	0.103	0.142	0.223	0.267	0.246
17 : Manufacture of textiles	0.186	0.169	0.169	0.159	0.159	0.151	0.150	0.171	0.175
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.183	0.177	0.169	0.192	0.170	0.138	0.148	0.146	0.138
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.043	0.038	0.036	0.036	0.036	0.034	0.036	0.034	0.034
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.121	0.115	0.115	0.110	0.117	0.104	0.107	0.112	0.109
21 : Manufacture of pulp, paper and paper products	0.058	0.052	0.046	0.046	0.045	0.044	0.047	0.051	0.052
22 : Publishing, printing and reproduction of recorded media	0.502	0.529	0.511	0.859	0.823	0.848	0.862	0.788	0.782
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.111	0.099	0.101	0.104	0.105	0.101	0.101	0.106	0.113
24 : Manufacture of chemicals and chemical products	0.241	0.211	0.193	0.179	0.100	0.109	0.124	0.113	0.115
25 : Manufacture of rubber and plastic products	0.048	0.045	0.046	0.044	0.044	0.045	0.046	0.047	0.050
26 : Manufacture of other non-metallic mineral products	0.152	0.155	0.143	0.149	0.125	0.128	0.140	0.140	0.134
27 : Manufacture of basic metals	0.047	0.044	0.041	0.033	0.032	0.029	0.029	0.030	0.032
28 : Manufacture of fabricated metal products, except machinery and equipment	0.039	0.033	0.032	0.036	0.041	0.038	0.039	0.041	0.046
29 : Manufacture of machinery and equipment n.e.c.	0.121	0.102	0.092	0.084	0.093	0.095	0.092	0.100	0.093
30 : Manufacture of office machinery and computers	0.066	0.066	0.060	0.059	0.058	0.058	0.062	0.063	0.062
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.210	0.205	0.195	0.206	0.181	0.181	0.167	0.203	0.204
32 : Manufacture of radio, television and communication equipment and apparatus	0.173	0.156	0.151	0.126	0.120	0.127	0.129	0.133	0.128
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.547	0.591	0.649	0.638	0.658	0.672	0.627	0.607	0.485
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.289	0.239	0.240	0.242	0.348	0.325	0.425	0.432	0.359
35 : Manufacture of other transport equipment	0.050	0.042	0.040	0.038	0.034	0.034	0.028	0.029	0.030
36 : Manufacture of furniture; manufacturing n.e.c.	0.197	0.190	0.181	0.172	0.180	0.174	0.170	0.197	0.159
37 : Recycling	0.031	0.031	0.032	0.032	0.031	0.030	0.035	0.039	0.039

Table A3-B. Import penetration ratios by NACE-2: Bulgaria

NACE 2-digit sectors	1995	1996	1997	1998	1999	2000	2001
15 : Manufacture of food products and beverages	0.178	0.149	0.171	0.156	0.132	0.149	0.165
16 : Manufacture of tobacco products	0.095	0.129	0.078	0.118	0.120	0.124	0.027
17 : Manufacture of textiles	0.225	0.256	0.240	0.337	0.737	0.791	0.818
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.301	0.314	0.367	0.447	0.511	0.511	0.566
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.289	0.398	0.412	0.442	0.665	0.699	0.707
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.190	0.225	0.214	0.219	0.188	0.221	0.236
21 : Manufacture of pulp, paper and paper products	0.464	0.470	0.429	0.505	0.523	0.576	0.606
22 : Publishing, printing and reproduction of recorded media	0.101	0.117	0.114	0.124	0.160	0.120	0.091
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.135	0.083	0.096	0.869	0.086	0.136	0.504
24 : Manufacture of chemicals and chemical products	0.535	0.486	0.341	0.576	0.540	0.595	0.617
25 : Manufacture of rubber and plastic products	0.315	0.323	0.348	0.422	0.514	0.556	0.591
26 : Manufacture of other non-metallic mineral products	0.166	0.180	0.152	0.157	0.172	0.237	0.260
27 : Manufacture of basic metals	0.273	0.248	0.173	0.481	0.240	0.448	0.495
28 : Manufacture of fabricated metal products, except machinery and equipment	0.278	0.316	0.265	0.269	0.354	0.396	0.473
29 : Manufacture of machinery and equipment n.e.c.	0.491	0.450	0.458	0.530	0.537	0.606	0.618
30 : Manufacture of office machinery and computers	0.595	0.734	0.586	0.738	0.772	0.770	0.821
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.369	0.408	0.328	0.438	0.466	0.476	0.565
32 : Manufacture of radio, television and communication equipment and apparatus	0.644	0.703	0.763	0.821	0.848	0.823	0.835
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.726	0.734	0.770	0.770	0.742	0.774	0.784
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.839	0.766	0.783	0.864	0.948	0.943	0.963
35 : Manufacture of other transport equipment	0.399	0.204	0.172	0.459	0.426	0.555	0.590
36 : Manufacture of furniture; manufacturing n.e.c.	0.344	0.352	0.384	0.439	0.452	0.516	0.485
37 : Recycling	-	-	-	-	-	-	-
All manufacturing firms	0.322	0.296	0.262	0.401	0.390	0.433	0.522

Table A3-H. Import penetration ratios by NACE-2: Hungary

NACE 2-digit sectors	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
15 : Manufacture of food products and beverages	0.083	0.095	0.110	0.099	0.096	0.122	0.133	0.113	0.125	0.123
16 : Manufacture of tobacco products	0.019	0.013	0.020	0.032	0.067	0.055	0.040	0.038	0.038	0.014
17 : Manufacture of textiles	0.668	0.699	0.750	0.777	0.540	0.548	0.761	0.772	0.762	0.796
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.487	0.481	0.485	0.508	0.616	0.585	0.611	0.637	0.650	0.651
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.626	0.659	0.728	0.740	0.804	0.802	0.823	0.842	0.854	0.846
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.293	0.283	0.331	0.342	0.349	0.385	0.410	0.414	0.448	0.442
21 : Manufacture of pulp, paper and paper products	0.447	0.445	0.491	0.475	0.493	0.532	0.561	0.583	0.627	0.605
22 : Publishing, printing and reproduction of recorded media	0.093	0.097	0.103	0.102	0.091	0.098	0.157	0.152	0.153	0.129
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.068	0.138	0.181	0.136	0.123	0.099	0.103	0.107	0.130	0.093
24 : Manufacture of chemicals and chemical products	0.534	0.515	0.545	0.562	0.565	0.592	0.646	0.666	0.657	0.656
25 : Manufacture of rubber and plastic products	0.419	0.402	0.439	0.448	0.473	0.552	0.586	0.615	0.624	0.595
26 : Manufacture of other non-metallic mineral products	0.219	0.235	0.263	0.238	0.269	0.294	0.347	0.350	0.355	0.342
27 : Manufacture of basic metals	0.428	0.479	0.526	0.514	0.528	0.574	0.596	0.603	0.608	0.612
28 : Manufacture of fabricated metal products, except machinery and equipment	0.308	0.323	0.364	0.316	0.357	0.413	0.454	0.484	0.490	0.497
29 : Manufacture of machinery and equipment n.e.c.	0.626	0.600	0.652	0.629	0.616	0.682	0.726	0.751	0.752	0.747
30 : Manufacture of office machinery and computers	0.729	0.765	0.772	0.764	0.758	0.893	0.891	0.905	0.923	0.907
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.438	0.410	0.499	0.533	0.587	0.706	0.725	0.723	0.791	0.781
32 : Manufacture of radio, television and communication equipment and apparatus	0.660	0.609	0.612	0.586	0.650	0.793	0.838	0.823	0.824	0.883
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.664	0.622	0.652	0.633	0.586	0.614	0.639	0.687	0.731	0.715
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.676	0.644	0.664	0.654	0.689	0.794	0.853	0.873	0.887	0.868
35 : Manufacture of other transport equipment	0.615	0.895	0.733	0.644	0.497	0.381	0.381	0.413	0.516	0.555
36 : Manufacture of furniture; manufacturing n.e.c.	0.457	0.424	0.500	0.507	0.532	0.583	0.593	0.628	0.640	0.615
37 : Recycling	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000

Table A3-R. Import penetration ratios by NACE-2: Romania

NACE 2-digit sectors	1998	1999	2000	2001	2002
15 : Manufacture of food products and beverages	0.1122	0.1045	0.1086	0.1202	0.1202
16 : Manufacture of tobacco products	0.0082	0.0108	0.0115	0.0132	0.0166
17 : Manufacture of textiles	0.6331	0.6838	0.7120	0.7307	0.7302
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.1603	0.1435	0.1393	0.1476	0.1773
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.5097	0.5518	0.5700	0.5992	0.5938
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.0811	0.0858	0.0901	0.1070	0.1189
21 : Manufacture of pulp, paper and paper products	0.4421	0.4085	0.3911	0.4545	0.4327
22 : Publishing, printing and reproduction of recorded media	0.1152	0.1049	0.1028	0.0940	0.0892
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.0998	0.1029	0.1136	0.1896	0.1153
24 : Manufacture of chemicals and chemical products	0.4025	0.4414	0.4401	0.4748	0.5099
25 : Manufacture of rubber and plastic products	0.3854	0.4190	0.4254	0.4616	0.4626
26 : Manufacture of other non-metallic mineral products	0.1160	0.1344	0.1512	0.1693	0.1870
27 : Manufacture of basic metals	0.1839	0.2432	0.2627	0.3060	0.3127
28 : Manufacture of fabricated metal products, except machinery and equipment	0.2175	0.2612	0.2724	0.2926	0.3065
29 : Manufacture of machinery and equipment n.e.c.	0.4780	0.5049	0.5028	0.5178	0.5269
30 : Manufacture of office machinery and computers	0.5771	0.6764	0.7550	0.7888	0.8052
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.4506	0.5159	0.5773	0.5631	0.5488
32 : Manufacture of radio, television and communication equipment and apparatus	0.6271	0.6320	0.7712	0.7536	0.7761
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.6566	0.6999	0.6825	0.6867	0.6630
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.2621	0.2411	0.3336	0.4420	0.4386
35 : Manufacture of other transport equipment	0.1265	0.1843	0.2328	0.1981	0.2116
36 : Manufacture of furniture; manufacturing n.e.c.	0.1608	0.2018	0.1981	0.2114	0.2258
37 : Recycling	0.0000	0.0000	0.0000	0.0000	0.0000

Table A3-S. Import penetration ratios by NACE-2: Slovenia

NACE 2-digit sectors	1994	1995	1996	1997	1998	1999	2000	2001	2002
15 : Manufacture of food products and beverages	0.225	0.235	0.153	0.171	0.196	0.184	0.213	0.195	0.221
16 : Manufacture of tobacco products	0.556	0.529	0.487	0.509	0.522	0.506	0.423	0.390	0.379
17 : Manufacture of textiles	0.982	0.942	0.730	0.800	0.801	0.757	0.915	0.942	0.844
18 : Manufacture of wearing apparel; dressing and dyeing of fur	0.465	0.465	0.494	0.555	0.449	0.467	0.540	0.560	0.596
19 : Tanning and dressing of leather; manufacture of luggage and footwear	0.181	0.184	0.144	0.149	0.157	0.175	0.203	0.228	0.226
20 : Manufacture of wood and wood products, except furniture; articles of straw	0.424	0.463	0.330	0.386	0.326	0.398	0.430	0.404	0.413
21 : Manufacture of pulp, paper and paper products	0.114	0.119	0.086	0.092	0.105	0.123	0.133	0.148	0.126
22 : Publishing, printing and reproduction of recorded media	0.328	0.232	0.236	0.021	0.028	0.409	0.581	0.282	0.259
23 : Manufacture of coke, refined petroleum products and nuclear fuel	0.372	0.387	0.333	0.335	0.355	0.345	0.415	0.389	0.372
24 : Manufacture of chemicals and chemical products	0.444	0.485	0.437	0.404	0.418	0.433	0.473	0.465	0.456
25 : Manufacture of rubber and plastic products	0.163	0.208	0.182	0.189	0.207	0.208	0.212	0.238	0.239
26 : Manufacture of other non-metallic mineral products	0.389	0.357	0.423	0.386	0.410	0.378	0.402	0.423	0.408
27 : Manufacture of basic metals	0.266	0.268	0.270	0.289	0.294	0.280	0.292	0.291	0.304
28 : Manufacture of fabricated metal products, except machinery and equipment	0.337	0.310	0.288	0.349	0.331	0.317	0.346	0.367	0.346
29 : Manufacture of machinery and equipment n.e.c.	0.308	0.336	0.229	0.249	0.240	0.258	0.254	0.275	0.341
30 : Manufacture of office machinery and computers	0.336	0.341	0.282	0.301	0.323	0.314	0.362	0.354	0.349
31 : Manufacture of electrical machinery and apparatus n.e.c.	0.444	0.454	0.443	0.368	0.397	0.401	0.563	0.425	0.405
32 : Manufacture of radio, television and communication equipment and apparatus	0.279	0.303	0.322	0.296	0.304	0.298	0.311	0.319	0.318
33 : Manufacture of medical, precision and optical instruments, watches and clocks	0.604	0.635	0.643	0.659	0.688	0.671	0.715	0.698	0.677
34 : Manufacture of motor vehicles, trailers and semi-trailers	0.221	0.180	0.156	0.144	0.123	0.172	0.258	0.278	0.363
35 : Manufacture of other transport equipment	0.233	0.241	0.208	0.227	0.210	0.240	0.255	0.249	0.249
36 : Manufacture of furniture; manufacturing n.e.c.	0.024	0.021	0.026	0.030	0.038	0.022	0.037	0.102	0.028
37 : Recycling	0.225	0.235	0.153	0.171	0.196	0.184	0.213	0.195	0.221
All manufacturing firms	0.350	0.350	0.314	0.314	0.315	0.334	0.379	0.365	0.360

Part B. Selected Estimation Results on the Adjustment of Manufacturing Firms in Bulgaria, Hungary and Slovenia to Competitive Pressure

B1. The Effect of Competitive Pressure on the Firms' Productive Efficiency

Table B1-B1. Bulgaria: estimated augmented Cobb-Douglas PF by NACE-2 digit manufacturing sectors, panel OLS estimations for 1995-2001
Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	Const.	L	K	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged IA	Debt ratio	R2	N obs.
1995 - 2001												
15	4.714 ***	0.761 ***	0.240 ***	-0.729 ***	-0.184 ***	0.112 *	1.844 ***	0.145 *	0.101 **	-0.052	0.779	5581
16	6.815 ***	0.492 ***	0.241 ***			-0.212	4.334 ***	0.271	0.080	-0.634	0.851	146
17	4.383 ***	0.693 ***	0.221 ***	-0.243 **	-0.019	0.175	0.554 ***	0.190 *	0.136	-0.161	0.872	921
18	4.119 ***	0.689 ***	0.244 ***	-0.158 *	-0.004	0.018	1.939 ***	0.112 ***	-0.013	0.083	0.857	2693
19	3.889 ***	0.687 ***	0.274 ***	0.091	0.094	0.015	2.945 ***	-0.089	0.015	-0.047	0.863	579
20	4.412 ***	0.685 ***	0.187 ***	0.128	0.084	-0.093	2.476 ***	0.172 *	-0.027	0.530 ***	0.762	1147
21	4.406 ***	0.568 ***	0.292 ***	-0.047	0.001	-0.210	1.394 ***	1.068 ***	0.080	0.059	0.817	514
22	4.293 ***	0.665 ***	0.232 ***	0.712 ***	0.076 *	0.081	2.546 ***	0.682 *	0.136 *	0.010	0.747	1268
23	7.349 ***	0.465 *	0.145		-0.449		1.871 *	5.118 **	0.081	3.089	0.936	29
24	5.195 ***	0.636 ***	0.244 ***	-0.608 ***	-0.040	0.205 *	1.383 ***	0.302 **	0.055	-0.006	0.875	974
25	4.330 ***	0.611 ***	0.261 ***	-0.140	0.079 *	0.208 *	1.394 ***	0.233	-0.063	0.062	0.818	1109
26	4.422 ***	0.751 ***	0.205 ***	-0.017	0.015	0.058	0.886 ***	-0.137	0.188 **	-0.018	0.865	941
27	4.816 ***	0.771 ***	0.157 ***	0.348 **	-0.038	-0.429 *	1.258 ***	-0.160	0.363 **	-0.561 **	0.854	388
28	4.338 ***	0.700 ***	0.197 ***	0.004	0.069 **	0.292 ***	1.626 ***	0.185 *	0.155 **	0.233 *	0.777	1982
29	5.075 ***	0.646 ***	0.213 ***	-0.557 ***	-0.062 **	0.469 ***	1.653 ***	0.300 ***	0.215 ***	-0.074	0.847	2343
30	5.648 ***	0.619 ***	0.173 ***	-1.619	0.385	0.798	1.767 **	-0.492	-0.260	0.234	0.700	161
31	5.282 ***	0.536 ***	0.240 ***	-0.655 ***	-0.033	0.576 ***	2.515 ***	0.115	0.239 **	-0.035	0.823	875
32	4.762 ***	0.524 ***	0.296 ***	-0.872	0.143 *	0.305	1.827 ***	0.114	0.358 **	0.040	0.831	248
33	5.061 ***	0.622 ***	0.164 ***	0.234 *	0.043	1.143 ***	1.574 ***	0.290	-0.245 *	-0.152	0.727	491
34	4.243 ***	0.600 ***	0.280 ***	-0.803	0.418 ***	-0.199	2.647 ***	0.195	-0.020	0.477	0.848	213
35	4.348 ***	0.721 ***	0.234 ***	-0.561 *	0.036	0.501 **	0.560	0.639 ***	0.395 **	-0.097	0.880	196
36	4.163 ***	0.726 ***	0.191 ***	-0.039	0.177 ***	0.010	1.635 ***	0.214 ***	0.047	-0.132	0.801	1237

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-B2. Bulgaria: estimated augmented Cobb-Douglas PF by NACE-2 digit manufacturing sectors, panel OLS estimations for 1995-2001
Dependent variable: Z=sales=f(K,L,M)

NACE 2-digit sectors	Const.	L	K	M	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	R2	N obs.
1995 - 2001													
15	1.810 ***	0.126 ***	0.062 ***	0.776 ***	-0.161 ***	-0.057 ***	0.022	0.412 ***	-0.022	-0.003	0.026	0.965	5581
16	3.124 ***	0.127 ***	0.050 **	0.694 ***			-0.066	1.684 ***	0.081	-0.060	-0.319	0.973	146
17	2.071 ***	0.177 ***	0.035 ***	0.734 ***	-0.052	-0.011	0.102 *	0.089	0.120 ***	0.026	0.028	0.979	921
18	2.331 ***	0.259 ***	0.098 ***	0.615 ***	-0.075 *	0.017	0.016	0.546 ***	0.069 ***	-0.027	0.024	0.954	2693
19	2.284 ***	0.230 ***	0.070 ***	0.668 ***	-0.062	-0.018	-0.036	0.907 ***	-0.007	0.016	0.049	0.972	579
20	2.001 ***	0.158 ***	0.045 ***	0.726 ***	0.065	0.033	-0.042	0.834 ***	0.017	-0.022	0.181 ***	0.957	1147
21	1.635 ***	0.116 ***	0.047 ***	0.796 ***	-0.018	-0.022	-0.066	0.204 *	0.277 **	-0.011	-0.032	0.978	514
22	1.812 ***	0.145 ***	0.070 ***	0.733 ***	0.180 *	0.037 **	-0.045	0.729 ***	0.305 **	0.043	-0.040	0.955	1268
23	2.297 ***	0.005	0.041	0.849 ***		-0.406 **		0.474 **	0.883	-0.005	0.336	0.997	29
24	1.851 ***	0.081 ***	0.076 ***	0.775 ***	-0.151 ***	-0.001	0.038	0.354 ***	0.102 **	-0.050	-0.042	0.982	974
25	1.983 ***	0.126 ***	0.069 ***	0.727 ***	-0.014	0.037 **	0.039	0.487 ***	0.096	-0.058 *	0.055	0.966	1109
26	1.666 ***	0.115 ***	0.053 ***	0.789 ***	0.086 *	-0.004	-0.023	0.245 ***	-0.032	0.020	-0.046	0.980	941
27	1.367 ***	0.101 ***	0.020	0.849 ***	0.000	0.035	-0.078	0.248 ***	-0.102	0.060	-0.027	0.986	388
28	1.983 ***	0.164 ***	0.063 ***	0.715 ***	0.045	0.022	0.068	0.517 ***	0.050	0.023	0.054	0.954	1982
29	2.269 ***	0.176 ***	0.059 ***	0.712 ***	-0.191 ***	-0.032 ***	0.168 ***	0.505 ***	0.039	0.053 **	-0.013	0.966	2343
30	2.121 ***	0.191 ***	0.005	0.730 ***	-0.120	0.190	0.220	0.569 *	-0.063	-0.093	0.046	0.954	161
31	2.125 ***	0.105 ***	0.074 ***	0.737 ***	-0.122	-0.012	0.126 **	0.646 ***	0.040	0.029	0.004	0.967	875
32	2.471 ***	0.134 ***	0.136 ***	0.646 ***	-0.314	0.027	0.008	0.599 *	-0.023	0.282 ***	0.151	0.945	248
33	2.423 ***	0.195 ***	0.026 *	0.696 ***	0.097	0.046	0.381 ***	0.428 **	0.073	-0.116 *	0.068	0.932	491
34	1.001 ***	0.082 **	0.092 ***	0.826 ***	0.089	0.022	-0.216 *	0.206	-0.149	-0.102	0.287 **	0.973	213
35	1.865 ***	0.177 ***	0.054 ***	0.744 ***	-0.163 *	0.020	0.069	0.155	0.153 **	0.136 **	-0.041	0.984	196
36	1.733 ***	0.164 ***	0.049 ***	0.749 ***	0.113 **	0.034 *	0.030	0.408 ***	0.003	-0.037	-0.098 *	0.962	1237

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-B3. Bulgaria: estimated augmented Cobb-Douglas production frontiers by NACE-2 digit manufacturing sectors, for 1995-2001
Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	Const.	L	K	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	gamma	N obs.	mean eff.
1995 - 2001													
15	5.937 ***	0.608 ***	0.263 ***	-0.616 ***	-0.123 ***	0.109	3.242 ***	0.075	0.065 *	-0.010	0.812 ***	5581	0.43
16	5.264 ***	0.492 ***	0.229 ***	34.543 ***	-1.000 **	-0.161	4.917 ***	0.174	0.124	-0.695	0.606 ***	146	0.67
17	6.012 ***	0.572 ***	0.203 ***	-0.353 ***	-0.050	0.129	0.872 ***	0.125	0.010	-0.145	0.874 ***	921	0.46
18	5.057 ***	0.591 ***	0.258 ***	-0.242 ***	0.001	0.122 **	3.101 ***	0.081 **	-0.054	-0.026	0.790 ***	2693	0.55
19	4.758 ***	0.456 ***	0.362 ***	0.141	0.195 *	0.077	4.073 ***	-0.090	-0.084	0.390 **	0.857 ***	579	0.52
20	5.583 ***	0.588 ***	0.180 ***	0.028	0.092 *	-0.127	2.227 ***	0.139 *	-0.035	0.650 ***	0.790 ***	1147	0.49
21	5.649 ***	0.495 ***	0.276 ***	0.079	0.012	-0.090	1.620 ***	0.771 **	-0.005	0.070	0.713 ***	514	0.51
22	5.433 ***	0.495 ***	0.248 ***	0.811 ***	0.129 ***	0.373 **	3.122 ***	0.205	0.058	-0.029	0.849 ***	1268	0.43
24	6.366 ***	0.519 ***	0.269 ***	-0.720 ***	0.024	0.312 **	1.667 ***	0.191 *	0.006	-0.026	0.837 ***	974	0.45
25	5.738 ***	0.535 ***	0.245 ***	-0.200	0.027	0.346 **	1.489 ***	0.030	-0.121 *	0.064	0.804 ***	1109	0.48
26	6.187 ***	0.551 ***	0.225 ***	-0.125	-0.022	0.111	1.270 ***	0.076	-0.023	-0.002	0.906 ***	941	0.43
27	6.702 ***	0.511 ***	0.239 ***	0.078	-0.011	-0.907 ***	1.332 ***	-0.294	0.230 *	-0.296	0.928 ***	388	0.32
28	5.395 ***	0.549 ***	0.235 ***	0.151	0.045	0.345 ***	2.080 ***	0.151	0.112 **	0.271 **	0.804 ***	1982	0.48
29	6.095 ***	0.546 ***	0.223 ***	-0.489 ***	-0.044 *	0.635 ***	1.944 ***	0.130 *	0.211 ***	0.087	0.796 ***	2343	0.50
30	7.877 ***	0.592 ***	0.060	-0.770	0.029	0.632	2.521 ***	-0.728 *	-0.067	-0.437	0.888 ***	161	0.34
31	6.716 ***	0.359 ***	0.254 ***	-0.427 *	-0.030	0.795 ***	3.917 ***	0.077	0.026	-0.211	0.884 ***	875	0.43
32	5.776 ***	0.431 ***	0.330 ***	-0.763	0.089	0.288	2.030 ***	0.107	0.259 *	0.268	0.810 ***	248	0.47
33	6.721 ***	0.368 ***	0.231 ***	0.241	-0.006	0.755 **	1.907 ***	0.373 **	-0.249 ***	-0.250	0.906 ***	491	0.39
34	7.287 ***	0.364 ***	0.343 ***	-1.941 ***	0.029	-0.771 *	2.668 ***	-0.219	-0.019	0.188	0.918 ***	213	0.36
35	5.291 ***	0.644 ***	0.261 ***	-0.577 *	0.030	0.535 *	0.741 *	0.331	0.233	-0.311	0.734 ***	196	0.54
36	5.469 ***	0.621 ***	0.186 ***	-0.213 *	0.130 ***	0.197 *	2.666 ***	0.033	0.040	-0.163	0.774 ***	1237	0.52

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-B4. Bulgaria: estimated augmented Cobb-Douglas production frontiers by NACE-2 digit manufacturing sectors, for 1995-2001
Dependent variable: Z=sales=f(K,L,M)

NACE 2-digit sectors	Const.	L	K	M	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	gamma	N obs.	mean eff.
1995 - 2001														
15	2.341 ***	0.104 ***	0.076 ***	0.747 ***	-0.129 ***	-0.045 ***	0.012	0.781 ***	-0.012	0.006	0.021	0.695 ***	5581	0.73
16	5.290 ***	0.150 ***	0.050 **	0.664 ***	10.417 ***	-2.394 ***	-0.034	1.986 ***	0.051	-0.063	-0.375 **	0.525 ***	146	0.85
17	3.442 ***	0.131 ***	0.007	0.691 ***	-0.119 ***	-0.007	0.062	0.249 ***	0.077 *	0.026	0.003	0.934 ***	921	0.60
18	2.864 ***	0.228 ***	0.108 ***	0.599 ***	-0.115 **	0.007	0.082 ***	1.215 ***	0.054 ***	-0.017	0.012	0.748 ***	2693	0.72
19	3.039 ***	0.176 ***	0.072 ***	0.641 ***	0.026	0.013	-0.070	1.599 ***	-0.015	-0.018	0.205 **	0.815 ***	579	0.71
20	2.417 ***	0.153 ***	0.050 ***	0.699 ***	0.053	0.042 *	-0.052	0.862 ***	0.017	-0.018	0.207 ***	0.508 ***	1147	0.81
21	2.007 ***	0.101 ***	0.055 ***	0.776 ***	0.004	-0.018	-0.063	0.265 *	0.247 **	-0.032	-0.030	0.530 ***	514	0.83
22	2.271 ***	0.131 ***	0.085 ***	0.696 ***	0.254 **	0.053 ***	-0.017	0.931 ***	0.219	0.038	-0.048	0.614 ***	1268	0.77
24	2.469 ***	0.060 ***	0.098 ***	0.733 ***	-0.197 ***	0.019	0.065	0.541 ***	0.090 *	-0.041	-0.095	0.731 ***	974	0.75
25	2.438 ***	0.119 ***	0.073 ***	0.704 ***	-0.012	0.039 **	0.075	0.562 ***	0.046	-0.065 **	0.060	0.571 ***	1109	0.78
26	2.405 ***	0.108 ***	0.067 ***	0.734 ***	-0.040	-0.008	-0.001	0.454 ***	-0.016	-0.009	-0.016	0.777 ***	941	0.77
27	1.739 ***	0.074 ***	0.016	0.848 ***	0.014	0.024	-0.127	0.366 ***	-0.054	0.082 *	-0.030	0.684 ***	388	0.79
28	2.586 ***	0.143 ***	0.079 ***	0.674 ***	0.094 *	0.005	0.081	0.789 ***	0.040	0.026	0.076	0.685 ***	1982	0.75
29	2.789 ***	0.169 ***	0.067 ***	0.679 ***	-0.151 ***	-0.027 **	0.254 ***	0.666 ***	0.018	0.069 ***	0.012	0.696 ***	2343	0.76
30	2.936 ***	0.152 ***	0.008	0.671 ***	0.446	0.159	-0.079	0.756 ***	-0.010	0.021	-0.322	0.934 ***	161	0.58
31	3.067 ***	0.073 ***	0.104 ***	0.66 ***	0.027	-0.027	0.195 ***	1.393 ***	0.026	-0.010	-0.069	0.859 ***	875	0.68
32	3.526 ***	0.097 ***	0.199 ***	0.558 ***	-0.325	0.027	-0.032	0.928 **	-0.066	0.212 **	0.718 ***	0.869 ***	248	0.60
33	3.323 ***	0.153 ***	0.062 ***	0.636 ***	0.116	0.000	0.310 **	0.651 **	0.170 *	-0.093 *	0.054	0.815 ***	491	0.66
34	1.752 ***	0.070 **	0.113 ***	0.791 ***	-0.255	-0.005	-0.339 ***	0.784 ***	-0.091	-0.055	0.235 *	0.752 ***	213	0.75
35	2.138 ***	0.187 ***	0.048 ***	0.736 ***	-0.190 *	0.013	0.103	0.212	0.095	0.123 **	-0.059	0.522 ***	196	0.84
36	2.086 ***	0.154 ***	0.054 ***	0.733 ***	0.084 *	0.028	0.097 **	0.634 ***	-0.040	-0.033	-0.102 *	0.541 ***	1237	0.82

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-H1. Hungary: estimated augmented Cobb-Douglas PF by NACE-2 digit manufacturing sectors, panel OLS estimations for 1995-2001
Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	Const.	L	K	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	R2	N obs.
1995 - 2001												
15	-0.800 ***	0.702 ***	0.315 ***	0.174 *	-0.006	0.284 ***	1.374 ***	0.073	0.000	0.013 ***	0.831	5022
17	-0.591 ***	0.614 ***	0.334 ***	0.117 *	0.023 **	0.211 ***	0.306 ***	0.071	-0.002	-0.007	0.809	1349
18	-0.953 ***	0.742 ***	0.205 ***	0.117	-0.026 ***	0.154 ***	2.965 ***	0.366 ***	0.000	-0.020	0.845	2616
19	-1.456 ***	0.743 ***	0.152 ***	0.947 ***	0.043	0.023 ***	10.271 ***	0.427 ***	0.004	0.007	0.823	1050
20	-0.886 ***	0.663 ***	0.261 ***	0.578 ***	0.009	-.051	5.910 ***	0.442 ***	0.000	-0.007	0.804	1556
21	-0.094	0.722 ***	0.309 ***	-0.560 **	-0.072 **	0.348 ***	1.911 ***	-0.319 **	0.000	0.172 ***	0.855	455
22	-0.443 ***	0.610 ***	0.296 ***	-0.217	0.100 ***	0.801 ***	2.663 ***	0.255 *	0.000	0.031 ***	0.763	1877
24	-0.313 ***	0.560 ***	0.388 ***	0.249 *	0.040	0.318 ***	0.535 ***	0.144	0.004	-0.139 **	0.819	998
25	-0.644 *	0.651 ***	0.370 ***	0.338 ***	-0.003	0.334 ***	0.992 **	-0.029	0.000	-0.008	0.807	1800
26	-0.280 ***	0.661 ***	0.368 ***	0.318 ***	-0.146 ***	0.285 ***	0.722 ***	-0.186 **	0.001	-0.081 **	0.867	1335
27	-0.930 ***	0.816 ***	0.223 ***	0.286 ***	0.035	0.429 ***	0.236 **	0.097	0.004 *	-0.013	0.877	554
28	-0.429 ***	0.760 ***	0.209 ***	-0.080 **	-0.023 *	0.166 ***	2.430 ***	0.265 ***	0.000	0.000	0.766	4245
29	0.278 ***	0.723 ***	0.179 ***	-0.343 ***	-0.049 ***	0.317 ***	1.151 ***	0.195 ***	0.000	0.002	0.810	3136
30	0.533	0.410 ***	0.425 ***	0.757 *	0.039	0.083	0.256 ***	0.120	0.006	0.088 ***	0.849	152
31	-0.094	0.666 ***	0.303 ***	0.022	-0.012	0.153 ***	0.291 ***	-0.118 *	-0.001	-0.033	0.863	1254
32	-0.185	0.780 ***	0.183 ***	-0.255	0.046 *	0.567 ***	1.945 **	-0.297 ***	0.000	0.057 ***	0.830	754
33	-0.320	0.725 ***	0.310 ***	-0.716 ***	0.058	0.311 ***	0.402	-0.090	0.005 *	0.257 ***	0.793	900
34	-0.268	0.758 ***	0.326 ***	-0.382 **	-0.099 **	0.236 ***	0.987 ***	-0.042	0.007 **	-0.029	0.904	653
35	-0.357	0.691 ***	0.347 ***	-0.609 **	0.042	-.021	1.007 **	0.131	0.000	-0.161	0.802	209
36	-0.824 ***	0.733 ***	0.259 ***	0.085	-0.026	0.207 ***	1.372 ***	0.250 ***	-0.001	0.017 *	0.808	1479
37	-0.350	0.655 ***	0.256 ***	0.000	0.306	-.369 *	1.927 ***	0.298	0.198 *	0.014 *	0.771	97

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-H2. Hungary: estimated augmented Cobb-Douglas PF by NACE-2 digit manufacturing sectors, panel OLS estimations for 1995-2001
Dependent variable: Z=sales=f(K,L,M)

NACE 2-digit sectors	Const.	L	K	M	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	R2	N obs.
1995 - 2001													
15	0.228 ***	0.135 ***	0.021 ***	0.863 ***	-0.009	0.003	0.046 ***	0.160 ***	0.037 ***	0.000	0.000	0.987	5312
17	0.480 ***	0.193 ***	0.067 ***	0.717 ***	0.041	0.017 ***	0.127 ***	0.068 **	0.095 ***	0.000	-0.003	0.959	1397
18	0.364 ***	0.327 ***	0.075 ***	0.587 ***	0.065	-0.022 ***	0.061 ***	1.079 ***	0.179 ***	0.000	-0.004	0.947	2649
19	0.184	0.350 ***	0.014	0.607 ***	0.311 ***	-0.021	-0.013	3.338 ***	0.292 ***	0.001	0.020 **	0.935	1082
20	0.358 ***	0.126 ***	0.034 ***	0.831 ***	0.073 **	0.003	-0.044 **	0.919 ***	0.138 ***	0.000	-0.006 *	0.976	1617
21	0.412 ***	0.131 ***	0.003	0.878 ***	-0.167 ***	-0.017 **	0.089 ***	0.177	0.039	0.000	-0.001 ***	0.989	469
22	0.415 ***	0.109 ***	0.042 ***	0.843 ***	0.004	0.016 **	0.087 ***	0.292 ***	0.225 ***	0.000	-0.001	0.974	1964
24	0.371 ***	0.086 ***	0.042 ***	0.882 ***	0.047	-0.018 **	0.061 ***	0.031	0.046 *	0.002 **	-0.011	0.985	1029
25	0.278 ***	0.132 ***	0.063 ***	0.816 ***	0.189 ***	0.020 **	0.059 ***	-0.119	0.075 ***	0.000	-0.007	0.979	1850
26	0.442 ***	0.196 ***	0.048 ***	0.785 ***	0.067 **	-0.029 ***	0.048 ***	0.259 ***	0.008	0.000	-0.022 *	0.980	1370
27	0.286 ***	0.178 ***	-0.016	0.847 ***	-0.014	0.003	0.133 ***	-0.023	0.111 ***	0.002	-0.039 ***	0.990	571
28	0.445 ***	0.201 ***	0.029 ***	0.777 ***	-0.025 *	-0.007	0.048 ***	0.290 ***	0.116 ***	0.000	-0.003	0.966	4321
29	0.608 ***	0.195 ***	0.012 ***	0.781 ***	-0.110 ***	-0.014 **	0.078 ***	-0.015	0.130 ***	0.000	-0.009 *	0.970	3193
30	0.510 ***	0.154 ***	0.056 **	0.800 ***	0.027	0.025 ***	-0.013	0.015	0.123	0.002	0.007	0.987	154
31	0.686 ***	0.186 ***	0.069 ***	0.713 ***	-0.008	-0.005	0.115 ***	0.064 **	0.083 ***	0.001	-0.020 *	0.980	1275
32	0.502 ***	0.262 ***	-0.012	0.786 ***	-0.123	-0.015	0.172 ***	0.188	-0.066	-0.001	0.001	0.963	790
33	0.325 **	0.237 ***	-0.002	0.800 ***	-0.001	0.021	0.007	0.037	0.073	0.000	-0.014	0.948	937
34	0.553 ***	0.195 ***	0.044 ***	0.774 ***	-0.061	-0.036 *	0.092 ***	0.232 ***	0.073 **	0.002 *	-0.010	0.986	667
35	0.624 ***	0.151 ***	0.062 ***	0.788 ***	-0.105	-0.020	-0.075	0.194	0.007	0.000	-0.028	0.983	214
36	0.412 ***	0.182 ***	0.039 ***	0.765 ***	0.026	-0.006	0.047 **	0.363 **	0.168 ***	0.000	0.003	0.969	1531
37	-0.227	0.187 ***	-0.114 ***	0.952 ***	0.000	0.154	-0.073 *	0.166	0.356 ***	0.017 ***	-0.005	0.975	117

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-H3. Hungary: estimated augmented Cobb-Douglas production frontiers by NACE-2 digit manufacturing sectors, for 1995-2001
Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	Const.	L	K	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	gamma	N obs.	mean eff.
1995 - 2001													
15	-0.088	0.667 ***	0.324 ***	0.152 *	0.013	0.337 ***	1.455 ***	0.172 ***	0.000	0.014 **	0.755 ***	5022	0.57
17	0.020	0.620 ***	0.334 ***	0.137 **	0.031 ***	0.195 ***	0.324 ***	0.011	-0.002	-0.005	0.762 ***	1349	0.61
18	-0.268 ***	0.715 ***	0.223 ***	0.046	-0.026 ***	0.143 ***	4.098 ***	0.288 ***	0.000	-0.009	0.816 ***	2616	0.62
19	-0.725 ***	0.688 ***	0.170 ***	0.817 ***	0.046	0.014	12.200 ***	0.404 ***	0.005	0.007	0.666 ***	1050	0.60
20	-0.074	0.607 ***	0.277 ***	0.475 ***	0.010	0.015	6.374 ***	0.432 ***	0.000	-0.009	0.831 ***	1556	0.52
21	0.574 ***	0.695 ***	0.307 ***	-0.486 **	-0.057 *	0.333 ***	2.279 ***	-0.313 *	0.000	0.159 *	0.800 ***	455	0.57
22	0.213 **	0.626 ***	0.286 ***	-0.323 **	0.093 ***	0.804 ***	3.076 ***	0.250 **	0.000	0.032 ***	0.731 ***	1877	0.57
24	0.733 ***	0.472 ***	0.419 ***	0.311 **	0.031	0.359 ***	0.800 ***	0.123	0.005	-0.109 **	0.843 ***	998	0.44
25	0.151	0.614 ***	0.378 ***	0.314 ***	-0.012	0.412 ***	1.061 **	-0.079	0.000	0.004	0.790 ***	1800	0.58
26	0.430 ***	0.615 ***	0.377 ***	0.309 ***	-0.128 ***	0.299 ***	0.870 ***	-0.108	0.001 **	-0.051 **	0.785 ***	1335	0.57
27	-0.182	0.755 ***	0.259 ***	0.315 ***	0.039	0.452 ***	0.233	0.032	0.004	-0.007	0.747 ***	554	0.63
28	0.156 **	0.738 ***	0.213 ***	-0.091 ***	-0.022 *	0.174 ***	2.616 ***	0.285 ***	0.000	0.006	0.640 ***	4245	0.64
29	0.761 ***	0.705 ***	0.184 ***	-0.351 **	-0.048 ***	0.319 ***	1.210 ***	0.209 ***	0.000	0.002	0.501 ***	3136	0.68
30	-0.206	0.462 ***	0.400 ***	0.773	0.025	-.024	0.269 **	0.014	-0.002	0.084	0.719 ***	152	0.97
31	0.476 ***	0.645 ***	0.317 ***	0.073	-0.003	0.166 ***	0.280 ***	-0.176 ***	0.000	-0.019	0.715 ***	1254	0.59
32	0.634 ***	0.741 ***	0.206 ***	-0.357 **	0.048 *	0.539 ***	2.293 ***	-0.290 ***	0.000	0.058 ***	0.672 ***	754	0.46
33	0.616 **	0.641 ***	0.337 ***	-0.606 ***	0.065	0.314 ***	0.837	-0.140	0.006 *	0.316 ***	0.814 ***	900	0.51
34	0.116	0.744 ***	0.332 ***	-0.392 **	-0.098 **	0.233 ***	0.993 ***	-0.032	0.007 **	-0.028	0.352 **	653	0.71
35	1.059 **	0.674 ***	0.224 ***	-0.003	-0.039	-.035	1.742 ***	0.034	0.001	-0.242 ***	1.000 ***	209	0.52
36	-0.188 *	0.719 ***	0.255 ***	0.074	-0.038 *	0.203 ***	1.820 ***	0.283 ***	0.000	0.017	0.672 ***	1479	0.65
37	0.993	0.575 ***	0.354 ***	0.000	-0.053	-.366	2.817 ***	0.186	0.267 **	0.014	1.000 ***	97	0.48

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-H4. Hungary: estimated augmented Cobb-Douglas production frontiers by NACE-2 digit manufacturing sectors, for 1995-2001
Dependent variable: Z=sales=f(K,L,M)

NACE 2-digit sectors	Const.	L	K	M	Import penetration	Market concentration (rel. std deviation of sales)	Dummy for foreign controlled firms	Market share	Export share	Lagged investment	Debt ratio	gamma	N obs.	mean eff.
1995 - 2001														
15	0.332 ***	0.134 ***	0.025 ***	0.858 ***	-0.008	0.004	0.047 ***	0.165 ***	0.041 ***	0.000	0.000	0.269 ***	5312	0.91
17	0.767 ***	0.201 ***	0.077 ***	0.696 ***	0.032	0.016 ***	0.124 ***	0.069	0.077 **	0.000	-0.001	0.635 ***	1397	0.80
18	0.636 ***	0.326 ***	0.083 ***	0.574 ***	0.064 *	-0.022 ***	0.057 ***	1.361 ***	0.162 ***	0.000	-0.004	0.574 ***	2649	0.81
19	0.576 ***	0.320 ***	0.030 ***	0.599 ***	0.309 ***	-0.018	-0.014	3.840 ***	0.279 ***	0.002	0.019	0.679 ***	1082	0.75
20	0.645 ***	0.117 ***	0.052 ***	0.805 ***	0.047	-0.001	-0.024	1.047 ***	0.140 ***	0.000	-0.005	0.735 ***	1617	0.84
21	0.591 ***	0.141 ***	0.005	0.863 ***	-0.169 **	-0.019 **	0.092 ***	0.220	0.025	0.000	-0.001	0.601 ***	469	0.88
22	0.648 ***	0.117 ***	0.048 ***	0.821 ***	-0.028	0.019 **	0.097 ***	0.373 ***	0.297 ***	0.000	0.000	0.683 ***	1964	0.83
24	0.519 ***	0.084 ***	0.049 ***	0.875 ***	0.045	-0.018 *	0.061 ***	0.038	0.045	0.002 ***	-0.012	0.351 ***	1029	0.89
25	0.384 ***	0.133 ***	0.065 ***	0.811 ***	0.183 ***	0.021 **	0.062 ***	-0.109	0.075 ***	0.000	-0.007	0.264 ***	1850	0.91
26	0.601 ***	0.196 ***	0.052 ***	0.775 ***	0.072 ***	-0.028 ***	0.050 ***	0.282 ***	0.008	0.000	-0.021 ***	0.402 ***	1370	0.87
27	0.526 ***	0.161 ***	-0.001	0.837 ***	-0.007	0.006	0.138 ***	-0.022	0.099 ***	0.003	-0.030 ***	0.694 ***	571	0.87
28	0.533 ***	0.201 ***	0.029 ***	0.775 ***	-0.025 *	-0.006	0.049 ***	0.298 *	0.117 ***	0.000	-0.003	0.170 ***	4321	0.92
29	0.601	0.194 ***	0.010 ***	0.787 ***	-0.112 ***	-0.014 *	0.070 ***	-0.054	0.127 ***	0.000	-0.008	0.001	3193	0.99
30	0.867 ***	0.113 **	0.079 **	0.787 ***	0.090	0.022 *	0.019	0.006	0.208 **	0.006	0.012	0.775 ***	154	0.81
31	0.682	0.192 ***	0.065 ***	0.714 ***	-0.007	-0.005	0.112 ***	0.064	0.084 ***	0.001	-0.022 *	0.002	1275	0.99
32	1.006 ***	0.234 ***	0.025 ***	0.758 ***	-0.150	-0.018	0.189 ***	0.301	-0.039	-0.001 **	0.010 **	0.797 ***	790	0.71
33	0.777 ***	0.210 ***	0.033 ***	0.765 ***	-0.071	0.043	0.096 **	-0.151	0.063	0.000	-0.007	0.788 ***	937	0.72
34	0.870 ***	0.171 ***	0.069 ***	0.758 ***	-0.084	-0.034 **	0.095 ***	0.220 **	0.100 ***	0.002 **	-0.010	0.799 ***	667	0.80
35	0.984 ***	0.167 ***	0.069 ***	0.740 ***	-0.118	-0.024	-0.067	0.293 **	0.064	0.000	-0.040	0.850 ***	214	0.83
36	0.419	0.174 ***	0.035 ***	0.779 ***	0.052	-0.012	0.047 **	0.332 ***	0.157 ***	0.000	0.002	0.002	1531	0.99
37	0.494	0.140 ***	-0.032	0.877 ***	0.000	0.177	-0.115 ***	-0.084	0.186 *	0.022	-0.002	1.000 ***	117	0.84

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. Estimated year dummies not reported.

Table B1-R1. Romania: estimated augmented Cobb-Douglas production frontiers by NACE-2 digit manufacturing sectors, for 1998-1999
Dependent variable: Z=sales=f(K,L,M)

NACE 2-digit sectors	1998 Const.	L	K	M	Export share	Debt ratio	N obs.	1999 Const.	L	K	M	Export share	Debt ratio	N obs.
15	0.637 ***	0.071 ***	0.029 ***	0.887 ***	-0.005	0.145 ***	1104	0.638 ***	0.058 ***	0.037 ***	0.893 ***	-0.261 *	0.276 **	941
17	2.627	0.210 ***	0.060 **	0.624 ***	-0.239 ***	0.221 ***	342	3.713	0.234 ***	0.079 **	0.590 ***	-0.258 ***	0.214 ***	320
18	4.129	0.276 ***	0.151 ***	0.376 ***	0.086	-0.042	168	3.483 ***	0.286 ***	0.146 **	0.411 ***	-0.087	1.255 *	199
19	2.171 ***	0.200 ***	0.100 **	0.617 ***	-0.168 *	0.163	138	3.557	0.205 ***	0.052 *	0.636 ***	-0.087 *	0.287 **	150
20	1.433 ***	0.087 ***	0.110 ***	0.751 ***	0.433	0.921 **	258	1.518 ***	0.069 ***	0.130 ***	0.746 ***	-0.541	0.248	261
21	1.853 ***	0.096 ***	0.055	0.775 ***	0.323	0.319	58	0.774 **	0.106 ***	-0.044	0.863 ***	-0.093	0.352	65
22	1.870 ***	0.027 **	0.181 ***	0.710 ***	-2.919 *	0.824 *	164	3.829 ***	0.086 **	0.283 ***	0.435 ***	-0.040	0.170 *	143
24	1.397 ***	0.059 ***	0.066 **	0.820 ***	0.068	0.823 **	200	1.670 ***	0.081 ***	0.111 ***	0.745 ***	-0.011	0.410 *	183
25	1.646 ***	0.094 ***	0.054 **	0.786 ***	0.348 *	1.058 **	135	1.834 ***	0.105 ***	0.036 *	0.787 ***	-1.685	1.443	139
26	1.550 *	0.199	0.028	0.724	-0.316	0.081	158	1.310	0.221 ***	-0.020	0.766 ***	-0.389 ***	0.161 **	166
27	1.340 ***	0.099 ***	0.029	0.827 ***	0.179	0.231	105	1.012	0.072 *	0.035 *	0.858 ***	0.117	0.149 **	103
28	1.768 ***	0.128 ***	0.126 ***	0.674 ***	0.787 *	0.638	343	1.802 ***	0.101 ***	0.130 ***	0.699 ***	2.504 *	0.803 *	307
29	2.343 ***	0.271 ***	0.071 **	0.567 ***	-1.596	4.171	154	1.967 ***	0.239 ***	0.002	0.687 ***	0.346 *	1.396 ***	169
30	0.732	0.074 **	0.071	0.861 ***	0.056	-0.072 *	45	0.767 ***	0.032 **	0.095 ***	0.852 ***	1.193	-0.793	43
31	1.711 ***	0.064 **	0.181 ***	0.686 ***	-0.152	0.013	77	1.566 **	0.116 ***	0.062 *	0.771 ***	0.750	2.008	83
32	0.967 *	0.093 **	0.211 **	0.672 ***	2.181 **	1.057 *	34	1.482 *	0.147 **	0.075	0.738 ***	-0.051 **	1.703 *	32
33	3.741 ***	0.142 ***	0.098	0.597 ***	0.039	0.073	44	3.643 **	0.081 *	0.102 *	0.648 ***	0.514	0.075	43
34	1.222 ***	0.139 ***	0.073 **	0.751 ***	0.074	0.145	68	0.952 ***	0.135 ***	0.047 **	0.796 ***	-0.218	0.215 *	64
35	1.931 **	0.179 **	0.132 **	0.620 ***	-0.442	0.193 *	52	1.493 ***	0.125 **	0.103 **	0.725 ***	-0.085	1.023 ***	58
36	1.646 ***	0.152 ***	0.176 ***	0.611 ***	0.181 *	0.575 **	151	1.815 ***	0.085 ***	0.198 ***	0.647 ***	-0.278	1.651 *	165
37	0.859 **	0.075 **	0.012	0.887 ***	0.219 *	0.613 **	57	0.325	0.024 **	0.058 **	0.916 ***	0.148 *	0.357	64

Notes: * significant at 10%;** significant at 5%;*** significant at 1%.

Table B1-R2. Romania: estimated augmented Cobb-Douglas production frontiers by NACE-2 digit manufacturing sectors, for 2000-2001
Dependent variable: Z=sales=f(K,L,M)

NACE 2-digit sectors	2000 Const.	L	K	M	Export share	Debt ratio	N obs.	2001 Const.	L	K	M	Debt ratio	N obs.	TE 1998	TE 1999	TE 2000	TE 2001
15	0.585 ***	0.070 ***	0.012 *	0.915 ***	-0.612 ***	0.060 ***	899	0.469	0.068 ***	0.024 **	0.903 ***	0.040 *	915	0.97	0.90	0.83	0.98
17	3.765	0.236 ***	0.047 **	0.619 ***	-0.212 ***	0.252 ***	319	3.131 ***	0.189 ***	0.050 **	0.626 ***	0.226 ***	327	0.87	0.27	0.28	0.93
18	2.552 ***	0.225 ***	0.129 ***	0.545 ***	-0.001 **	0.175 **	222	2.639 ***	0.188 ***	0.142 ***	0.571 ***	0.241 ***	291	0.87	0.94	0.97	0.89
19	3.093 **	0.180 ***	0.086 **	0.616 ***	-0.157 **	0.234 **	182	3.071 ***	0.177 ***	0.056 **	0.636 ***	0.189 *	219	0.96	0.38	0.71	0.92
20	1.688 ***	0.070 ***	0.110 ***	0.753 ***	-0.008 *	0.306 ***	317	1.544 ***	0.080 ***	0.041 **	0.820 ***	0.223 *	278	0.91	0.89	0.89	0.92
21	0.853 **	0.085 ***	0.317	0.863 ***	-0.428	0.189	71	1.666 ***	0.073 ***	0.110 **	0.755 ***	0.177	75	0.87	0.95	0.94	0.88
22	1.540 **	0.148 ***	0.144 ***	0.656 ***	0.059	0.128 ***	153	1.158 **	0.151 ***	0.105 **	0.716 ***	0.160 **	156	0.90	0.97	0.95	0.95
24	1.332 ***	0.062 **	0.059 **	0.831 ***	-0.260 **	0.253 ***	179	1.536 ***	0.078 ***	0.115 ***	0.753 ***	3.007	181	0.95	0.88	0.93	0.90
25	0.941 **	0.089 ***	0.041 **	0.844 ***	-0.015	0.167 **	155	1.202 ***	0.089 ***	0.040 *	0.833 ***	1.880 *	161	0.96	0.91	0.97	0.92
26	1.235 ***	0.216 ***	-0.004	0.758 ***	-0.063	0.053	185	0.856 **	0.172 ***	-0.001	0.817 ***	0.414 *	192	0.96	0.93	0.96	0.98
27	0.910 **	0.073 **	-0.045 *	0.945 ***	0.745	0.547	112	1.827 *	0.116	0.002	0.810 *	0.156 **	117	0.88	0.95	0.95	0.97
28	1.657 ***	0.099 ***	0.106 ***	0.733 ***	1.056 *	1.260 *	314	1.675 *	0.120	0.088	0.734	0.126	319	0.99	0.92	0.94	0.90
29	2.019 ***	0.230 ***	0.020	0.679 ***	1.232 *	1.727 *	169	1.832 **	0.150 ***	0.065 **	0.715 ***	0.081 *	191	0.89	0.95	0.90	0.99
30	0.891	0.015	0.100	0.855 ***	-0.160	0.231	36	1.038 *	0.050 *	0.068 **	0.845 ***	0.001	29	0.70	0.92	0.91	1.00
31	1.273 ***	0.118 ***	0.035	0.808 ***	0.032	0.745 ***	91	2.108 **	0.177 ***	0.026	0.719 ***	0.412 **	94	1.00	0.91	0.97	0.97
32	1.527 *	0.185 **	0.078	0.689 ***	-0.134	0.319	33	0.575	0.149 *	0.044	0.813 ***	0.229	27	0.94	0.92	0.96	0.95
33	2.642 **	0.154 **	-0.003	0.735 ***	-0.088	-0.063	50	1.003 *	0.183 ***	-0.014	0.817 ***	0.455 *	51	0.68	0.78	1.00	0.98
34	1.539 ***	0.150 ***	0.056 **	0.745 ***	-0.142 *	0.491 **	70	0.984 **	0.157 ***	-0.017	0.837 ***	0.130 *	75	0.99	0.97	0.89	0.97
35	1.404 ***	0.208 ***	0.058 *	0.698 ***	-0.196	0.205	59	2.814 **	0.169 ***	0.196 **	0.516 ***	-0.342	67	0.92	0.94	0.93	0.97
36	1.590 ***	0.146 ***	0.104 ***	0.695 ***	-0.067 **	0.342 ***	195	1.415 ***	0.139 ***	0.083 **	0.732 ***	0.400 ***	220	0.97	0.93	0.96	0.97
37	0.882 **	0.041 ***	0.019 *	0.907 ***	-0.027	0.065 **	110	1.206	0.063 **	0.020	0.869 ***	-0.063	101	0.97	0.98	0.98	1.00

Notes: * significant at 10%;** significant at 5%;*** significant at 1%. TE – Mean technical efficiency level in the sector.

Table B1-S1. Slovenia: estimated augmented Cobb-Douglas PF by NACE-2 digit manufacturing sectors, panel OLS estimations for 1995-2002
Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	L	K	Dummy foreign owned firms	Dummy foreign affiliates	Export share	Market share	Concentr. (rel. std deviation of sales)	Import penetr.	No. imp. products	Average import tarrif	Const.	No. obs.	Adj R2	AR(1)	AR(2)
15	0.731 ***	0.193 ***	0.299 ***	-0.024	-0.224	0.093 ***	0.195	0.213 **	0.472 ***	-0.035	5.430 ***	953	0.874	0.000 ***	0.000 ***
17	0.795 ***	0.090 ***	0.164 **	0.039	-0.114 ***	0.035 ***	-0.011	-0.171 *	0.066	-0.331	8.415 ***	585	0.878	0.000 ***	0.000 ***
18	0.821 ***	0.118 ***	0.004	-0.008	-0.023	0.015 ***	0.069	-0.021	0.228	-0.366 **	7.031 ***	534	0.903	0.000 ***	0.000 ***
19	0.657 ***	0.224 ***	0.408 **	0.057	-0.009	0.016	-0.065	-0.147	0.192	-0.383 **	7.654 ***	187	0.893	0.033 *	0.568
20	0.684 ***	0.119 ***	-0.225 **	-0.247 ***	0.144 **	0.149 ***	-0.828 ***	0.269 ***	-0.001	-0.594 ***	8.374 ***	725	0.848	0.000 ***	0.000 ***
21	0.599 ***	0.274 ***	0.254 ***	-0.146 *	-0.260 ***	0.043 ***	0.249	0.153	0.948	-0.572 ***	3.740	255	0.920	0.000 ***	0.003 ***
22	0.684 ***	0.260 ***	0.309 **	-0.088	-0.780 ***	0.083 ***	0.028	-0.002	0.092	-0.338	6.310 ***	707	0.821	0.000 ***	0.000 ***
24	0.606 ***	0.210 ***	0.154 ***	0.194 ***	-0.021	0.062 ***	0.029	0.030	-0.366 **	-1.011 ***	7.594 ***	479	0.893	0.000 ***	0.000 ***
25	0.707 ***	0.172 ***	0.097 *	0.131 *	-0.069	0.024 ***	0.026	0.162 *	0.083	-0.765 ***	6.551 ***	694	0.856	0.000 ***	0.000 ***
26	0.536 ***	0.226 ***	0.362 ***	-0.047	0.122	0.112 ***	0.473	0.362 **	0.517 ***	-0.087	4.424 ***	535	0.874	0.000 ***	0.000 ***
27	0.621 ***	0.190 ***	0.135	0.244 **	0.126 *	0.028 ***	-0.299	-0.030	-0.067	-1.100	9.324 ***	244	0.875	0.007 ***	0.024 **
28	0.660 ***	0.176 ***	0.164 ***	0.059	-0.058 *	0.095 ***	-0.674 **	0.314	-0.142 **	-0.263	7.414 ***	1628	0.829	0.000 ***	0.000 ***
29	0.676 ***	0.120 ***	0.188 ***	0.123 ***	0.076 *	0.111 ***	-0.054	-0.010	0.165	-1.003 ***	7.985 ***	1151	0.839	0.000 ***	0.000 ***
30	0.440 ***	0.207 ***	-0.381	-0.007	0.940 **	0.083 ***	0.216	0.033	1.233 **	-0.693 ***	5.069 **	164	0.659	0.017 **	0.076 *
31	0.597 ***	0.226 ***	0.218 ***	0.146 ***	0.000	0.068 ***	-0.310	0.115	0.182 **	-0.368	7.236 ***	633	0.930	0.000 ***	0.000 ***
32	0.666 ***	0.133 ***	0.129 *	0.283 ***	0.020	0.028 ***	0.008	0.014	0.040	-0.794 ***	7.774 ***	306	0.873	0.002 ***	0.003 ***
33	0.554 ***	0.260 ***	-0.029	0.066	-0.036	0.031 ***	-0.099	-0.057	-0.651 *	-1.219 ***	8.525 ***	476	0.828	0.000 ***	0.000 ***
34	0.891 ***	0.098 ***	0.366 ***	-0.018	-0.142 ***	0.007 **	-0.132 **	0.074 *	-0.348 **	-0.554 ***	9.080 ***	303	0.874	0.007 ***	0.003 ***
35	1.171 ***	0.075	-0.332	-0.314	0.080	0.000	-0.051	0.762 ***	0.958 *	-0.252	3.626	51	0.804	0.364	0.421
36	0.815 ***	0.107 ***	0.060	-0.012	-0.096	0.092 ***	-0.681 ***	-0.046	-0.436 **	-0.289 ***	9.123 ***	799	0.804	0.000 ***	0.001 ***

Notes: * significant at 10%;** significant at 5%;*** significant at 1%.

Table B1-S2. Slovenia: estimated augmented Cobb-Douglas PF by NACE-2 digit manufacturing sectors, panel estimations with fixed effects for 1995-2002 Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	L	K	Dummy foreign owned firms	Dummy foreign affiliates	Export share	Market share	Concentr. (rel. std deviation of sales)	Import penetr.	No. imp. products	Average import tarrif	No. obs.	Adj R2	AR(1)	AR(2)
15	0.750 ***	0.118 **	0.142	-0.052	-0.473 **	0.194 **	0.219	0.214 ***	0.005 ***	-0.005	944	0.447	0.442	0.195
17	0.740 ***	-0.017	-0.003	0.060	-0.035	0.040 ***	-0.018	-0.184 ***	0.000	-0.045 ***	582	0.600	0.115	0.587
18	0.719 ***	0.078 **	-0.089 ***	-0.090	0.016	0.173 ***	0.109	-0.005	0.004	-0.014 *	526	0.581	0.054 *	0.042 **
19	0.454 ***	0.233	0.241	0.113	0.024	0.039 **	-0.040	-0.121	0.002	-0.040 ***	185	0.370	0.621	0.156
20	0.699 ***	0.136 ***	-0.316	-0.255 *	0.074	0.238 ***	-0.795 ***	0.261 ***	0.000	-0.049 ***	712	0.475	0.424	0.099 *
21	0.430 **	0.150 ***	0.075	-0.301 ***	-0.233	0.062 *	0.412 *	0.300 **	0.010 ***	-0.071 ***	255	0.667	0.023 **	0.607
22	0.472 ***	0.058	0.337	-0.003	0.794 **	0.238 ***	-0.026	-0.015	-0.001	-0.060 ***	696	0.435	0.866	0.084 *
24	0.701 ***	0.093	0.014	-0.051	-0.019	0.198 ***	-0.089	-0.016	-0.005 ***	-0.123 ***	478	0.622	0.115	0.338
25	0.589 ***	0.153 **	0.007	0.166	0.235	0.035 ***	0.031	0.153 **	0.001	-0.068 ***	685	0.620	0.052 *	0.279
26	0.405 ***	0.163 ***	-0.070	-0.162 *	0.207	0.133 **	0.434	0.389 ***	0.006 ***	-0.009	530	0.492	0.499	0.875
27	0.669 ***	0.256 ***	0.288	0.223 **	-0.020	-0.015	-0.265 *	-0.024	-0.001	-0.123 **	241	0.562	0.834	0.092 *
28	0.708 ***	0.158 ***	0.205 ***	0.092	0.244 ***	0.175 **	-0.375 **	0.221 **	-0.001	-0.035 ***	1607	0.680	0.619	0.000 ***
29	0.721 ***	0.140 ***	0.113	0.064	0.099	0.126 **	-0.002	-0.014	0.002 *	-0.083 ***	1143	0.611	0.310	0.015 **
30	1.110 ***	-0.114	-0.068	-0.021	1.278	0.087 ***	0.277	-0.106	0.004	-0.108 ***	160	0.740	0.788	0.185
31	0.594 ***	0.169 ***	0.090	0.131 *	0.099	0.123 ***	-0.230	0.100	0.001	-0.050 ***	622	0.711	0.027 **	0.043 **
32	1.067 ***	0.064	0.227 **	0.062	0.013	0.078 ***	0.037	0.012	0.001	-0.070 ***	302	0.776	0.774	0.461
33	0.566 ***	0.179 ***	-0.066	-0.310 **	0.032	0.130 **	-0.111	0.368 ***	-0.005 ***	-0.108 ***	467	0.697	0.207	0.238
34	1.168 ***	0.133 ***	0.162	0.190	0.036	0.006	-0.125 ***	-0.082	-0.002	-0.052 ***	300	0.699	0.821	0.804
35	1.497 ***	-0.069	0.447 **	0.013	0.284 **	0.003	-0.013	0.304 ***	0.007 **	-0.055	48	0.696	0.164	0.653
36	0.710 ***	0.091 ***	0.195	0.035	-0.167	0.106 **	-0.614 ***	0.002	-0.004 **	-0.026 ***	792	0.463	0.607	0.112

Notes: * significant at 10%;** significant at 5%;*** significant at 1%.

Table B1-S3. Slovenia: estimated augmented dynamic Cobb-Douglas PF by NACE-2 digit manufacturing sectors, system-GMM estimations for 1995-2002 Dependent variable: Y=value added=f(K,L)

NACE 2-digit sectors	Lagged dependent variable	L	K	Dummy foreign owned firms	Dummy foreign affiliates	Export share	Market share	Concentr. (rel. std deviation of sales)	Import penetr.	No. imp. products	Average import tarrif	Const.	No. obs.	Adj R2	AR(1)	AR(2)
15	0.428 ***	0.803 ***	-0.004	0.280 *	0.184 **	-0.339	0.049	0.245 *	0.087	0.319 ***	-0.007	1.873 ***	953	1.000	0.042 **	0.077 *
17	0.400 ***	0.828 ***	0.062	-0.022	0.098	-0.056	0.020 ***	-0.060	-0.206 ***	0.024	-0.292 **	5.952 ***	585	1.000	0.010 ***	0.817
18	0.393 ***	0.640 ***	0.114	0.031	0.187 **	-0.020	0.021 ***	0.043	0.015	-0.067	-0.075	5.132	534	1.000	0.001 ***	0.123
19	0.114	0.895 ***	0.335 **	0.482 ***	0.139	0.065	0.012	-0.079	-0.052	-0.098	-0.229 *	7.794 ***	187	0.752	0.006 ***	0.358
20	0.052	1.191 ***	0.138 **	0.117	-0.241	-0.031	0.153 ***	-0.388	0.304 ***	0.107	-0.356 **	6.677 ***	725	1.000	0.039 **	0.122
21	0.349 ***	0.511	0.309 **	-0.049	-0.157 **	0.206	0.047 ***	0.404	0.188	0.803 **	-0.396 ***	-4.330	255	0.789	0.001 ***	0.159
22	0.585 ***	0.382	0.301 *	0.064	-0.169 *	0.067	0.037	-0.227	-0.037	-0.115	0.006	3.472 **	707	0.000	0.000 ***	0.125
24	0.480 ***	0.398 ***	0.236	0.029	-0.123 *	0.175	0.046 ***	0.440 ***	0.038	0.155	-0.158	0.564	479	0.821	0.012 **	0.178
25	0.335 ***	0.772 ***	0.138 *	0.097	-0.048	0.180	0.025 ***	0.024	0.093 *	-0.072	-0.443 ***	5.538 ***	694	1.000	0.015 **	0.138
26	0.085	0.786 **	0.222 **	0.269	-0.186	0.073	0.147 ***	-0.059	0.649 **	0.766	0.147	0.056	535	1.000	0.034 **	0.376
27	0.223 ***	0.825 ***	0.221	-0.012	0.101	0.307 *	0.028 **	-0.139	-0.069	-0.288 **	-0.944 **	9.602 ***	244	0.113	0.001 ***	0.504
28	0.317 ***	0.775 ***	0.255 ***	0.111 *	0.094	-0.012	-0.008	0.275	-0.150	-0.153 **	-0.459 ***	6.343 ***	1628	0.998	0.000 ***	0.593
29	0.204 ***	0.801 ***	0.123	0.314 ***	0.118	0.287 *	0.080	-0.058	-0.064	0.156	-0.691 ***	5.748 ***	1151	1.000	0.001 ***	0.991
30	0.323 ***	0.816 **	-0.005	-0.818	0.139 **	0.971 **	0.059 ***	0.001	-0.045	0.460	-0.969 ***	3.236	164	1.000	0.003 ***	0.134
31	0.401 ***	0.461 ***	0.317 ***	0.182 *	0.122	-0.007	0.041 **	0.252	0.014	0.049	-0.274	2.963 *	633	1.000	0.000 ***	0.692
32	0.336 **	0.825 ***	0.070 **	0.021	0.178	0.036	0.028 ***	0.050	0.015	0.158 *	-0.547 **	4.023 **	306	0.991	0.001 ***	0.333
33	0.296 ***	0.570 **	0.241 **	-0.130	-0.133	0.021	0.050 ***	0.110	-0.170	-0.369	-0.845 ***	8.889 ***	476	1.000	0.001 ***	0.380
34	0.437 ***	1.041 ***	0.098	0.105	0.018	-0.002	0.001	-0.079	-0.111	-0.404 **	-0.380 ***	8.595 ***	303	1.000	0.015 **	0.146
35	-0.295 *	2.474 ***	-0.013 ***	0.652 ***	0.076	0.172	0.011 *	0.008	0.161 ***	0.533	-0.280	4.795	51	1.000	0.130	0.708
36	0.354 ***	0.673 ***	0.132	0.075	-0.056	0.140	0.096 ***	0.060	-0.014	-0.135	-0.233 ***	6.224 ***	799	1.000	0.003 ***	0.752

Notes: * significant at 10%;** significant at 5%;*** significant at 1%.

Part B. Selected Estimation Results on the Adjustment of Manufacturing Firms to Competitive Pressure

B2. The Effect of Competitive Pressure on the Firms' Pricing Behaviour

Table B2-B. Bulgaria: estimated mark-up equations by NACE-2 digit manufacturing sectors, based on Y=sales=f(K,L,M); panel estimations with varying coefficients and random effects

NACE 2-digit sectors	Const.	Import penetration	Dummy for foreign controlled firms	Market concentration (relative standard deviation of sales)	Market share	Export share	Debt ratio	R^2	Wald-test	Markup
1995-2001										
15	0.259 ***	-0.090 ***	0.020	-0.016 ***	0.026	-0.059 ***	0.028 ***	0.539	57.671 ***	1.268 ***
16	0.936 ***	1.129	-0.609	-0.434 ***	0.138	-0.092 **	-0.365 ***	0.712	68.445 ***	1.539 ***
17	0.146 ***	-0.002	-0.005	-0.007 ***	-0.066 **	0.107 ***	-0.006	0.608	54.466 ***	1.178 ***
18	0.136 ***	0.058 **	-0.069 ***	0.005 ***	0.170 *	-0.008	0.103 ***	0.505	77.178 ***	1.203 ***
19	0.044	0.103 ***	0.007	0.029	-0.031	-0.065 ***	0.202 ***	0.495	29.872 ***	1.158 ***
20	0.107 ***	0.129 ***	-0.024	-0.007 ***	-0.127	-0.028	0.256 ***	0.462	40.225 ***	1.135 ***
21	0.295 ***	-0.199 ***	-0.088 ***	-0.024 ***	0.039	0.079	0.224 ***	0.550	36.708 ***	1.228 ***
22	0.145 ***	-0.210 ***	-0.002	0.020 ***	0.284 ***	0.543 ***	-0.066 ***	0.642	140.131 ***	1.246 ***
23	0.059	0.200 *		-0.029	0.017	1.451 ***	0.419	0.977	90.923 ***	1.389 ***
24	0.092 **	0.057	0.035	0.004 **	0.215 ***	-0.047 **	-0.063	0.576	73.846 ***	1.184 ***
25	0.281 ***	-0.124 ***	-0.004	-0.021 ***	-0.101 **	-0.004	0.111 ***	0.706	47.312 ***	1.210 ***
26	0.089 ***	0.033	-0.030	0.017 ***	0.081 ***	-0.039	0.143 ***	0.535	43.269 ***	1.151 ***
27	0.132 ***	0.075 **	-0.051	-0.003 ***	-0.058	-0.105 **	0.224 ***	0.549	161.569 ***	1.153 ***
28	0.047 **	0.064 *	0.117 ***	0.036 **	-0.039	0.079 ***	0.086 ***	0.503	93.723 ***	1.181 ***
29	0.156 ***	-0.026	-0.013	0.002 ***	0.192 ***	-0.076 ***	0.229 ***	0.515	106.028 ***	1.194 ***
30	0.484	-0.383	-0.095	-0.061	-0.199 *	0.210 **	0.698 **	0.373	14.452 **	1.212 ***
31	0.077 **	0.089	0.036	-0.004 **	0.208 ***	0.026	-0.212 ***	0.525	54.835 ***	1.143 ***
32	0.466 *	-0.209	-0.114 **	-0.080 *	-0.152	0.330 ***	-0.194 **	0.567	36.614 ***	1.177 ***
33	0.041	0.021	-0.045 *	0.050	-0.110	-0.135 ***	0.086 ***	0.544	66.226 ***	1.147 ***
34	0.001		0.797	0.089	0.562 **	-0.285 **	0.265	0.449	12.669 **	1.239 ***
35	-0.007	0.139 ***	-0.094 **	0.038	-0.054	-0.123 **	0.791 ***	0.665	88.484 ***	1.148 ***
36	0.008	0.122 ***	0.087 ***	0.054	-0.015	-0.028	0.004	0.494	38.720 ***	1.171 ***
37										

Notes: * significant at 10%;** significant at 5%;*** significant at 1%.

Table B2-H. Hungary: estimated mark-up equations by NACE-2 digit manufacturing sectors, based on Y=sales=f(K,L,M); panel estimations with varying coefficients and random effects

NACE 2-digit sectors	Const.	Import penetration	Dummy for foreign controlled firms	Market concentration (relative standard deviation of sales)	Market share	Export share	Debt ratio	R^2	Wald-test	Markup
1995-2001										
15	0.06 **	-0.36	0.39 **	0.00	0.76 **	0.44 **	0.06	0.13	59.17 **	1.08 ***
16	-0.48	-5.42	0.77	6.89	0.39	-3.12	16.86	0.70	7.07	1.38 ***
17	0.17 **	0.82 **	0.25	-0.17 **	-0.11	-0.65 *	0.20	0.21	25.39 **	1.17 ***
18	0.15 **	-0.28	-0.07	0.03	-0.19	-0.46 **	-0.04	0.22	23.66 **	1.14 ***
19	0.06	-0.17	0.17	0.11	2.68	0.22	-0.03	0.17	7.05	1.12 ***
20	0.13 **	0.09	0.73 **	-0.13 *	2.93	-0.32	-0.08	0.16	21.71 **	1.11 ***
21	0.25 **	-0.13	0.21	-0.25 **	0.04	0.89 *	0.13	0.58	41.89 **	1.22 ***
22	0.14 **	-0.48	0.14	-0.01	-1.55 *	-0.60	-0.02	0.33	11.79	1.14 ***
23	0.22 **	-1.15 **	0.73 **	0.16	-0.85	-0.69 *	-0.10	0.41	65.55 **	1.24 ***
24	0.10 **	-0.05	0.11	0.07	1.13	0.49 **	0.09	0.34	22.34 **	1.16 ***
25	0.08 **	0.73 **	0.32 *	0.46 **	0.78	-0.54 *	0.58 **	0.58	69.31 **	1.32 ***
26	0.03	0.07	0.00	0.13	-0.65	1.49 **	0.06	0.30	38.99 **	1.12 ***
27	0.09 **	-0.02	0.18	0.12 *	1.93	0.68 **	-0.05	0.32	76.62 **	1.18 ***
28	0.09 **	0.51 **	0.25 **	0.01	0.57	0.09	-0.29 **	0.30	49.26 **	1.14 ***
29	-0.22	2.70	1.19	0.07	0.45	2.92	1.07	0.51	46.02 **	1.38 ***
30	0.10 **	0.47	0.35	0.06	-0.24	0.35	-0.03	0.34	22.04 **	1.23 ***
31	0.06	1.09	0.74	-0.08	-1.44	0.97	0.30	0.28	46.63 **	1.23 ***
32	0.22 **	-0.12	0.74 **	-0.19	-3.23	0.86 *	0.01	0.36	22.74 **	1.23 ***
33	0.21 **	-0.52	0.07	-0.08	1.50	-0.44	0.07	0.29	9.32	1.16 ***
34	0.14 **	-0.21	0.31	-0.03	-2.05	0.07	0.23	0.37	5.45	1.13 ***
35	0.13 **	-0.54	0.79 **	0.02	1.39	0.12	0.08	0.25	34.94 **	1.15 ***
36	-0.06	0.00	-0.34	0.35	0.12	0.26	-0.11	0.24	2.31	1.03 ***
37	0.06 **	-0.36	0.39 **	0.00	0.76 **	0.44 **	0.06	0.13	59.17 **	1.08

Notes: * significant at 5%; ** significant at 1%.

Part C. Selected estimation results on the effects of competitive pressure on firms' pricing behaviour in imperfect markets in Bulgaria and Hungary

Table C-1. Estimation results for production functions and markup equations for Bulgarian manufacturing sectors (panel estimations, 1995-2001)

Dependent variable in production function (eq. (4)): total revenue (net sales); estimation in logarithms of levels.
Markup equation: Roeger type estimation of the Lerner index.
Estimation methods: instrumental variables and random effects for the production function (G2SLS); OLS for the markup equation.

NACE 2-digit sectors	Estimated production function								Estimated markup equation (constant RS)		Markup adjusted for non-constant RS	
	Const A_0	Time *T*	*L*	*M*	*K*	R^2	N obs.	Returns to scale λ	Markup *θ*	R^2	Markup *θ*	% bias
15 Food products and beverages	1.051	0.001	0.012	0.878 ***	0.049 ***	0.960	5861	0.939 ***	1.306 ***	0.502	1.226	6.5
16 Tobacco products	6.099 *	-0.029	0.236	0.571 ***	0.139 ***	0.959	149	0.946	1.337 ***	0.572	1.265	5.7
17 Textiles	-1.494	0.032 ***	0.053	0.854 ***	0.022	0.974	933	0.930 ***	1.252 ***	0.470	1.164	7.6
18 Wearing apparel, fur	2.849 ***	-0.008	0.216 ***	0.676 ***	0.083 ***	0.951	2766	0.975 *	1.261 ***	0.481	1.230	2.5
19 Leather, luggage and footwear	1.598	0.000	0.109 ***	0.821 ***	0.040	0.964	590	0.970 *	1.234 ***	0.489	1.196	3.1
20 Wood and wood products except furniture	-0.616	0.024 ***	0.100 ***	0.797 ***	0.039 **	0.954	1214	0.936 ***	1.227 ***	0.401	1.148	6.9
21 Pulp, paper and paper products	-5.183	0.063 **	0.044	0.930 ***	0.014	0.972	540	0.987	1.243 ***	0.462	1.227	1.3
22 Publishing, printing, recorded media	15.570 ***	-0.139 ***	0.188 ***	0.645 ***	0.109 ***	0.945	1334	0.942 ***	1.252 ***	0.475	1.180	6.1
23 Coke, refined petroleum and nuclear fuel	13.578 ***	-0.115 ***	0.201	0.731 ***	0.024	0.993	30	0.957	1.280 ***	0.641	1.224	4.5
24 Chemicals	4.576 ***	-0.030 ***	0.073	0.773 ***	0.090 ***	0.981	1004	0.936 ***	1.265 ***	0.478	1.184	6.8
25 Rubber and plastic products	-0.233	0.017	0.054	0.851 ***	0.041	0.961	1144	0.947 ***	1.315 ***	0.488	1.245	5.6
26 Other non-metallic mineral products	5.233 ***	-0.040 ***	0.058	0.839 ***	0.051 ***	0.977	985	0.949 ***	1.218 ***	0.460	1.156	5.4
27 Basic metals	-0.717	0.023 ***	0.077 *	0.854 ***	0.033	0.983	396	0.964 ***	1.262 ***	0.476	1.216	3.8
28 Fabricated metal products exc. machinery	3.552 ***	-0.018 ***	0.119 ***	0.747 ***	0.080 ***	0.949	2060	0.946 ***	1.229 ***	0.419	1.162	5.7
29 Machinery and equipment n.e.c.	1.553 **	-0.002	0.099 ***	0.838 ***	0.047 ***	0.963	2428	0.984	1.230 ***	0.460	1.210	1.6
30 Office machinery and computers	-3.599	0.074 ***	0.327 ***	0.554 ***	0.032	0.940	187	0.913 ***	1.237 ***	0.367	1.129	9.5
31 Electrical machinery and apparatus n.e.c.	2.123 *	-0.007	0.035	0.836 ***	0.070 ***	0.963	912	0.941 ***	1.237 ***	0.409	1.164	6.3
32 Radio, television and communication	5.768 ***	-0.039 **	0.091	0.705 ***	0.143 ***	0.941	267	0.939 *	1.224 ***	0.379	1.149	6.5
33 Medical, precision and optical instruments	4.910 ***	-0.023 **	0.168 ***	0.633 ***	0.102 ***	0.927	516	0.903 ***	1.243 ***	0.399	1.122	10.7
34 Motor vehicles, trailers and semi-trailers	3.435 **	-0.024 *	0.129	0.797 ***	0.090 ***	0.973	217	1.016	1.255 ***	0.441	1.276	-1.6
35 Other transport equipment	0.804	0.009	0.153 **	0.782 ***	0.053	0.981	199	0.989	1.164 ***	0.487	1.151	1.1
36 Furniture; manufacturing n.e.c.	0.263	0.019 **	0.170 ***	0.711 ***	0.071 ***	0.959	1295	0.951 ***	1.226 ***	0.464	1.166	5.1
MAPE												5.2

Notes:
(i) The symbols *, ** and *** refer to significance levels of 10%, 5% and 1%, respectively.
(ii) The hypotheses regarding returns to scale are as follows: H0: λ=1; markup: H0: θ=1.
(iii) Time dummies (not reported in this table) were also included in the estimation of the production function.
(iv) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price markups.
(v) The abbreviation “n.e.c.” stands for “not elsewhere classified” and the abbreviation “MAPE” stands for “mean absolute percentage error”.

Table C-2. Estimation results for production functions and markup equations for Hungarian manufacturing sectors (panel estimations, 1995-2001)

Dependent variable in production function (eq. (4)): total revenue (net sales); estimation in logarithms of levels.
Markup equation: Roeger type estimation of the Lerner index.
Estimation methods: instrumental variables and random effects for the production function (G2SLS); OLS for the markup equation.

NACE 2-digit sectors	Estimated production function								Estimated markup equation (constant RS)		Markup adjusted for non-constant RS	
	Const A_0	Time *T*	*L*	*M*	*K*	R^2	N obs.	Returns to scale λ	Markup *θ*	R^2	Markup *θ*	% bias
15 Food products and beverages	-0.221	0.003 **	0.054 *	0.992 ***	-0.022 **	0.984	5218	1.024 ***	1.083 ***	0.120	1.109	-2.3
16 Tobacco products	-4.156 *	0.043 **	0.318 **	0.616 ***	0.194 ***	0.992	44	1.129 *	1.319 ***	0.630	1.489	-11.4
17 Textiles	0.640	-0.001	0.393 ***	0.437 ***	0.139 ***	0.934	1355	0.969 **	1.176 ***	0.190	1.140	3.2
18 Wearing apparel, fur	1.092 ***	-0.008 ***	0.208 ***	0.888 ***	-0.016	0.911	2606	1.081 ***	1.137 ***	0.210	1.229	-7.5
19 Leather, luggage and footwear	1.322 ***	-0.012 ***	0.346 ***	0.711 ***	0.012	0.919	1055	1.069 ***	1.117 ***	0.170	1.194	-6.4
20 Wood and wood products except furniture	0.635 **	-0.004	0.068	0.942 ***	0.024	0.973	1579	1.034 ***	1.113 ***	0.140	1.150	-3.3
21 Pulp, paper and paper products	-0.024	0.004	0.100 **	0.874 ***	0.038 **	0.986	463	1.013	1.228 ***	0.540	1.243	-1.2
22 Publishing, printing, recorded media	0.791 ***	-0.005 **	0.060 **	0.934 ***	0.028 ***	0.972	1904	1.022 **	1.139 ***	0.330	1.164	-2.2
23 Coke, refined petroleum and nuclear fuel	4.197 ***	-0.046 ***	0.169	1.008 ***	-0.094	0.999	16	1.084	1.162 ***	0.880	1.260	-7.7
24 Chemicals	1.427 ***	-0.009 ***	0.203 ***	0.685 ***	0.118 ***	0.978	1004	1.006	1.232 ***	0.370	1.240	-0.6
25 Rubber and plastic products	0.246	0.003	0.149 ***	0.783 ***	0.066 ***	0.979	1813	0.999	1.161 ***	0.330	1.160	0.1
26 Other non-metallic mineral products	0.237	0.000	0.165 ***	0.862 ***	0.022	0.976	1339	1.049 ***	1.317 ***	0.550	1.381	-4.7
27 Basic metals	-0.392	0.008 *	0.233 ***	0.751 ***	0.045	0.987	564	1.029 **	1.112 ***	0.240	1.144	-2.8
28 Fabricated metal products exc. machinery	0.047	0.003	0.162 ***	0.853 ***	0.020	0.964	4270	1.035 ***	1.177 ***	0.310	1.219	-3.4
29 Machinery and equipment n.e.c.	0.983 ***	-0.007 ***	0.087 ***	0.969 ***	-0.015	0.960	3139	1.042 ***	1.141 ***	0.290	1.189	-4.0
30 Office machinery and computers	-0.452	0.009	0.051	0.942 ***	0.009	0.983	148	1.002	1.336 ***	0.340	1.338	-0.2
31 Electrical machinery and apparatus n.e.c.	-0.041	0.006	0.156 ***	0.837 ***	0.022	0.976	1254	1.016	1.221 ***	0.320	1.240	-1.6
32 Radio, television and communication	0.364	0.001	0.201 ***	0.821 ***	0.008	0.967	773	1.031 **	1.234 ***	0.220	1.272	-3.0
33 Medical, precision and optical instruments	1.995 ***	-0.016 ***	0.148 ***	0.894 ***	0.006	0.950	908	1.048 ***	1.222 ***	0.340	1.280	-4.6
34 Motor vehicles, trailers and semi-trailers	0.718 *	-0.004	0.128 ***	0.871 ***	0.028 *	0.988	650	1.027 **	1.168 ***	0.270	1.199	-2.6
35 Other transport equipment	0.407	0.002	0.174 *	0.741 ***	0.054	0.982	210	0.969 *	1.130 ***	0.350	1.095	3.2
36 Furniture; manufacturing n.e.c.	0.696 **	-0.004	0.183 ***	0.801 ***	0.038 *	0.967	1502	1.022	1.145 ***	0.220	1.170	-2.2
37 Recycling	1.888	-0.023	0.063	1.133 ***	-0.101 *	0.954	112	1.095 *	1.033 **	0.220	1.131	-8.7
MAPE												3.8

Notes:
(i) The symbols *, ** and *** refer to significance levels of 10%, 5% and 1%, respectively.
(ii) The hypotheses regarding returns to scale are as follows: H0: λ=1; markup: H0: θ=1.
(iii) Time dummies (not reported in this table) were also included in the estimation of the production function.
(iv) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price markups.
(v) The abbreviation “n.e.c.” stands for “not elsewhere classified” and the abbreviation “MAPE” stands for “mean absolute percentage error”.

Table C-R1. Estimation results for production functions and mark-up equations for Romanian manufacturing sectors (panel estimations, 1999 over 1998)

Dependent variable in production function (eq. (4)): total revenue (net sales); estimation in logarithms of levels.
Markup equation: Roeger type estimation of the Lerner index.
Estimation methods: instrumental variables and random effects for the production function (G2SLS); OLS for the mark-up equation.

NACE 2-digit sectors	Estimated production function							
	Constant	L	M	K	RS (λ)	Mark-up	Adjusted MU	% bias
15 Food products and beverages	0.580	0.074	0.888	0.027	0.989	1.085	1.073	1.12
16 Tobacco products	0.185	0.068	0.925	0.013	1.006	0.921	0.927	0.59
17 Textiles	2.641	0.255	0.596	0.036	0.887	1.155	1.024	11.28
18 Wearing apparel, fur	3.933	0.280	0.374	0.152	0.806	1.362	1.098	19.37
19 Leather, luggage and footwear	2.174	0.206	0.597	0.112	0.915	1.206	1.103	8.55
20 Wood and wood products except furniture	1.701	0.094	0.757	0.075	0.926	1.120	1.037	7.38
21 Pulp, paper and paper products	1.261	0.137	0.891	-0.070	0.958	1.079	1.034	4.25
22 Publishing, printing, recorded media	2.264	0.035	0.681	0.171	0.887	1.487	1.320	11.27
23 Coke, refined petroleum and nuclear fuel	0.539	0.043	0.982	-0.044	0.981	1.041	1.021	1.89
24 Chemicals	1.430	0.062	0.815	0.064	0.941	1.171	1.101	5.93
25 Rubber and plastic products	1.663	0.102	0.786	0.044	0.932	1.134	1.056	6.81
26 Other non-metallic mineral products	1.519	0.201	0.725	0.025	0.950	1.113	1.058	4.96
27 Basic metals	1.195	0.098	0.856	0.001	0.955	1.012	0.967	4.50
28 Fabricated metal products exc. machinery	1.761	0.126	0.675	0.127	0.928	1.173	1.089	7.15
29 Machinery and equipment n.e.c.	2.147	0.316	0.573	0.027	0.916	1.167	1.069	8.42
30 Office machinery and computers	0.304	0.074	0.894	0.049	1.016	0.983	0.999	1.65
31 Electrical machinery and apparatus n.e.c.	1.699	0.065	0.678	0.189	0.932	1.323	1.233	6.80
32 Radio, television and communication	0.929	0.134	0.802	0.045	0.982	1.439	1.413	1.83
33 Medical, precision and optical instruments	3.125	0.146	0.606	0.098	0.851	1.213	1.032	14.92
34 Motor vehicles, trailers and semi-trailers	1.215	0.140	0.757	0.066	0.963	1.149	1.106	3.68
35 Other transport equipment	1.920	0.246	0.584	0.102	0.931	1.269	1.182	6.87
36 Furniture; manufacturing n.e.c.	1.620	0.147	0.626	0.165	0.939	1.287	1.208	6.14
37 Recycling	0.547	0.107	0.896	-0.008	0.994	0.945	0.939	0.57
MAPE								6.34

Notes:
(i) The figures in italics denote significance levels smaller than 10% in the sectoral production function equations.
(ii) The hypotheses regarding returns to scale are as follows: H0: λ=1; mark-up: H0: θ=1.
(iii) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price mark-ups.
(v) The abbreviation “n.e.c.” stands for “not elsewhere classified” and the abbreviation “MAPE” stands for “mean absolute percentage error”.

Table C-R2. Estimation results for production functions and mark-up equations for Romanian manufacturing sectors (panel estimations, 2000 over 1999)

Dependent variable in production function (eq. (4)): total revenue (net sales); estimation in logarithms of levels.
Markup equation: Roeger type estimation of the Lerner index.
Estimation methods: instrumental variables and random effects for the production function (G2SLS); OLS for the mark-up equation.

NACE 2-digit sectors	Estimated production function							
	Constant	L	M	K	RS (λ)	Mark-up	Adjusted MU	% bias
15 Food products and beverages	0.531	0.061	0.900	0.028	0.988	1.119	1.106	1.18
16 Tobacco products	0.185	0.068	0.925	0.013	1.006	0.921	0.927	0.59
17 Textiles	2.326	0.287	0.584	0.039	0.911	1.158	1.054	8.94
18 Wearing apparel, fur	3.424	0.295	0.410	0.139	0.843	1.368	1.153	15.66
19 Leather, luggage and footwear	2.457	0.218	0.605	0.077	0.901	1.197	1.078	9.93
20 Wood and wood products except furniture	1.469	0.080	0.793	0.069	0.942	1.162	1.095	5.81
21 Pulp, paper and paper products	0.635	0.110	0.929	-0.047	0.993	1.117	1.109	0.75
22 Publishing, printing, recorded media	3.771	0.085	0.432	0.289	0.806	1.419	1.311	7.64
23 Coke, refined petroleum and nuclear fuel	0.712	0.061	0.902	0.014	0.977	1.365	1.346	1.41
24 Chemicals	1.493	0.098	0.797	0.047	0.942	1.061	1.000	5.78
25 Rubber and plastic products	1.672	0.117	0.809	0.007	0.934	0.936	0.874	6.65
26 Other non-metallic mineral products	1.270	0.235	0.748	-0.016	0.967	1.023	0.989	3.26
27 Basic metals	0.971	0.065	0.865	0.034	0.964	0.966	0.931	3.58
28 Fabricated metal products exc. machinery	1.753	0.104	0.709	0.115	0.928	1.136	1.054	7.22
29 Machinery and equipment n.e.c.	2.373	0.228	0.629	0.041	0.899	1.238	1.113	10.13
30 Office machinery and computers	0.408	0.033	0.898	0.063	0.994	1.045	1.038	0.64
31 Electrical machinery and apparatus n.e.c.	1.403	0.134	0.791	0.031	0.955	1.328	1.269	4.50
32 Radio, television and communication	0.991	0.136	0.710	0.131	0.978	1.004	0.982	2.24
33 Medical, precision and optical instruments	3.197	0.079	0.693	0.071	0.843	1.301	1.096	15.73
34 Motor vehicles, trailers and semi-trailers	0.801	0.134	0.791	0.059	0.985	1.088	1.072	1.53
35 Other transport equipment	1.537	0.223	0.651	0.079	0.952	1.349	1.285	4.76
36 Furniture; manufacturing n.e.c.	1.581	0.088	0.671	0.181	0.940	1.345	1.264	6.04
37 Recycling	0.350	0.039	0.907	0.051	0.998	1.045	1.043	0.20
MAPE								5.40

Notes:
(i) The figures in italics denote significance levels smaller than 10% in the sectoral production function equations.
(ii) The hypotheses regarding returns to scale are as follows: H0: λ=1; mark-up: H0: θ=1.
(iii) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price mark-ups.
(v) The abbreviation “n.e.c.” stands for “not elsewhere classified” and the abbreviation “MAPE” stands for “mean absolute percentage error”.

Table C-R3. Estimation results for production functions and mark-up equations for Romanian manufacturing sectors (panel estimations, 2001 over 2000)

Dependent variable in production function (eq. (4)): total revenue (net sales); estimation in logarithms of levels.
Markup equation: Roeger type estimation of the Lerner index.
Estimation methods: instrumental variables and random effects for the production function (G2SLS); OLS for the mark-up equation.

NACE 2-digit sectors	Estimated production function							
	Constant	L	M	K	RS (λ)	Mark-up	Adjusted MU	% bias
15 Food products and beverages	0.370	0.075	0.905	0.019	1.000	1.034	1.034	0.02
16 Tobacco products	0.185	0.068	0.925	0.013	1.006	0.921	0.927	0.59
17 Textiles	2.303	0.278	0.603	0.033	0.913	1.298	1.185	8.70
18 Wearing apparel, fur	2.650	0.237	0.520	0.136	0.893	1.171	1.045	10.71
19 Leather, luggage and footwear	2.736	0.198	0.583	0.102	0.883	1.119	0.988	11.72
20 Wood and wood products except furniture	1.649	0.075	0.755	0.100	0.930	1.207	1.122	7.04
21 Pulp, paper and paper products	0.544	0.096	0.862	0.037	0.995	1.013	1.008	0.48
22 Publishing, printing, recorded media	1.628	0.137	0.630	0.173	0.940	1.324	1.244	6.03
23 Coke, refined petroleum and nuclear fuel	0.650	0.048	0.906	0.024	0.977	1.365	1.346	1.41
24 Chemicals	1.098	0.080	0.825	0.058	0.963	1.026	0.988	3.70
25 Rubber and plastic products	0.939	0.096	0.842	0.035	0.973	1.031	1.003	2.71
26 Other non-metallic mineral products	1.203	0.216	0.757	-0.003	0.970	0.997	0.967	3.01
27 Basic metals	0.830	0.087	0.950	-0.061	0.975	0.973	0.949	2.45
28 Fabricated metal products exc. machinery	1.558	0.096	0.740	0.102	0.938	1.087	1.020	6.19
29 Machinery and equipment n.e.c.	1.884	0.248	0.681	0.001	0.931	1.070	0.995	6.93
30 Office machinery and computers	1.199	0.022	0.811	0.117	0.949	1.202	1.141	5.05
31 Electrical machinery and apparatus n.e.c.	1.319	0.132	0.783	0.043	0.958	1.156	1.108	4.16
32 Radio, television and communication	1.451	0.208	0.662	0.089	0.958	1.115	1.129	1.22
33 Medical, precision and optical instruments	2.687	0.154	0.730	0.101	0.985	1.067	1.054	1.62
34 Motor vehicles, trailers and semi-trailers	1.350	0.131	0.735	0.086	0.953	1.316	1.255	4.69
35 Other transport equipment	1.455	0.206	0.689	0.062	0.957	1.147	1.097	4.33
36 Furniture; manufacturing n.e.c.	1.446	0.151	0.678	0.122	0.951	1.109	1.055	4.88
37 Recycling	0.734	0.046	0.910	0.020	0.976	1.048	1.024	2.35
MAPE								4.35

Notes:
(i) The figures in italics denote significance levels smaller than 10% in the sectoral production function equations.
(ii) The hypotheses regarding returns to scale are as follows: H0: λ=1; mark-up: H0: θ=1.
(iii) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price mark-ups.
(v) The abbreviation “n.e.c.” stands for “not elsewhere classified” and the abbreviation “MAPE” stands for “mean absolute percentage error”.

Table C-R4. Time course for RTS (return to scale coefficients) and mark-up coefficients for Romanian manufacturing, by sector, during 1998-2001

NACE 2-digit sectors	Returns to scale (RS)				Mark-ups Constant RS			Adjusted Mark-ups Non-constant RS			Mark-ups bias % differential		
	1998	1999	2000	2001	1999	2000	2001	1999	2000	2001	1999	2000	2001
15 Food products and beverages	0.99	0.99	1.00	1.00	1.08	1.12	1.03	1.07	1.11	1.03	1.1	1.2	0.0
16 Tobacco products		1.01				0.92			0.93			-0.6	
17 Textiles	0.89	0.91	0.91	0.87	1.15	1.16	1.30	1.02	1.05	1.18	11.3	8.9	8.7
18 Wearing apparel, fur	0.81	0.84	0.89	0.91	1.36	1.37	1.17	1.10	1.15	1.05	19.4	15.7	10.7
19 Leather, luggage and footwear	0.91	0.90	0.88	0.87	1.21	1.20	1.12	1.10	1.08	0.99	8.5	9.9	11.7
20 Wood and wood products except furniture	0.93	0.94	0.93	0.94	1.12	1.16	1.21	1.04	1.09	1.12	7.4	5.8	7.0
21 Pulp, paper and paper products	0.96	0.99	1.00	0.96	1.08	1.12	1.01	1.03	1.11	1.01	4.2	0.7	0.5
22 Publishing, printing, recorded media	0.89	0.81	0.94	0.97	1.49	1.42	1.32	1.32	1.31	1.24	11.3	7.6	6.0
23 Coke, refined petroleum and nuclear fuel	0.98	0.98	0.98	0.97	1.04	1.36		1.02	1.35		1.9	1.4	
24 Chemicals	0.94	0.94	0.96	0.95	1.17	1.06	1.03	1.10	1.00	0.99	5.9	5.8	3.7
25 Rubber and plastic products	0.93	0.93	0.97	0.95	1.13	0.94	1.03	1.06	0.87	1.00	6.8	6.6	2.7
26 Other non-metallic mineral products	0.95	0.97	0.97	0.99	1.11	1.02	1.00	1.06	0.99	0.97	5.0	3.3	3.0
27 Basic metals	0.96	0.96	0.98	0.93	1.01	0.97	0.97	0.97	0.93	0.95	4.5	3.6	2.5
28 Fabricated metal products exc. machinery	0.93	0.93	0.94	0.94	1.17	1.14	1.09	1.09	1.05	1.02	7.2	7.2	6.2
29 Machinery and equipment n.e.c.	0.92	0.90	0.93	0.93	1.17	1.24	1.07	1.07	1.11	1.00	8.4	10.1	6.9
30 Office machinery and computers	1.02	0.99	0.95	0.92	0.98	1.04	1.20	1.00	1.04	1.14	-1.6	0.6	5.1
31 Electrical machinery and apparatus n.e.c.	0.93	0.95	0.96	0.92	1.32	1.33	1.16	1.23	1.27	1.11	6.8	4.5	4.2
32 Radio, television and communication equipment and apparatus	0.98	0.98	0.96	1.01	1.44	1.00	1.12	1.41	0.98	1.13	1.8	2.2	-1.2
33 Medical, precision and optical instruments	0.85	0.84	0.88	0.98	1.21	1.30	1.07	1.03	1.10	1.05	14.9	15.7	1.6
34 Motor vehicles, trailers and semi-trailers	0.96	0.98	0.95	0.98	1.15	1.09	1.32	1.11	1.07	1.25	3.7	1.5	4.7
35 Other transport equipment	0.93	0.95	0.96	0.88	1.27	1.35	1.15	1.18	1.28	1.10	6.9	4.8	4.3
36 Furniture; manufacturing n.e.c.	0.94	0.94	0.95	0.95	1.29	1.34	1.11	1.21	1.26	1.06	6.1	6.0	4.9
37 Recycling	0.99	1.00	0.98	0.95	0.94	1.05	1.05	0.94	1.04	1.02	0.6	0.2	2.4
MAPE											6.3	5.4	4.3

Notes:
(I) The abbreviation “n.e.c.” stands for “not elsewhere classified” and the abbreviation “MAPE” stands for “mean absolute percentage error”.

Table C-3. Returns to scale and price markups (estimated and corrected) for Bulgarian manufacturing firms grouped by size

NACE 2-digit sectors	Firms with less than 20 employees				Firms with more than 20 but less than 200 employees				Firms with more than 200 employees			
	Returns to scale (RS)	Estimated markup	Markup adjusted for RS	% bias	Returns to scale (RS)	Estimated markup	Markup adjusted for RS	% bias	Returns to scale (RS)	Estimated markup	Markup adjusted for RS	% bias
15	0.884	1.359	1.201	13.1	0.989	1.259	1.246	1.1	0.997	1.268	1.264	0.3
16					0.926	1.362	1.262	7.9	0.879	1.300	1.143	13.7
17	0.768	1.407	1.080	30.3	0.966	1.187	1.147	3.5	0.969	1.172	1.135	3.2
18	0.949	1.410	1.338	5.4	0.955	1.224	1.169	4.7	1.060	1.149	1.217	-5.6
19	0.863	1.378	1.189	15.9	1.019	1.177	1.199	-1.8	0.996	1.157	1.153	0.4
20	0.847	1.283	1.087	18.0	1.006	1.129	1.136	-0.6	0.811	1.161	0.941	23.4
21	0.900	1.281	1.153	11.1	1.019	1.233	1.257	-1.9	0.956	1.110	1.061	4.6
22	0.871	1.268	1.105	14.8	1.014	1.214	1.231	-1.4	0.959	1.219	1.169	4.2
24	0.839	1.361	1.142	19.1	0.953	1.158	1.103	5.0	1.043	1.235	1.288	-4.1
25	0.832	1.378	1.146	20.2	1.011	1.215	1.228	-1.0	0.952	1.149	1.094	5.0
26	0.868	1.349	1.171	15.2	1.000	1.141	1.140	0.0	0.975	1.185	1.156	2.5
27	0.806	1.333	1.074	24.1	0.887	1.255	1.113	12.8	1.001	1.105	1.106	-0.1
28	0.872	1.262	1.100	14.7	1.001	1.177	1.178	-0.1	1.028	1.194	1.228	-2.7
29	0.962	1.284	1.235	4.0	0.999	1.193	1.192	0.1	1.049	1.157	1.213	-4.6
30	0.897	1.338	1.201	11.4	0.953	1.125	1.072	4.9	1.032	1.088	1.123	-3.1
31	0.822	1.315	1.081	21.7	1.009	1.143	1.153	-0.9	0.955	1.161	1.109	4.7
32	0.970	1.242	1.204	3.1	1.034	1.200	1.241	-3.3	0.858	1.177	1.010	16.6
33	0.875	1.305	1.142	14.3	0.951	1.125	1.070	5.2	0.936	1.108	1.037	6.8
34	0.884	1.279	1.130	13.2	1.028	1.255	1.291	-2.8	0.996	1.155	1.151	0.4
35	1.037	1.207	1.251	-3.5	1.159	1.130	1.309	-13.7	1.124	1.123	1.262	-11.0
36	0.883	1.289	1.138	13.3	1.008	1.172	1.181	-0.8	0.963	1.160	1.117	3.9
MAPE				14.3				3.5				5.8

Notes:
(i) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price markups.
(ii) The abbreviation “MAPE” stands for “mean absolute percentage error”.

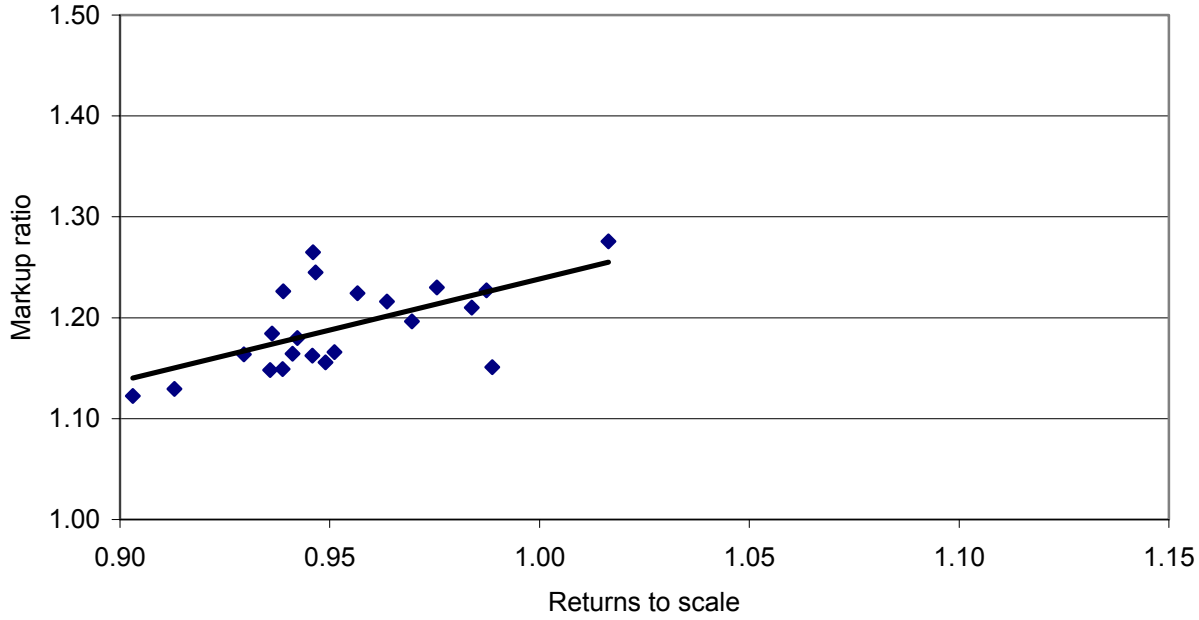
Table C-4. Returns to scale and price markups (estimated and corrected) for Hungarian manufacturing firms grouped by size

NACE 2-digit sectors	Firms with less than 20 employees				Firms with more than 20 but less than 200 employees				Firms with more than 200 employees			
	Returns to scale (RS)	Estimated markup	Markup adjusted for RS	% bias	Returns to scale (RS)	Estimated markup	Markup adjusted for RS	% bias	Returns to scale (RS)	Estimated markup	Markup adjusted for RS	% bias
15	1.043	1.094	1.141	-4.1	1.012	1.081	1.094	-1.2	0.974	1.094	1.066	2.7
16									1.521	1.277	1.942	-34.2
17	0.981	1.597	1.567	1.9	0.980	1.152	1.129	2.0	1.014	1.063	1.078	-1.4
18	1.257	1.128	1.418	-20.4	1.078	1.135	1.224	-7.3	0.993	1.127	1.119	0.7
19	0.884	1.268	1.121	13.1	1.067	1.119	1.194	-6.3	0.977	1.146	1.119	2.4
20	1.011	1.060	1.072	-1.1	1.022	1.105	1.129	-2.1	1.005	1.137	1.142	-0.5
21	0.907	1.165	1.057	10.2	1.017	1.219	1.239	-1.6	1.031	1.292	1.332	-3.0
22	1.056	1.167	1.232	-5.3	0.994	1.127	1.121	0.6	1.023	1.119	1.145	-2.3
24	1.201	1.171	1.407	-16.7	1.017	1.170	1.190	-1.7	1.042	1.059	1.103	-4.0
25	0.971	1.080	1.048	3.0	1.057	1.184	1.252	-5.4	0.967	1.122	1.085	3.4
26	0.989	1.133	1.121	1.1	1.069	1.250	1.336	-6.4	1.075	1.404	1.509	-7.0
27	1.018	1.186	1.207	-1.7	1.035	1.159	1.199	-3.4	0.984	1.098	1.081	1.6
28	0.986	1.186	1.170	1.4	1.045	1.167	1.219	-4.3	0.975	1.339	1.305	2.6
29	1.124	1.154	1.297	-11.0	1.015	1.167	1.184	-1.4	0.986	1.124	1.109	1.4
30	1.026	1.211	1.243	-2.5	1.039	1.123	1.167	-3.7				
31	1.035	1.267	1.311	-3.4	0.957	1.206	1.155	4.4	0.992	1.266	1.256	0.8
32	1.018	1.170	1.191	-1.8	1.030	1.269	1.307	-2.9	0.952	1.390	1.324	5.0
33	1.017	1.223	1.244	-1.7	1.057	1.226	1.296	-5.4	0.800	1.191	0.953	24.9
34	1.053	1.221	1.285	-5.0	1.021	1.256	1.283	-2.1	0.988	1.180	1.165	1.2
35	1.076	0.954	1.027	-7.1	0.914	1.128	1.031	9.4	1.083	1.101	1.192	-7.6
36	0.983	1.085	1.067	1.7	1.104	1.176	1.298	-9.4	1.036	1.097	1.137	-3.5
37	0.867	1.052	0.912	15.4	1.098	1.027	1.127	-8.9				
MAPE				6.2				4.3				5.5

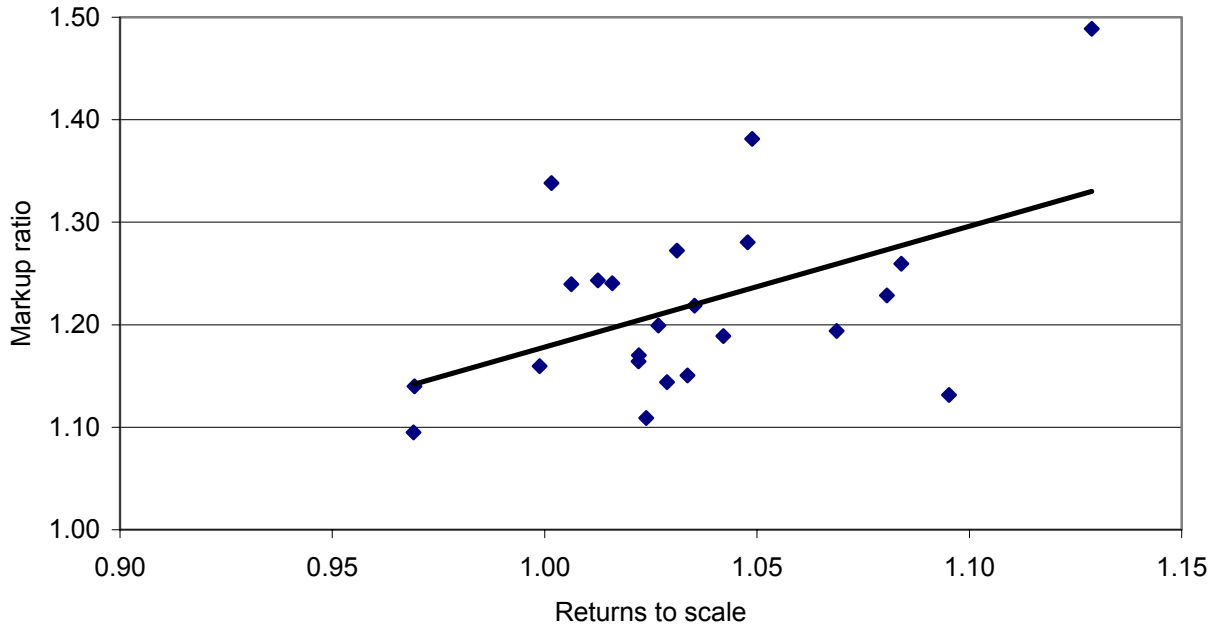
Notes:
(i) The reported % measurement bias is calculated as the % difference between the estimated and adjusted values of the price markups.
(ii) The abbreviation “MAPE” stands for “mean absolute percentage error”.

Figure C-1. Returns to scale and markup ratios by NACE-2 digit manufacturing sectors

A. Bulgaria



B. Hungary



C. Romania

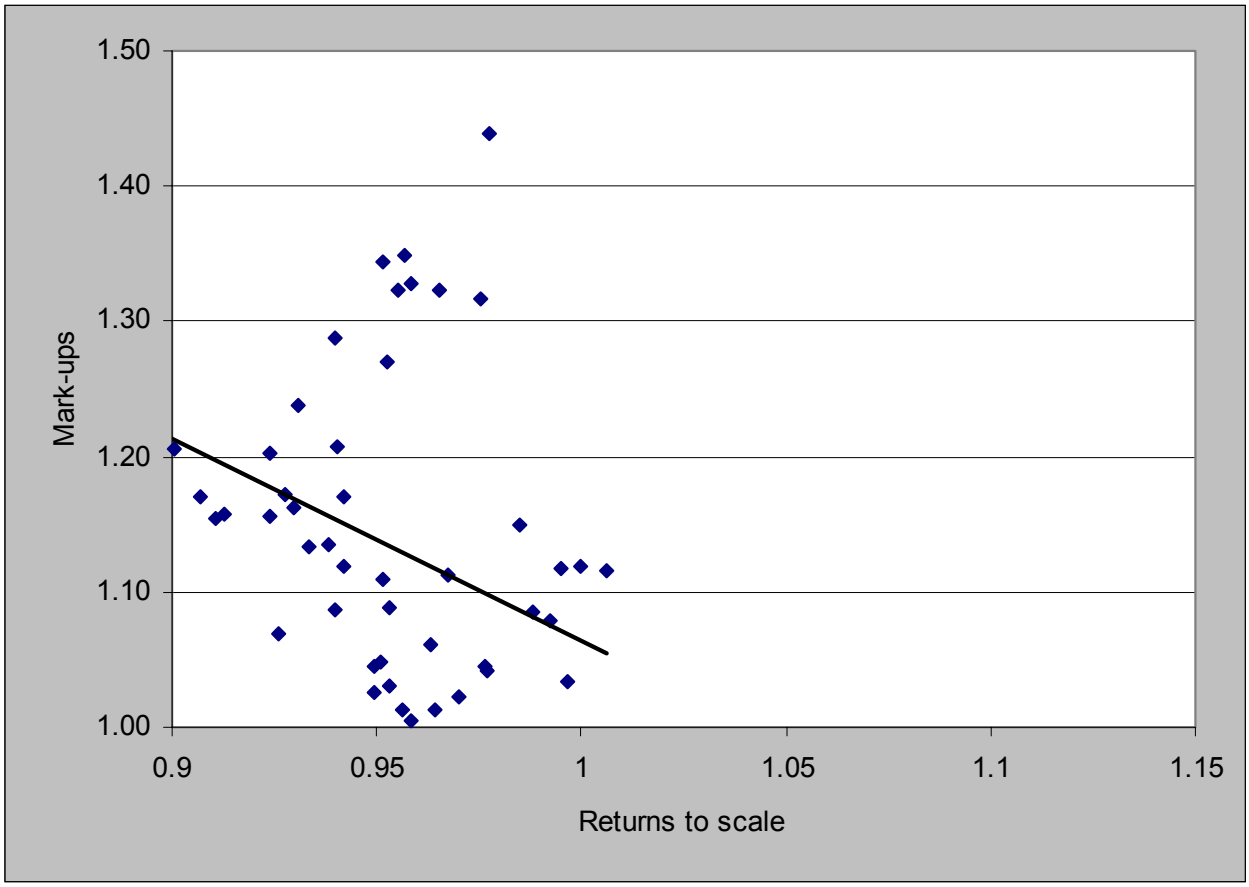
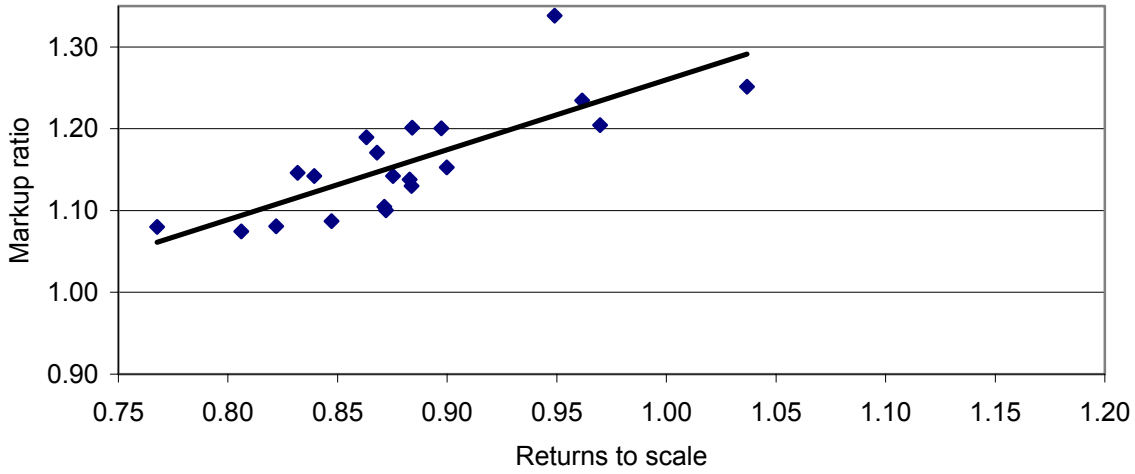
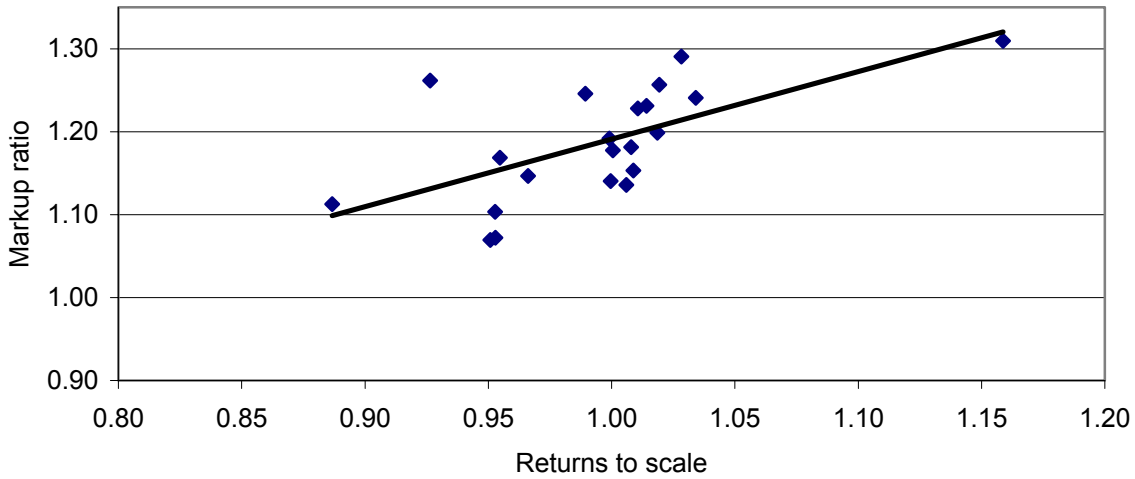

1.50
1.40
1.30
1.20
1.10
1.00
Mark-ups
0.9
0.95
1
1.05
1.1
1.15
Returns to scale

Figure C-2. Returns to scale and markup ratios in Bulgarian manufacturing by NACE-2 digit sectors and size of firms

A. Firms with less than 20 employees



B. Firms with more than 20 but less than 200 employees



C. Firms with more than 200 employees

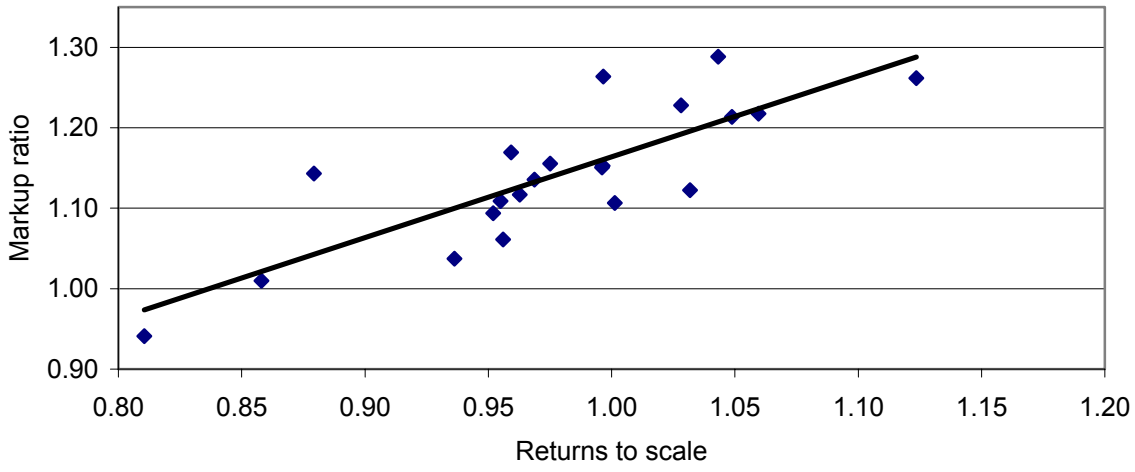
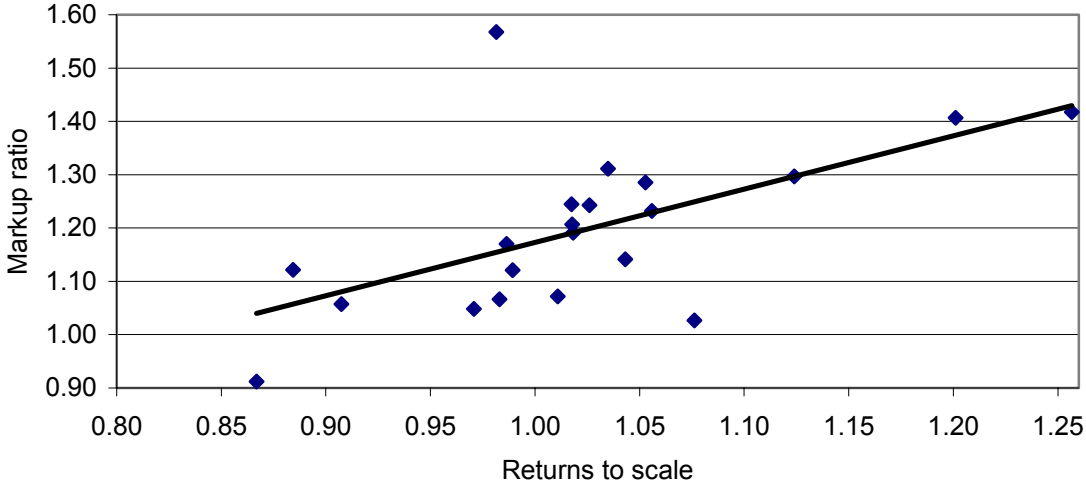
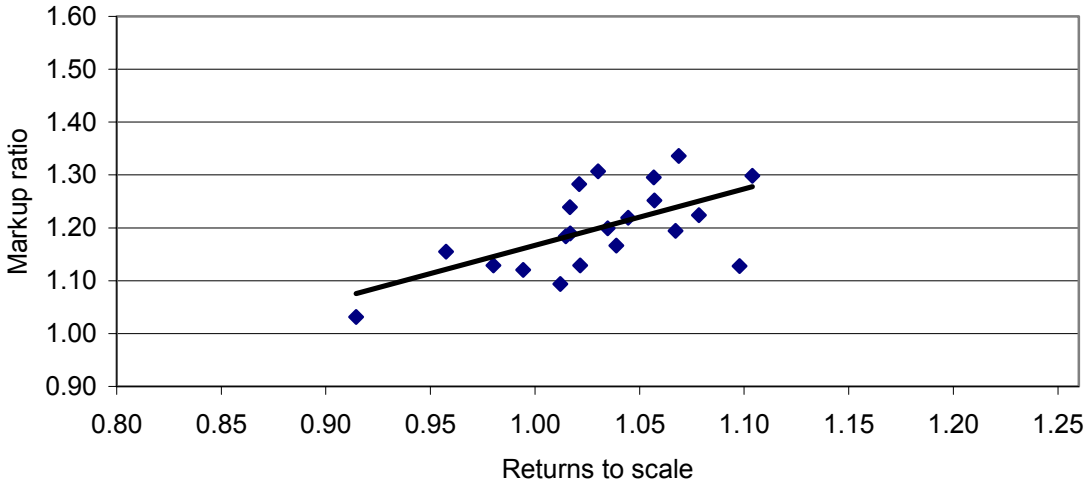


Figure C-3. Returns to scale and markup ratios in Hungarian manufacturing by NACE-2 digit sectors and size of firms

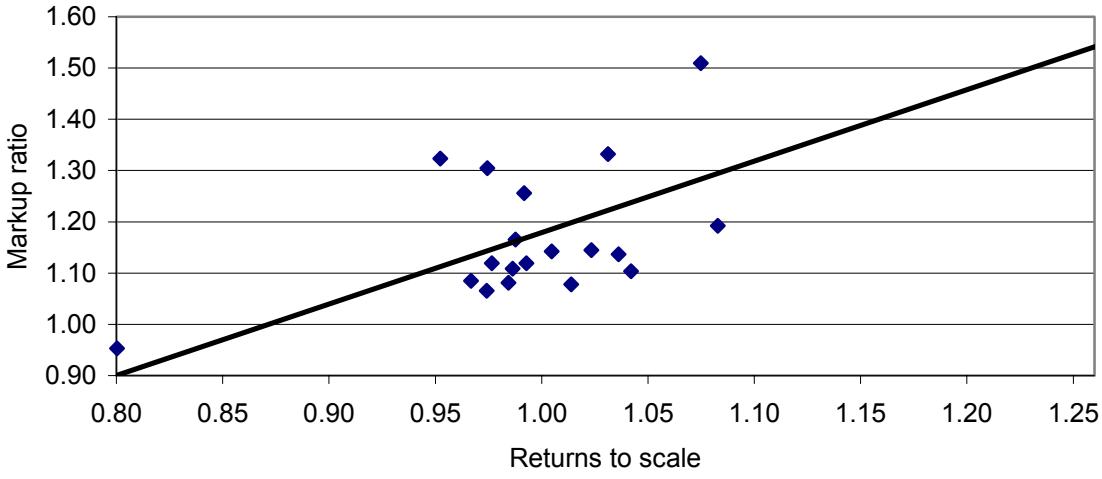
A. Firms with less than 20 employees



B. Firms with more than 20 but less than 200 employees



C. Firms with more than 200 employees



Part D. Selected estimation results on the cross-country analysis of firms' responses to competitive pressure, institutional interactions and change

Table D-1. Descriptive statistics for the model variables of the cross-country model

Variable	*Bulgaria*			*Hungary*			*Romania*		
	N obs	Mean	St.dev.	N obs	Mean	St.dev.	N obs	Mean	St.dev.
Mean efficiency level	147	0.798	0.053	78	0.781	0.093	84	0.904	0.127
Average markup ratio (unadjusted)	159	1.314	0.573	145	1.178	0.120	63	1.150	0.140
Average markup ratio (adjusted)	154	1.240	0.325	145	1.185	0.117	63	1.082	0.120
Import penetration ratio, %	159	0.211	0.250	67	0.478	0.238	92	0.330	0.233
Export ratio, %	159	0.239	0.180	161	0.418	0.227	92	0.308	0.210
Herfindhal index by NACE 2-digit sectors	159	0.121	0.169	161	0.304	0.212	92	0.066	0.086
Share of three[1)] largest firms by NACE 2-digit sectors, %	159	0.049	0.114	161	0.396	0.091	69	0.331	0.239
Share of foreign-controlled firms in total sales (NACE2), %	159	0.117	0.146	161	0.539	0.170	..	..	..
Share of long-term debt in the firms' total assets (NACE2), %	159	0.167	0.132	161	0.233	0.113	..	..	..

[1)] Five largest in the case of Romania.

Table D-2. Estimation results (OLS) for the equation of the technical efficiency level, pooled data for Bulgaria and Hungary

Variable		
Period	1995-2002	1995-2002
No. observations	181	181
Constant	0.794 ***	0.878 ***
	(9.95)	(7.35)
Import penetration ratio	-0.089 ***	-0.081 ***
	(-5.87)	(-4.95)
Herfindhal index by NACE 2-digit sectors	0.167 ***	
	(4.10)	
Share of three largest firms by		-0.003
NACE 2-digit sectors		(-0.04)
Share of foreign-controlled firms in	0.052 *	0.061 *
total sales (by NACE 2-digit sectors)	(1.62)	(1.71)
Share of long-term debt in the firms'	-0.120 ***	-0.121 ***
total assets (by NACE 2-digit sectors)	(-3.57)	(-3.44)
EBRD index of “progress in transition”	0.004	-0.011
	(0.17)	(-0.41)
Country dummy	0.011	-0.019
	(0.61)	(-0.30)
R2	0.273	0.203
Root MSE	0.048	0.050

Notes:
(i) The symbols *, ** and *** refer to significance levels of 10%, 5% and 1%, respectively.

Table D-3. Estimation results (OLS) for the equation of the technical efficiency level, pooled data for Bulgaria, Hungary and Romania

Variable		
Period	1995-2002	1995-2002
No. observations	273	273
Constant	0.753 ***	0.737 ***
	(8.46)	(7.63)
Import penetration ratio	-0.115 ***	-0.110 ***
	(-5.46)	(-4.97)
Herfindhal index by NACE 2-digit sectors	0.142 ***	
	(2.50)	
Share of three largest firms by		0.049
NACE 2-digit sectors		(1.24)
EBRD index of "progress in transition"	0.064 **	0.065 **
	(2.00)	(1.94)
Country dummy Bulgaria	-0.120 ***	-0.098 ***
	(-10.8)	(-5.77)
Country dummy Hungary	-0.115 ***	-0.147 ***
	(-5.35)	(-4.28)
R2	0.339	0.294
Root MSE	0.082	0.083

Notes:
(i) The time period for Romania is 1998-2001.
(ii) The symbols *, ** and *** refer to significance levels of 10%, 5% and 1%, respectively.

Table D-4. Estimation results (OLS) for the markup equation, pooled data for Bulgaria and Hungary

	Markups not adjusted for returns to scale		Markups adjusted for returns to scale	
Period	1995-2002	1995-2002	1995-2002	1995-2002
No. observations	219	219	214	214
Constant	1.847 ***	0.923	1.060 ***	0.372
	(2.65)	(1.22)	(2.56)	(0.76)
Import penetration ratio	-0.013	-0.022	-0.021	-0.048
	(-0.09)	(-0.15)	(-0.24)	(-0.57)
Export ratio	0.180	0.166	0.272 ***	0.237 **
	(0.94)	(0.89)	(2.48)	(2.17)
Herfindhal index by NACE 2-digit sectors	-0.046		-0.067	
	(-0.23)		(-0.52)	
Share of three largest firms by		0.886 ***		0.565 **
NACE 2-digit sectors		(2.79)		(2.32)
Share of foreign-controlled firms in	0.046	0.025	-0.020	-0.076
total sales (by NACE 2-digit sectors)	(0.17)	(0.10)	(-0.13)	(-.50)
Share of long-term debt in the firms'	0.048	-0.056	0.084	0.050
total assets (by NACE 2-digit sectors)	(0.17)	(-0.20)	(0.46)	(0.28)
EBRD index of “progress in transition”	-0.216	-0.172	-0.011	0.075
	(-1.00)	(-0.81)	(0.09)	(0.59)
Country dummy	0.022	0.800 ***	0.084	0.590 ***
	(0.15)	(2.56)	(0.96)	(2.57)
R2	0.022	0.056	0.039	0.062
Root MSE	0.500	0.491	0.284	0.280

Notes:
(i) The symbols *, ** and *** refer to significance levels of 10%, 5% and 1%, respectively.

Table D-5. Estimation results (OLS) for the markup equation, pooled data for Bulgaria, Hungary and Romania

	Markups adjusted for returns to scale	
Period	1995-2002	1995-2002
No. observations	283	283
Constant	1.069 ***	0.970 ***
	(4.02)	(3.60)
Import penetration ratio	-0.011	-0.023
	(-0.17)	(-0.35)
Export ratio	0.201 ***	0.211 ***
	(2.49)	(2.62)
Herfindhal index by NACE 2-digit sectors	-0.062	
	(-0.58)	
Share of three largest firms by		0.179 *
NACE 2-digit sectors		(1.63)
EBRD index of “progress in transition”	-0.014	-0.001
	(-0.15)	(-.01)
Country dummy Bulgaria	0.170 ***	0.220 ***
	(4.45)	(4.43)
Country dummy Hungary	0.108	-0.013
	(1.49)	(-0.14)
R2	0.082	0.090
Root MSE	0.253	0.252

Notes:
(i) The time period for Romania is 1998-2001.
(ii) The symbols *, ** and *** refer to significance levels of 10%, 5% and 1%, respectively.