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Trade Reorientation and Productivity Growth in Bulgarian Enterprises

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Trade matters. Trade in Bulgaria's transition economy is an important source of growth in total factor productivity in manufacturing enterprises.

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Summary findings

Djankov and Hoekman extend the literature on the microeconomics of transition by investigating the relative importance of integration with world markets as a source of productivity growth in Bulgarian firms. They focus on the potential importance for economic growth of greater access (after trade liberalization) to global markets for designs, equipment, and intermediates.

For individual firms, the intensity of competition in the final product market should be a powerful force, inducing efforts to restructure and to improve productive efficiency. But it is difficult empirically to incorporate that factor into a firm-level econometric analysis, because import competition is common to all firms in an industry.

One trade-related factor that can be analyzed at the level of the firm is the role of access to foreign intermediates and capital goods, as well as greater access to world markets for the firm's output after the abolition of central planning. The policy shift involved is fairly analogous to a move from autarky (the CMEA system) to virtual free trade. As a result the forces identified in the literature on endogenous growth should operate. That is, firms now have the opportunity to buy intermediates and equipment that allow them to improve their productivity and to learn by exporting to more mature markets. The changes that occurred in trade patterns after opening the economy provide one indicator of managers' attempts to import better technology.

Djankov and Hoekman's analysis suggests that trade matters — that trade is an important source of growth in total factor productivity at the firm level.

The partial correlations suggest that firms that reorient their trade patterns — arguably the most appropriate measure of trade integration for transition economies — tend to have higher growth rates for total factor productivity.

This paper — a product of the International Trade Division, International Economics Department — is part of a larger effort in the department to analyze the role of trade in the transition process in Central and Eastern Europe. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Jennifer Ngaine, room N5-056, telephone 202-473-7947, fax 202-522-1159, Internet address jngaine@worldbank.org. January 1997. (23 pages)

Trade Reorientation and Post-Reform Productivity Growth in Bulgarian Enterprises*

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Summary

The recent literature on transition economies provides a multitude of stylized facts on enterprise restructuring. A number of studies have established partial correlations between firm restructuring in Central and Eastern European countries (CEECs) and firm-specific variables relating to initial conditions, hardening of budget constraints, and internal governance. Most regression-based analyses have tended to be based on industry-level data. A few use small cross-sections of firms. Almost all studies focus on the advanced transition economies (Czech Republic, Hungary, Poland). This paper extends the literature on the microeconomics of transition by investigating the relative importance of integration into world markets as a source of productivity growth at the level of the firm in Bulgaria.

The empirical analysis is motivated by the general body of conceptual work relating to the role of international trade as a source of growth. The primary focus is on the potential importance for economic growth of greater access to global markets for designs, equipment and intermediates following trade liberalization. From the perspective of an individual firm the intensity of competition in the final product market should be a powerful force inducing efforts to restructure and improve productive efficiency. Empirically, however, it is difficult to incorporate this factor into a firm-level econometric analysis since import competition is common to all firms in an industry. A trade-related factor that can be taken into account in a firm-level analysis is the role of access to foreign intermediates and capital goods, as well as the greater access to world markets for the firm's output that emerged as a result of the abolition of central planning. To a significant extent the policy shift involved is analogous to a move from autarky (the CMEA system) to virtual free trade. As a result, the forces identified in the endogenous growth literature should operate, i.e., firms now have the opportunity to buy intermediates and equipment that allows them to improve their productivity and to learn-by-exporting to more mature markets. The changes that occurred in trade patterns subsequent to opening the economy provide one indicator of attempts by managers to import better technology.

The results of the empirical analysis suggest that trade is an important source of TFP growth at the level of the firm. As is suggested by the endogenous growth literature, trade matters. We find that shifts in the pattern of imports of intermediates--and reorientation of export production--towards global markets are positively correlated with TFP growth. The coefficients are of the expected sign, relatively large in magnitude, and statistically highly significant. In contrast, the level of exports as a share of output was found not be correlated with TFP growth. Although no attempt has been made to establish causality, the partial correlations that are found are highly suggestive. They support the theory in the sense that firms that reorient their trade patterns--which is argued to be the most appropriate measure of trade integration for economies in transition--tend to have higher growth rates of total factor productivity.

Trade Reorientation and Post-Reform Productivity Growth in Bulgarian Enterprises

I. Introduction

There are a growing number of studies establishing partial correlations between firm restructuring in Central and Eastern European countries (CEECs) and firm-specific variables relating to initial conditions, hardening of budget constraints, and internal governance. This paper extends the literature on the microeconomics of transition by investigating the relative importance of integration into world arkets as a source of productivity growth at the level of the firm. The empirical analysis is motivated by the general body of conceptual work relating to the role of international trade as a source of growth. The primary focus is on the potential importance for economic growth of greater access to global markets for designs, equipment and intermediates following trade liberalization (Romer, 1991; Grossman and Helpman, 1991; Feenstra, Markusen, and Zeile, 1992). Our results suggest that firm-level total factor productivity growth in Bulgaria in the initial post-reform period (1991-95) exhibits systematic variations with the degree of integration in world trade.

The paper is organized as follows: Section II surveys the existing literature on enterprise restructuring in economies in transition. Much of the analysis in the literature has been at the level of the economy as a whole, or at the level of the industry. As relatively little work has been done at the level of the firm, we develop a simple conceptual framework that is helpful in understanding the approach that is pursued. Section III briefly discusses the process of economic reform in Bulgaria after 1991. Section IV describes the data set and Section V sets out the estimation procedure that is used to relate firm-level productivity growth to various explanatory variables, including changes in integration into the world market. Section VI reports the results. Changes in the pattern of imports of intermediates and sales for export are found to be significant, both in absolute terms and statistically. Section VII concludes.

II. Survey of the Literature and Conceptual Framework

The recent literature on transition economies provides a multitude of stylized facts on enterprise restructuring. A large number of case studies describe the restructuring process in great detail. Most regression-based analyses tend to be based on industry-level data. A few use small cross-sections of firms (e.g., Pinto and van Wijnbergen, 1994). Almost all studies focus on the advanced transition economies (Czech Republic, Hungary, Poland). Definitions of restructuring vary, and are often not stated explicitly. Three types of restructuring can be identified, all of which are interrelated: operational restructuring (e.g. changing the factor mix through layoffs), financial restructuring (e.g., rescheduling or forgiveness of debt), and legal restructuring (e.g., transformation of state-owned enterprises (SOEs) into joint stock companies; or privatization). Profitability is often used as a proxy for restructuring: a firm that attains or maintains profitability is implied to have taken the necessary steps to restructure. In the transition context, however, the link between restructuring and profitability is loose. Firms will be subject to various shocks and often will not have incentives to report profits truthfully. In many countries profit shifting and tax evasion are pervasive, and it is often difficult to assess the initial conditions that apply on a firm-by-firm basis (because of the accounting conventions used under central planning). Measuring restructuring on the basis of levels or changes in firm productivity avoids some of these problems. Thus, many studies use labor productivity (Svejnar, 1996). Although the literature on developing countries has focused on changes in total factor productivity (TFP), due to data non-availability this has not yet been done in the context of economies of transition. Conceptually, the latter measure is the most relevant measure to capture efforts to restructure at the level of the firm. As the data set available to us is detailed enough to allow for TFP estimation, this is the variable used in this paper.

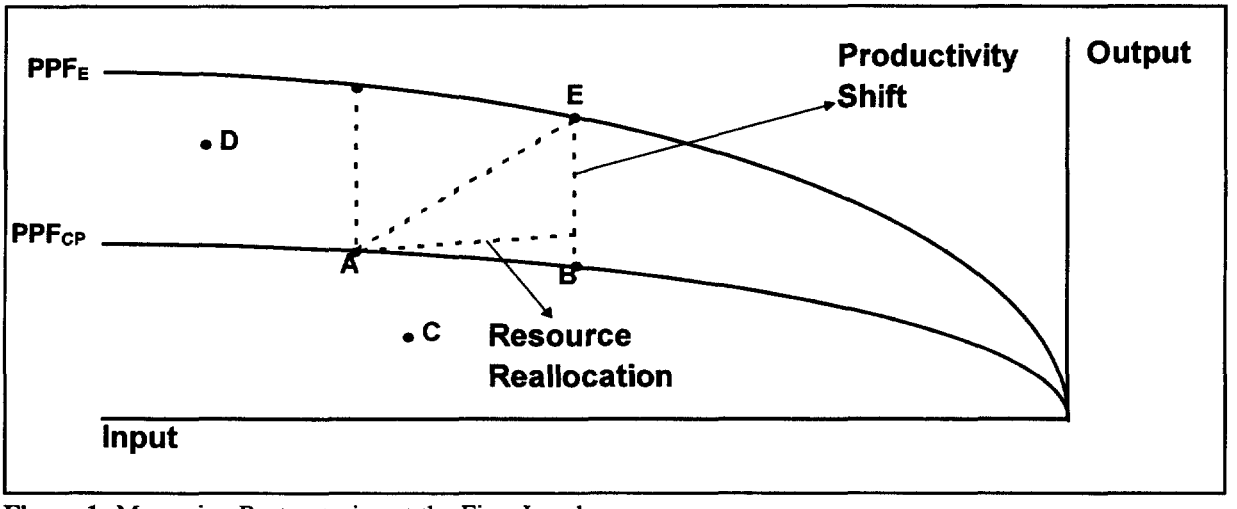

Figure 1: Measuring Restructuring at the Firm Level

A useful conceptual framework for thinking about various measures of restructuring at the level of the firm is illustrated in Figure 1. Suppose a firm is initially at point A on the production frontier under central planning (PPF_{CP}). After the collapse of central planning and the implementation of economic reform, the firm confronts major shocks as aggregate demand collapses, relative prices of goods and services change drastically, etc.[1] As a result, subject to varying lags depending on access to finance, feasibility of building up inter-enterprise arrears and the like, the managers of the firm will adjust input use and reduce output. This process may involve large-scale layoffs. It may also involve the firm moving inside the PPF (say to point C) as a result of constraints on adjusting factor use, or because of deliberate actions by managers to strip the firm of valuable resources for private gain. Associated reductions in input use are not in themselves indicative of restructuring; they are largely driven by the macro shock.

Under central planning the firm is expected to be inefficient relative to a cost-minimizing firm that uses global "best practice" technologies. In Figure 1, the distance between points A and F is a

[1] See World Bank (1996) for a description and analysis of the stylized facts of the initial stages of transition away from central planning.

measure of the productivity growth potential. The movement towards the best practice production possibility frontier (PPF_E) that should occur over time as firms adjust to the post-reform set of incentives captures efforts by management to restructure. This may involve downsizing (e.g., towards point E) or expansion (say to point D). Thus, there are two dimensions to the adjustment process that must be kept distinct: the resource reallocation effects of demand and associated systemic shocks; and the productivity growth effect that arises from management efforts to improve efficiency.

Empirical studies of the behavior of firms in transition economies have identified three broad determinants of restructuring: a firm's initial conditions ("inheritance"), corporate governance (internal disciplines), and market disciplines (including both import competition and hardening of budget constraints). Initial conditions include factors such as sector of activity (Estrin, Gelb, and Singh, 1995), prior efforts at transformation (Estrin and Takla, 1995), the magnitude and quality of the existing capital stock, and the firm's financial situation (liabilities; creditworthiness; access to established channels of financing). Corporate governance includes the structure of property rights, especially the extent of progress towards full privatization (Estrin, 1994), the bargaining power of labor unions (Aghion, Blanchard and Burgess, 1994), and the presence of outside owners (Blanchard and Keeling, 1996). Although market disciplines are largely external to the firm, much may depend on managerial expectations regarding how binding these disciplines are. Thus, a belief that governments will not bail out loss-making firms or entities that have built up large inter-enterprise arrears and accounts payable is important (Kotzeva and Perotti, 1996).

The better are a firm's initial conditions in comparison to other firms in an industry, the greater the probability that the firm will survive the transition to a market economy. If initial conditions are "too" bad, the firm will presumably be broken up and liquidated at some point, depending among other things on the hardness of budget constraints. From an efficiency perspective, the better the initial conditions, the less scope there may be for productivity improvements. In terms of Figure 1, the closer

PPF_{CP} is to PPF_E, the smaller the scope (need) for restructuring. In most cases even if initial conditions are relatively good, virtually no firms confronted hard budget constraints and market disciplines under central planning. As a result, the conventional wisdom is that firms were generally far from best practices. The existence of certain initial conditions may then facilitate adjustment--e.g., the better the access to finance and the lower the inherited debt burden, the greater the scope for restructuring. The general presumption in the literature is that the greater the extent to which a firm can continue to benefit from subsidies and build-up arrears, the less incentive managers have to restructure. Conversely, the imposition of hard budget constraints should induce (with some lag) productivity improvements or lead to exit (Claessens and Peters, 1996). Finally, the standard hypothesis in the literature is that the greater the extent of private ownership, the better the productivity growth performance of the firm should be (Estrin and Takla, 1995).

From the perspective of an individual firm the intensity of competition in the final product market should be a powerful force inducing efforts to restructure and improve productive efficiency. Empirically, however, it is difficult to incorporate this factor into a firm-level econometric analysis since import competition is common to all firms in an industry. Studies investigating the impact of import competition in final product markets therefore focus on industries as the unit of analysis. This issue is not the focus of analysis in this paper.[2] Given that our interest is in productivity performance at the level of the firm, this effect is subsumed in industry dummies (see below).

Another trade-related factor that can be taken into account in a firm-level analysis is the role of access to foreign intermediates and capital goods, as well as the greater access to world markets for the firm's output that emerged as a result of the abolition of central planning. To a significant extent the policy shift involved is analogous to a move from autarky (the CMEA system) to virtual free trade. As

[2] Using an approach that is similar to the studies by Levinsohn (1993) and Harrison (1994), Djankov and Hoekman (1996) investigate the role of import competition in final goods markets on Bulgarian industries and conclude that this is an important determinant of differences in industry performance.

a result, the forces identified in the endogenous growth literature should operate, i.e., firms now have the opportunity to buy intermediates and equipment that allows them to improve their productivity (see Romer, 1991; Grossman and Helpman, 1991; Feenstra, Markusen, Zeile, 1992), and to learn-by-exporting to more mature markets (Clerides, Lach, and Tybout, 1996). The importance of these factors in "explaining" productivity growth has to our knowledge not been investigated in the transition literature.[3] Under central planning Bulgarian firms depended on the former CMEA markets for both inputs and exports. The changes that occurred in trade patterns subsequent to opening the economy provide one indicator of attempts by managers to import better technology. On the export side, buyers may transmit knowledge and designs that they receive from their other (often OECD) suppliers (World Bank, 1993). Our results suggest that greater imports of inputs and expanding exports to OECD markets are strongly correlated with increases in total factor productivity.[4]

III. Economic Reforms in Bulgaria

Before turning to the empirical analysis it is helpful to briefly summarize economic developments in Bulgaria during 1991-95. Starting in February 1991, Bulgaria underwent a "big bang" stabilization and structural reform program.[5] Most prices were liberalized, subsidies to most enterprises cut, and tight

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[3] It is of course difficult to determine the direction of causality and we make no attempt to solve the problem of the endogeneity of firm-level productivity growth and the extent of participation in international trade (Tybout and Westbrook, 1995; Clerides, Lach, and Tybout, 1996).

[4] Three firm-level studies that have attempted to determine the impact of exports on firm performance all concluded that this was not significant. Estrin and Takla (1995) found that the pre-reform export share of sales had no explanatory power when regressed on changes in labor productivity. Using the same data set on Bulgarian firms, Peters and Claessens (1996) and Avramov and Guenov (1995) find no correlation between the share of current exports in production and changes in value added and profitability, respectively. One reason for this is arguably mis-specification: there is no reason why the *level* of exports should be correlated with the *change* in a measure of efficiency. More likely is that changes in productivity are associated with changes (i.e., increases) in the level and direction of exports (see Tybout and Roberts, 1995).

[5] See Bogetic and Hillman (1995) for comprehensive discussions of the Bulgarian economy in transition.

monetary, fiscal and incomes policies adopted. Imports were substantially liberalized: exchange controls, quantitative restrictions and licensing requirements were abolished. A five-band tariff system was put in place, with tariffs equaling 5, 10,15, 25, or 40 percent (Fane, 1995).[6] Export restrictions, initially maintained for agriculture and reflecting food shortages in the country, were mostly abolished by 1993. State enterprise managers were given autonomy in decision-making. However, centralized wage setting through union-government bargaining and high excess wages tax reduced the scope for SOEs to link wages to productivity and sales.

Two distinctive factors characterize Bulgaria in the early transition period. First, privatization was not pursued with any vigor. Only about 10 percent of some 3,800 SOEs were privatized between 1992-95, accounting for just 2.5 percent of total assets (Claessens and Peters, 1996). The continued existence of a large state sector delayed the creation of new private industrial firms. Most new firms focused on the provision of services--both at the retail level (e.g., distribution, restaurants) and business services (e.g., transport, intermediation). The lack of privatization of industrial firms, in conjunction with a variety of tax-related incentives led to widespread "joint ventures" between private sector firms and industrial SOEs. As discussed at length in Hillman et al. (1995), private enterpreneurs had an incentive to use the assets of SOEs rather than establish separate production facilities, which were difficult to establish in any event given the uncertain policy environment regarding both property rights and macro-economic developments. SOE managers benefitted from such arrangements through greater opportunities for personal enrichment. The State lost, as the tax base was eroded.

A second factor is subsidies to large enterprises. Kotzeva and Perotti (1996) report that 70% of firm managers in 1994 expected a government bailout in case of poor performance. Soft loans extended to loss-making enterprises undermined the capital base of the banking system and reduced

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[6] The average collected tariff (tariff revenues as a share of imports) was 7 percent in 1993-94.

access to credit for other firms. Although the Government wrote off a significant portion of enterprise debt in 1991 and again in 1993 (in large part by converting bad "loans" into government bonds), aggregate subsidies (budget transfers and soft bank loans) to the industrial sector declined from 16% of GDP in 1990 to 2% of GDP in 1995. As noted by Claessens and Peters (1996), the hard-core of large loss-makers that continued to be financed through loans from state-owned banks, budget transfers, and arrears (tax, wage, and inter-enterprise) were concentrated in the utilities, mining, and construction sectors. Industrial firms generally confronted hard budget constraints early in the transition.[7]

Both factors should have negative implications for measures of productivity growth. In the first case this is because of standard "governance" related reasons, complemented by the fact that there will be an incentive for SOEs to try to underreport profits. If subsidies remain in place, restructuring incentives decline. However, as mentioned previously, most manufacturing firms received little in the way of direct subsidies. The fact that subsidies tended to go into non-tradables should result in crowding-out-type effects, with negative implications for manufacturing firms. Such effects will be common to all firms, however, and should therefore not have implications for comparisons across firms within industries.

IV. Data

The analysis that follows is based on a panel of quarterly observations for 1992:I--1995:I for all manufacturing firms compiled by the Bulgarian National Statistical Institute (NSI). There are 1,337 firms in the sample, all of which are SOEs or cooperatives. The data set used comprises a balanced

[7] A third factor was an unstable macro-economic environment (Fisher et.al, 1996; Sachs, 1996). The 1996 World Development Report estimates that transition economies with annual inflation above 40% generally fail to register industrial growth. As of 1994 the average inflation rate in Bulgaria was around 50%, having peaked at over 300% in 1991. Kotzeva and Perotti (1996) find that 20% of managers list unstable macroeconomic environment among the main obstacles of firm restructuring; an additional 45% list related variables (price variability in input markets, high interest rates). Since the focus of this paper is on firm-specific efforts to improve efficiency, the effect of macroeconomic policy--a common influence--is ignored.

panel of firms. For purposes of analysis a 81 sector breakdown was constructed, using the Bulgarian classification of state enterprises. The data set includes information on a large number of variables. Nominal values were converted to real values (base year 94:IV) using sector-specific producer price indices reported by the Bulgarian National Bank (*Bank Review*, various issues). Individual observations were checked for recording errors with the help of researchers from the NSI.[8] To account for additional outliers, all regressions are run twice, where the second run (reported in the tables) excluded firms with residuals from the first regression that exceed two standard deviations.[9]

Exports (reported in domestic currency) are converted in US$ at the average exchange rate for each quarter and then converted back in domestic currency at the end-1994 exchange rate.[10] Some of the accounting conventions used in Bulgaria required adjustments in the data.[11] During 1992-93 especially, some firms received direct or indirect government subsidies. Such subsidies are excluded from sales revenues. Production is measured by gross output instead of real value added. Although value-added estimates are used more frequently in productivity studies, value-added can be interpreted as a measure of output only if there is perfect competition. If imperfect competition exists, value-added suffers from an omitted-variable bias, and is subject to different aggregation biases. We therefore estimate production functions for each firm based on gross output and then convert the productivity

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[8] Several recording errors were found and corrected. A small number of firms were dropped from the sample because the original forms submitted to the NSI revealed coding errors. This checking process led to 9% of firms in the original sample to be excluded.

[9] In principle, there are techniques that do not unduly weight outliers, e.g., a median regression. Upon inspection, however, outliers in the data set are generated from value-subtracting firms, implying that the denominators in equations (5) and (6) are negative. TFP estimates for such firms will be a large negative number, and thus not readily interpretable.

[10] This was suggested by a referee.

[11] Production for inventory was included in sales revenues until 1993. The definition of production used in our analysis conforms to the convention as it includes the increase in inventory.

change estimate into value-added TFP change.[12] As there is little variation in the value of total fixed capital assets (machinery and equipment, vehicles, and buildings), the 92:I value of capital is taken as the base, to which investment reported by firms in each quarter is added and a depreciation charge is subtracted. Since depreciation numbers vary considerably across quarterly reports by the same firm, we use the numbers suggested by Hulten and Wykoff (1981): buildings are depreciated at a rate of 0.0361, and machinery and equipment at a rate of 0.1179. Data are also reported on both the average number of workers employed in each quarter, as well as the total hours worked. The ratio of blue-collar and white-collar labor is not available; the reported wage bill is averaged over all employees, including managers.

A possible factor confounding any empirical analysis using data reported by Bulgarian firms is that statistics are likely to be unreliable. In particular, given the extensive links between SOEs and the informal, private sector, data may be biased insofar as managers of SOEs have incentives to under-report economic activity and operating profits, and channel such profits to private sector partners via transfer pricing, arrears in accounts receivables, etc. The greater the prevalence of public-private sector cooperation, the greater the downward bias that may be expected in output, value and profit data reported to the NSI. In general, therefore, it must be borne in mind that statistical analyses based on "official" data will most likely paint too dark a picture.[13] While this could be a serious problem if the analysis were to focus on the levels of variables, in what follows we investigate changes in total factor productivity. As long as there is a consistent downward bias in the levels of the variables reported to the NSI, estimates of *changes* in TFP should not be affected. In any event, our interest is in the relationship between change in TFP and change in integration into the world economy. Even if the

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[12] For a detailed discussion of these issues see Basu and Fernald (1995) and Hulten (1978).

[13] For example, the statistics indicate that the cash operating surplus (value added net of wages and social payments) in 1994 was only 1.5 percent of GDP, down from 6.9 percent in 1992 (Claessens and Peters, 1996).

estimates of the magnitude of TFP changes are biased, this is not relevant for the analysis as long as the firms that report shifts in patterns of trade do not differ significantly in their reporting bias from firms that do not experience such shifts.

V. Estimation Procedure

The estimation is based on a two-step procedure. First, we estimate a standard neo-classical production function

$$Y_{it} = T_{it}[L_{it}^{s_{Li}} M_{it}^{s_{Mi}} K_{it}^{1-s_{Li}-s_{Mi}}]^{\gamma_i} \quad (1)$$

Or in log form

$$\ln Y_{i,t} = \gamma_i [s_{Li} \ln L_{i,t} + s_{Mi} \ln M_{i,t} + (1 - s_{Li} - s_{Mi}) \ln K_{i,t}] + lnT_{it} \qquad i=1,...,n;\ t=1,...,T \quad (2)$$

where $Y_{i,t}$ is gross output, $L_{i,t}$ is total hour worked, $M_{i,t}$ is materials used, $K_{i,t}$ is total capital stock, T_{it} is a measure of technology, and s_L and s_M are the shares of labor and material inputs' expenditures in total expenditure respectively. Two separate specifications of equation (2) are estimated. In the benchmark specification we substitute $ln\ T_{it} = \alpha_i + \epsilon_{it}$ where α_i represents firm-specific fixed effects and the disturbance term $\epsilon_{i,t}$ is $NID(0, \sigma^2)$. Our preferred specification also includes a term for the average number of hours worked to take into account the possibility that a change in employment is accompanied by a change in hours worked.[14] As we want to estimate changes in productivity and not levels, we first-difference equation (2) to obtain

$$\Delta y_{i,t} = \alpha_i + \gamma_i [s_{Li} \Delta l_{i,t} + s_{Mi} \Delta m_{i,t} + (1 - s_{Li} - s_{Mi})\ \Delta k_{i,t}] + \beta_{i,t} \Delta h_{it} + \epsilon_{i,t} \quad (3)$$

[14] This is a standard adjustment in the empirical macro literature. See e.g., Basu and Fernald (1995).

where $\Delta y_{i,t} = ln\ Y_{i,t} - ln\ Y_{i,t-1}$ and similarly for $\Delta l_{i,t}$, $\Delta m_{i,t}$, $\Delta k_{i,t}$ and $\Delta h_{i,t}$ (where the latter are hours worked). From either specification gross output-based total factor productivity (TFP) growth is estimated as the sum of the residual and the firm-specific intercept[15]

$$\Delta t_{it}^{G} = \alpha_i + \epsilon_{it} \tag{4}$$

This estimated change in gross output-based TFP is converted to a value-added productivity change

$$\Delta t_{it}^{VA} = \frac{\Delta t_i^{G}}{1 - s_m^{\,i}} \tag{5}$$

To provide a check on the robustness of the regression estimates, the value-added Solow residual is calculated directly from the data without estimating the production function as follows

$$\Delta t_{it}^{VA} = (\Delta y_{it} - s_M^{\,i} \Delta m_{It}) \frac{1}{1 - s_M^{\,i}} - \Delta l_{it} \frac{s_L}{1 - s_M^{\,i}} - \Delta k_{it} \frac{1 - s_L - s_M}{1 - s_M^{\,i}} \tag{6}$$

We then relate the change in TFP for each firm to various firm-specific variables. Consistent with the rest of literature, we run various regressions of the general form

$$\Delta t_{it}^{VA} = f(INITIAL\,CONDITIONS_i;\ \Delta GOVERNANCE_i;\ \Delta SUBSIDY_i;\ \Delta TRADE_i\ ;T_I) \tag{7}$$

including industry and time (T_I) dummies to control for sector-specific and economy-wide common shocks. INITIAL CONDITIONS consist of variables that characterize the status quo ante. GOVERNANCE represents variables relating to ownership and management. TRADE is a measure of the shift in trade patterns (see below). The coefficients from the regression (7) can be interpreted only as partial correlations. With the exception of TRADE the independent variables are taken from the

[15] The possibility of heteroskedasticity and autocorrelation is recognized. In the regressions reported below adjustments were made for the former and tests were performed for the latter.

literature and are used as controls in the particular partial correlations that we wish to explore--those between TFP changes and shifts in trade patterns.

VI. Results

The estimates of changes in TFP are presented in Table 1. The average share of labor, materials, and capital expenditure is 0.291, 0.567, and 0.142 respectively. We restrict the sum of the three to be equal to 1 since information on the cost of capital is not available. These shares are very similar to the respective shares of US manufacturing firms (Jorgenson, Gollop, Fraumeni, 1987): 0.30, 0.55 and 0.15. This suggests that the data are possibly not as biased as might be expected given the discussion in Section IV. Overall, there is no significant productivity growth in Bulgarian manufacturing during the 1992-95 period. This is consistent with other recent studies (Pohl, Djankov, Anderson, 1996; Avramov and Guenov, 1995, Peters and Claessens, 1996). This is generally explained by the absence of a comprehensive privatization program, the unstable macroeconomic environment, and the continued presence of soft budget constraints for certain industries. The estimates show some seasonal variation. Note that first quarter productivity growth is always negative, while second quarter productivity growth is usually positive. This is consistent with the pattern of TFP changes found in the US manufacturing industries (Miron and Barsky, 1989) and can be explained by the surge in demand during the pre-Christmas season.[16]

Three measures of TFP are reported. The TFP-I case includes an adjustment for hours worked, while TFP-II does not. There is therefore an upward bias in TFP-II due to not accounting for the possible change in average hours worked by employees. TFP-III is the Solow residual-based estimate. As all three TFP estimates are highly correlated (not reported), what follows is based on

[16] Some 38 percent of total industrial output in Bulgaria is produced in the fourth quarter.

regressions with TFP-I as the dependent variable. Four regressions are reported in Table 2. The first one includes only dummy variables for sector, location, and time. We include these environmental variables to control for the impact of general macroeconomic and common industry-specific shocks. The adjusted R^2 is very small (0.021) which suggests that inter-sectoral variations in productivity changes are not high.[17] The reason for this is that only ten of the eighty sector dummies are statistically significant (at the 5% level): those for computer components, primary textile processing, wool textiles, linen products, and vegetable oils are positive; those for petrol processing, fish, meat, bread and pasta, and rubber products are negative (not reported). Eight location-of-production dummies are included to test for the possible effect of production in the capital city (Sofia), the second largest city (Plovdiv), and proximity to the major sea port (Varna, Bugras), and the other regions (Lovech, Montana, Russe, Haskovo). These regional factors are not significant and do not become so in later regressions--a result also found by Estrin and Takla (1995) for the Czech and Slovak Republics. This is hardly surprising given the legacy of arbitrary location decisions on new economic establishments under central planning. The majority of time dummies are statistically significant and roughly follow the pattern of TFP changes.

Regressions 2 and 3 introduce firm-specific variables. The choice of explanatory variables is largely driven by what has been used in the literature (e.g., Estrin and Takla, 1995). The variables are mostly proxies for initial conditions and internal governance of the firm. The size variable (log of output) should capture scale effects that occur if large and small firms differ in the extent to which they have market power in product or factor markets. The subsidy variable (log of direct subsidies as a share of total revenues) and access to credit (log of new bank loans as a share of financial revenues)

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[17] The explanatory power of the various "general" dummies is much less than what is found for Czechoslovakia in the same type of regression by Estrin and Takla (1995). Using dummies for 18 industries, 10 regions, and one time dummy (1992), they obtain an R^2 of 0.101 in explaining labor productivity in Czechoslovakia for 1992-93. Our result is similar to the R^2 of 0.03 found by Claessens and Peters (1996) for Bulgaria using the same independent variables, but focusing on changes in value added instead of TFP.

measure the hardness of the budget constraint. Previous studies have found that labor-intensive firms find it easier to restructure because they are less dependent on outside financing for capital equipment. The share of labor expenditures in firm total expenditures is included as a proxy for labor intensity.[18]

The inclusion of firm-specific factors improves the fit of the regressions dramatically (R^2 of 0.113). Initial conditions are highly significant. The coefficients largely confirm the findings of Pinto and van Wijnbergen (1994) for Poland and Estrin and Takla (1995) for the Czech and Slovak Republics: large, labor-intensive firms with access to financing perform better than others. The size and credit variables are statistically significant, but the magnitude of the credit coefficient in particular is quite small. Note that the subsidy and labor intensity variables are insignificant. The former result is not unexpected, given that most subsidies in the 1992-95 period were targeted on non-tradable industries (not considered here). The labor intensity variable has the expected sign, but becomes statistically insignificant once dummies are included for past restructuring efforts (see below).

Noteworthy is the negative sign of the lagged profitability coefficient and the positive sign of the value-subtractor coefficient. The dummy for Value Subtractor is 1 if a firm could not pay for the cost of its material inputs in the previous quarter, and 0 otherwise; the dummy for Profitable Firms is 1 if a firm reported positive after tax profit in the previous quarter, and 0 otherwise. These variables are used as instruments for past productivity change[19] and can be regarded as proxies for changes in internal governance of the firm. That is, the "better" and more active are management efforts to restructure, the better TFP performance should be in the future. The coefficients suggest that successful restructuring is followed by a period of passivity, and vice versa (regression 3). Thus, the

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[18] Pre-reform investment dummies were included following the Estrin-Takla (1995) hypothesis that firms that received new machinery and equipment in the immediate pre-reform period (1988-91 in the case of Bulgaria) should do better than firms which did not receive any new machinery and equipment in the 10 years prior to reform. However, these variables were insignificant and are not reported.

[19] Since the inclusion of lagged values of the dependent variable (changes in TFP) will render the regression estimates inconsistent, we instrument for it by using the two profitability-related dummies.

worst-performing firms in the previous quarter improved the most, while firms which reported net profits registered a decline in productivity growth. This suggests that managers of relatively well-performing (profitable) firms take it easy, but those in charge of enterprises with serious financial problems are induced to undertake greater efforts to improve productivity. These findings may reflect the distorted incentive structure facing managers discussed previously.

Regression 4 turns to relationship between TFP growth and trade integration. Noteworthy in all of the regressions is the insignificance of the coefficient on the export share of sales. This is also found in other studies, and is sometimes interpreted to imply that there is no significant correlation between restructuring of firms and the extent of integration into world markets (e.g., Claessens and Peters, 1996). However, as noted earlier, there is no a priori reason to believe that *changes* in productivity should be related to the *level* of past exports. A better measure of the impact of trade is the change in the geographic pattern of imports and exports, as this fits much closer with the theoretical prediction that the improved access to the much richer global stock of technologies and know-how should allow (induce) managers to exploit this source of productivity improvement.

In regression 4 dummies are included for import and export redirection. The overall fit of the regression improves slightly, to 0.127. More important are the magnitude of the coefficient estimates. The import dummy differentiates between firms which have redirected a large share of their supply orders (over 30%) from domestic or former CMEA to OECD markets (Dummy = 1) and kept this extent of sourcing at this level or higher in the four quarters prior to our observation of productivity change. The dummy is set at zero for firms that continue to use local or former CMEA suppliers.[20] The estimated coefficient for this variable is positive in sign, relatively large as compared to other explanatory variables and highly significant statistically. This suggests that the use of imported

[20] Using this definition, 44 firms "redirect" their sourcing to OECD markets in 1990, 106 firms in 1991, 85 firms in 1992, 41 firms in 1993, and 64 firms in 1994.

intermediate inputs enhances productivity growth. The dummy for export redirection is also highly significant, and is double the size of the import redirection dummy. The export reorientation dummy differentiates between firms which have redirected more than 30 percent of their production from the domestic or former CMEA to OECD markets and sustained this over the four quarters prior to our measurement of TFP change (Dummy = 1), and those that have not (Dummy = 0).[21] Eighty-four firms became exporters to OECD markets in 1991, 108 in 1992, 168 in 1993, and 47 in 1994.

The use of discrete measures of trade integration assumes that redirection increases productivity regardless of the volume of exports or imports (provided it is consistently maintained). This simplifies the analysis because it avoids the problem of endogeneity of trade levels in the regressions. In principle, since our basic hypothesis is that there will be an upward shift in the productivity of new entrants into export/import markets, simple plots would allow a comparison of relative performance. However, due to the short time-series available, this was not possible.

VII. Conclusions

The impact of international trade can be analyzed at different levels. Most analyses focus on the effect of trade on the economy as a whole, or at the level of the industry. This is especially the case regarding the impact of import competition as a source of market discipline (see e.g., Levinsohn, 1993; Harrison, 1994). The analysis here was explicitly restricted to the level of the firm. Factors such as macro-economic forces which affect all firms and common industry-specific variables--which embody important forces such as the level and change in import competition on final product markets--are controlled for.

The results indicate that trade is an important source of TFP growth at the level of the firm. As

[21] See Hoekman and Djankov (1996) for an analysis of changes in the pattern of trade of Central and Eastern European countries during 1989-95.

is suggested by the endogenous growth literature, trade matters. We find that shifts in the pattern of imports of intermediates--and reorientation of export production--towards global markets are positively correlated with TFP growth. The coefficients are of the expected sign, relatively large in magnitude, and statistically highly significant. In contrast, the level of exports as a share of output was found not be correlated with TFP growth. Although no attempt has been made to establish causality, the partial correlations that are found are highly suggestive. They support the theory in the sense that firms that reorient their trade patterns--which has been argued to be the most appropriate measure of trade integration for economies in transition--tend to have higher growth rates of total factor productivity.

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Table 1: Changes in Total Factor Productivity (Value Added, Equation 5 in text)

Quarter	TFP-I*	TFP-II**	TFP-III***
II:92	0.104 (0.013)	0.124 (0.013)	0.140 (0.014)
III:92	-0.014 (0.012)	-0.035 (0.015)	-0.047 (0.017)
IV:92	0.075 (0.014)	0.107 (0.016)	0.118 (0.017)
I:93	-0.091 (0.014)	-0.099 (0.016)	0.002 (0.022)
II:93	0.015 (0.011)	0.036 (0.013)	0.057 (0.013)
III:93	0.049 (0.014)	0.064 (0.015)	0.086 (0.017)
IV:93	-0.037 (0.013)	-0.038 (0.014)	-0.070 (0.016)
I:94	-0.014 (0.015)	-0.011 (0.016)	0.053 (0.020)
II:94	0.039 (0.013)	0.019 (0.014)	0.068 (0.012)
III:94	-0.055 (0.018)	-0.054 (0.018)	-0.069 (0.019)
IV:94	0.035 (0.013)	0.033 (0.014)	0.060 (0.014)
I:95	-0.147 (0.017)	-0.156 (0.018)	-0.131 (0.021)
Median	0.000	0.011	0.055
Mean	-0.003	0.003	0.022
Standard Error	0.021	0.024	0.024
Implied Growth	-0.058	-0.008	0.258
R^2	0.906	0.875	---
Observations	1237	1237	1237

Note: Heteroskedasticity consistent standard errors in parentheses.
* Regression estimate including an adjustment for average hours worked.
** Regression estimate without adjustment for hours worked.
*** Solow residual calculation using equation 6 in the text.

Source: Authors' estimates.

Table 2: Determinants of Change in TFP

Independent Variable*	Change in TFP			
	I	II	III	IV
Intercept	-0.069 (-1.771)	-0.556 (-9.345)	-0.508 (-9.303)	-0.508 (-9.354)
Size		0.045 (11.339)	0.053 (13.985)	0.052 (13.576)
Subsidies		0.006 (1.008)	0.006 (0.924)	0.006 (0.924)
Credit		0.011 (3.294)	0.013 (4.273)	0.013 (4.294)
Labor Intensity		0.297 (6.382)	0.047 (1.056)	0.056 (1.231)
Export Share in Sales		0.001 (0.312)	0.001 (0.256)	0.001 (0.256)
Dummy for Export Redirection				0.262 (11.459)
Dummy for Import Redirection				0.107 (6.161)
Dummy for Value Subtractors			0.224 (15.780)	0.219 (15.570)
Dummy for Profitable Firms			-0.156 (-12.978)	-0.152 (-12.746)
Dummy for IV:92	0.088 (4.315)	0.061 (3.026)	0.009 (0.498)	0.011 (0.594)
Dummy for I:93	-0.073 (-3.589)	-0.075 (-3.627)	-0.106 (-5.474)	-0.102 (-5.290)
Dummy for II:93	0.029 (1.459)	-0.006 (0.301)	0.004 (0.244)	0.007 (0.344)
Dummy for III:93	0.066 (3.167)	0.048 (2.415)	0.052 (2.735)	0.055 (2.897)
Dummy for IV:93	-0.026 (-1.259)	-0.038 (-1.917)	-0.030 (-1.555)	-0.097 (-1.394)
Dummy for I:94	0.003 (0.147)	-0.021 (-1.072)	-0.040 (-2.089)	-0.038 (-1.959)
Dummy for II:94	0.056 (2.738)	0.042 (2.094)	0.060 (3.132)	0.065 (3.394)
Dummy for III:94	-0.036 (-1.771)	-0.041 (-2.044)	-0.008 (-0.416)	-0.003 (-0.163)
Dummy for IV:94	0.048 (2.346)	0.028 (1.408)	0.030 (1.588)	0.037 (1.944)
Dummy for I:95	-0.135 (-6.599)	-0.134 (-6.671)	-0.092 (-4.745)	-0.082 (-4.270)
Adjusted R^2	0.021	0.036	0.113	0.127
Durbin Watson Statistics	2.289	2.263	2.193	2.201

* Weighted Least Squares are used to correct for heteroskedasticity. All regressions include a vector of 80 sector dummies and a vector of 8 region dummies. The number of observations in each regression is 13,607. T-statistics are reported in parentheses. The presence of autocorrelation is rejected in all regressions at the 5% significance level.

Source: Authors' estimates.

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