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The Contribution of Rapid Financial Development to Asymmetric Growth of Manufacturing Industries: Common Claims vs. Evidence for Poland

George M. von Furstenberg
(Indiana University, Bloomington USA)

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Deutsche Bundesbank, Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-1
Telex within Germany 41227, telex from abroad 414431, fax +49 69 5601071

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax No +49 69 9566-3077

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Abstract:

CEE countries such as Poland started to experience a very high rate of financial development within a few years after emerging from socialism. A review of the literature suggests that this asymmetric development should have been most beneficial for those industry sectors most dependent on external finance. However, the widely-used Rajan and Zingales (1998) measure of young (exchange-listed U.S.) companies' dependence on external finance had no explanatory power for the structure of industry growth in Poland. This negative finding held for 1990-2001 as a whole and for two distinct sub-periods that differed in the speed of financial development. Reasons for this failure, and correlates of the RZ measure, are examined.

Keywords: Financial Development, Dependence on External Finance, Industry Structure, Poland

JEL-Classification: G20, G22, O14, O16

Non Technical Summary

Central and East European (CEE) countries such as Poland started to experience a very high rate of financial development within a few years after emerging from socialism. A review of the literature suggests that this asymmetric development should have been most beneficial for those industry sectors most dependent on external finance. Indeed, rapid catch-up financial development in CEE countries could have supported the emergence of similarly diversified industrial structures as in the more advanced EU-member countries, thereby helping to meet an optimal-currency-area criterion. However, the widely-used Rajan and Zingales (RZ) (1998) measure of young (exchange-listed U.S.) companies' dependence on external finance had no explanatory power for the structure of industry growth in Poland. This negative finding held for 1990-2001 as a whole and for two distinct sub-periods that differed in the speed of financial development.

Reasons for this failure, and correlates of the RZ measure, are examined. The appropriate conclusion to draw surely is not that financial development does not matter to the evolution of industry structure and to industrial development of sectors most dependent on external finance and insurance. The question rather is to what extent RZ's measure of dependence on external finance (DEF) reveals fundamental technological characteristics as they claim, or just the growth prospects, depreciation intensity, and actual and expected profitability of particular industries at particular stages of development in particular countries. The DEF values assigned to an industry in one country -- the United States on the basis of data for the 1980s -- could be quite wrong for that same industry in another country. This hypothesis will be tested with German company data in future work.

Nicht technische Zusammenfassung

Für die Länder Mittel- und Osteuropas (MOE) wie Polen begann nach dem Ende des Sozialismus eine sehr rasche finanzielle Entwicklung innerhalb nur weniger Jahre. Die einschlägige Literatur gibt zu der Vermutung Anlass, dass diese asymmetrische

Entwicklung am günstigsten für die Industriezweige hätte sein müssen, die am stärksten auf eine Finanzierung von außen angewiesen sind. Der rasche Aufholprozess im Bereich der finanziellen Entwicklung hätte die Entstehung ähnlich diversifizierter industrieller Strukturen wie in den weiter fortgeschrittenen EU-Ländern fördern und so dazu beitragen können, ein Kriterium eines optimalen Währungsraums zu erfüllen. Die von Rajan und Zingales (1998) entwickelte, häufig verwendete Meßgröße der Abhängigkeit junger (börsennotierter US-)Gesellschaften von Außenfinanzierung-mitteln gab jedoch keinen Aufschluss über die Struktur des Wachstums der einzelnen Wirtschaftszweige in Polen. Dieses negative Ergebnis gilt für den Zeitraum von 1990 bis 2001 insgesamt, aber auch für zwei verschiedene Teilperioden mit unterschiedlichem finanziellen Entwicklungstempo.

Es werden die Gründe für dieses Versagen sowie Korrelate des RZ-Indikators untersucht. Die richtige Schlussfolgerung ist jedenfalls nicht, dass die finanzielle Entwicklung für die Entwicklung der Industriestruktur oder die industrielle Entwicklung der am stärksten auf Außenfinanzierung und Versicherung angewiesenen Sektoren ohne Bedeutung ist. Die Frage ist vielmehr, inwieweit der von RZ entwickelte Indikator der Abhängigkeit von Außenfinanzierung grundlegende technologische Merkmale (wie von diesen behauptet) erkennen läßt oder nur ein Indikator für die Wachstumsaussichten, Abwertungsintensität und tatsächliche und erwartete Rentabilität bestimmter Industrien in bestimmten Entwicklungsphasen in bestimmten Ländern ist. Die einer Industrie in einem bestimmten Land – den Vereinigten Staaten auf Basis der Daten für die Achtzigerjahre – zugeordneten Werte könnten für die gleiche Industrie in einem anderen Land vollkommen falsch sein. Diese Hypothese wird in einer künftigen Arbeit anhand von deutschen Unternehmensdaten überprüft.

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1 Introduction

Financial Development (henceforth FD) can have a number of welfare implications for (a) consumption smoothing, (b) economic stability, (c) economic growth, and (d) the structure of growth by manufacturing-industry sectors. After briefly elaborating on (a), (b), and (c), the paper turns to its main subject, (d), by examining how rapid FD in one country may favor the growth of those of its industries with the greatest *Dependence on External Finance* (henceforth DEF).

(a) Buffering consumption against actuarial (e.g., life-cycle) variability of earnings and against future adversities (e.g., loss of income) is an important management task of households. In theoretical economics, that task is dealt with in optimization models that show how to accomplish both intertemporal and intercasual smoothing of consumption by use of credit and insurance at market-clearing financial prices.[1] The emphasis in this literature is on the representative consumer optimally managing consumption with the aid of an expanding list of financial instruments, assuming, frequently exogenous, income endowments with known probability weights.

(b) FD can contribute to macroeconomic stability, shock absorption, and the maintenance of living standards. However, it may also increase exposure to pervasive financial and economic crises in countries that experience rapid but uneven development, or an unstable mix of elements, in their financial systems (see, for example, Fecht, 2004).

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[1] von Furstenberg (2004) provides an overview and application.

(c) Once an economy's supply side is brought into the analysis, FD has additional contributions to make to economic welfare and to growth although not all of the ways in which FD changes the opportunity set of economic actors need spur economic growth. For instance, FD may reduce borrowing constraints of households[2] and increase the versatility of investment, insurance and portfolio assets so that more can be achieved with less saving and net financial investment.[3] On the other hand, a higher level of FD may make saving more rewarding and enhance the efficiency with which saving is intermediated and used. It may do so in part by improving risk analysis and operating efficiency in the financial sector thereby reducing intermediation spreads[4] in a way that can reconcile increased rewards for saving with a decline in the required rate of return on investment. Capital deepening could be the outcome even if what happens to the supply of national saving in a single (small) country had no appreciable effect on the global supply of saving. The reason is that as long as there is home bias in financial investments and imperfect substitutability at the margin among individual country portfolios generally, the local, and not only the global, supply of saving matters for domestic investment. Bandiera et al. (2000), Demetriades and Luintel (1996; 1997), Kelly and Mavrotas (2003), and Mavrotas and Kelly (2001a; 2001b) have examined some of these questions ranging from the effect of financial-sector development on saving -- and vice versa -- to the effect of national saving on growth.

Not only increased saving, but also more efficient use of a given amount of saving can raise growth. So can the removal of unnecessary (i.e., insurable) risk-based obstacles to undertaking investments with the highest expected rate of return. Relying in part on Baur et al. (2001), there are at least three sources of efficiency gains to be derived from FD in this regard:

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[2] Jappelli and Pagano (1994; 1999) have shown that liquidity constraints due to reducing the availability of credit and insurance to households may increase saving and investment and raise both the growth rate and welfare under certain conditions. Andersen and Tarp (2003, 189) conclude from their review that "the empirical evidence on the finance-growth nexus does not yield any clear-cut picture."

[3] Life insurance and financial derivatives in which the underlying gross positions, contingent claims, or notional exposures are much greater than the net positions (surrender value of life insurance, cost of options) are standard examples of portfolio and balance-sheet economizers. Annuity contracts can also economize the amount of saving sufficient to maintain living standards regardless of longevity.

[4] Koivu (2002) has found the interest margin, but not the usual balance-sheet measures of FD, such as bank credit allocated to the private sector, negative-significantly associated with growth in transition countries.

- *Information role.* The financial system plays an important economic role in providing information and analysis through assessment of individual prospects and through market prices (e.g., interest rates, security prices) that help coordinate decentralized decision-making in various sectors of the (world) economy. This helps companies and financial investors compare risk/return profiles of projects, thereby ensuring that the available resources are put to best use.

- *Risk transfer*. According to Merton (1992), separation of the providers of working capital for *real* investment (i.e., in personnel, plant, and equipment) from the providers of risk capital who bear the *financial* risk of these investments is a basic service provided by well-developed financial markets. Within these markets, risk transfers between banks, insurance companies, and capital markets (see Rule, 2001) can achieve further efficiencies. For instance, many companies find it far more expensive, if not impossible, to take out a loan without also purchasing coverage for insurable risks that otherwise could cripple their business. By insuring large identifiable losses and business interruptions that are largely beyond their control and thus often insurable, companies can tighten up the rate-of-return distributions they present to investors. They thereby reduce bankruptcy risk and the cost of externally raised capital. The lower discount rate applied to future earnings then encourages companies to put more weight on long-term growth opportunities.

- *Capital market role*. A well-functioning capital market provides for extensive risk diversification and pooling. Pooling refers to the combination of individual risk events that occur partly or wholly independently *within* a given class of financial business (credit, insurance, underwriting) among its clients. Diversification refers to the combination of different types of risks with low correlation *across* the various lines of business. Either form of aggregation makes loss experience much more predictable and brings it closer to being priced actuarially, i.e., with little or no risk premium though often with substantial overhead and service charges. The joint availability of bank-based and market-based finance, of pools of venture capital, and of insurance is likely to reduce the cash-flow sensitivity of business

investment and to allow more risky ventures with high return potential to be financed.[5]

In theory, therefore, rapid financial development may raise an economy's growth rate by mobilizing saving and improving the efficiency of intermediation and project selection. Yet identification and size of this effect are likely to be quite uncertain because a number of other growth factors, such as increased human capital formation, adoption of technological advances, and improved political and corporate governance and business infrastructure, normally occur alongside FD. Indeed, FD requires resources such as human and organizational capital, market and communications infrastructure, and a sound legal and regulatory environment, so that it is highly dependent on the growth of complementary, general-purpose inputs and factors. Consequently, isolating the contribution of FD has proved difficult in the cross-country, time-series panel studies of the national rates of economic (or industrial-output) growth commonly employed for that purpose. Levine et al. (2000) have made one of the most serious efforts to do so by considering the effects of financial intermediation and intermediary development on economic growth together with a few other conditioning factors. They still found that the FD effects, by themselves, remained "economically large." However, even if the effects of FD on an economy's overall rate of economic growth were negligible, FD surely would be expected to have a marked effect on the *industry structure* of growth.

(d) The latter proposition amounts to a largely separate hypothesis, less beset with identification problems, which Rajan and Zingales (1998), henceforth RZ, have brought to the fore. The advantage of the disaggregated approach is that it could be more discriminating than a cross-country approach in identifying the channels of FD effects on industrial development. Such an approach deals with two-digit manufacturing sectors or even finer classifications. It offers the best chance to isolate the output effects of rapid FD through its effect on industry composition, or on the structure -- rather than just the aggregate national level -- of growth. Presumably those industries most

[5] von Klackreuth (2004), von Kalkreuth and Murphy (2004), and McGuire (2004) have made recent applied contributions to this literature. See also Pulvino and Tarhan (2004) for a study of cash flow effects on capital expenditures by types of firms in a complete flow-of-funds accounting framework.

dependent on external finance are those that stand to get the greatest boost from rapid financial development.

RZ therefore expect the coefficient on the multiplicative interaction term, DEF x FD, to be positive significant and stable after allowing for country and industry fixed effects. Hence, for given country values of FD, an industry characterized by high DEF would be expected to grow less in the country with the lower FD. However, the difference in the industry's growth rates likely would turn against the country with the higher FD if FD rises rapidly in the country with the lower FD. Indeed, partial convergence of the latter's industry structure to that of the country with the higher FD is not possible unless its high-DEF industries grow, for a time, faster than its low-DEF industries, and the difference between these industry growth rates temporarily is greater than in the country with the higher FD. Hence predictions from dynamic applications of the RZ theory differ from those of comparative-static applications where countries are characterized by stable differences in FD.

Countries that emerged from socialism in Central and Eastern Europe (CEE) provide examples of "unbalanced" financial development whose contribution to economic growth should stand out more clearly than that of balanced, or moving-equilibrium, FD that occurs in train with a number of other growth factors in more advanced market-economies. The reason is that the conversion from non-price allocation by state-run unitary banking and insurance to market-based commercial credit and insurance should lead to rapid catch-up development of the financial sector. This, in turn, should provide the greatest stimulus to growth of those sectors that are the heaviest users of financial services traditionally identified as industry sectors most dependent on external finance.[6]

Should this theory-based conjecture be verified, it would identify rapid catch-up development of the financial sector as a driving force of greater convergence of industrial structures within the expanding EU. To the extent rapid FD is maintained in

[6] A caution is in order here. It is possible that capital- and technology-intensive industries that would be classified as high-DEF in market economies were favored by the industrial policies of socialism through non-market finance, soft budget constraints, and implicit insurance supplied selectively by the state. Such state-supported industries could have had the greatest difficulties adjusting to the disciplines of market-based finance. However, we subsequently do not find that RZ-DEF intensive industries are, in fact, capital intensive in the comparison country chosen for Poland.

the run-up to monetary union, a process endogenously strengthening the symmetry of exposure to industry-wide shocks between old and new members would be at work. This process differs from the strengthening of industrial linkages between countries due to trade enhancing effects of monetary union among industries and firms emphasized by Frankel and Rose (1998) and Rose and Engel (2002). Growing interdependence would increase the symmetry of exposure to country-specific supply and demand shocks: As prospective and actual EU members are integrated into the EU supply network, more cross-border trade in modular components and intermediates among them helps spread much of the demand and supply impulses originating anywhere in the EU to all its members. This process of exposure to secondary shocks that are transmitted from a principally- affected member country to others is different from all members being similarly exposed to primary shocks, including supply- and demand-shift shocks by industry sector. The emergence of similarly diversified industry structures,[7] which would tend to follow from FD in EU-accession countries gradually approaching the level in more advanced member countries, thus could help meet OCA criteria during the transition from financial repression toward European Monetary Union down the road.

1.1 Outline by Sections

Before searching for this effect empirically with Polish data for 19 manufacturing sectors, 1990-2001, this paper in Section 2 defines the concepts of *Dependence on External Finance* (DEF) and *Financial Development* (FD) and explains how they have been applied in previous literature to study the structure of industrial growth. Focusing on Poland as exemplar for CEE countries from Section 3 on, the paper proceeds to show that the rapid FD that appeared in Poland by a variety of indicators after 1995 does not have the expected positive-significant effect on relative rates of growth of DEF-intensive industries. Section 4 introduces additional explanatory variables to be considered along with DEF in attempting to explain differences in industry-sector growth between Poland and a high-FD comparison country (Austria). It also considers correlates of the widely-used two-digit industry DEF measure taken from RZ to help assess its suitability for characterizing the dependence on external finance of industries in Poland. An appendix further examines the strength of the links between possible

[7] This is an Optimal Currency Area (OCA) criterion first emphasized by Kenen (1969).

correlates of DEF intensity, such as industries' capital- and R&D-intensity, "tech" levels, and rates of multifactor productivity growth, to explain why the measure of RZ-DEF that was right for the United States in the 1980s may not be applicable elsewhere or at other times.

Section 5 concludes by reflecting on the financial puzzle posed by finding DEF unhelpful for explaining the structure of manufacturing industry growth in Poland. It suggests that the RZ

measure of DEF may not be suitable for Poland or other countries that have emerged from socialism. Unexpected correlations with certain industry characteristics found in the data raise questions about what the transplanted measure conveys. Furthermore, dependence on financial services overall and dependence on external finance for fixed-capital expansion alone may not be equivalent. Two-digit manufacturing industries also may differ in their dependence on such other financial services as trade credit and receivables financing, customer and project screening, risk analysis and management, and internet marketing and client financing. Furthermore, if the true measure of DEF by industry in a country, which may be RZ-DEF for the United States but not for other countries, were highly positively correlated with the rate of growth of capacity in those industries, as appears likely almost by definition, *any* industry that happens to grow rapidly at a given time and place would tend to have a high DEF. Then reverse causation would become an issue. Better measures of how rapid FD may improve various financial services in a way that benefits different industries unequally may, in time, emerge.

2 Asymmetric Effects of Financial Development on Industry Growth

FD is likely to have the greatest effect on the growth of those industries that are most dependent on external finance. The subsections that follow survey and analyze how the two concepts, FD and DEF, have been made operational through alternative measures proposed in existing literature. Several complementary measures of FD for Poland since the early 1990's, and their time-series correlations, are then presented at the beginning of Section 3.

2.1 Dependence on External Finance

The DEF of a firm, or of an aggregate of firms in an industry, varies with the degree to which its business requires substantial amounts of up-front outside financing. Rajan and Zingales (1998, 563) give a number of reasons why some industries characteristically depend more on external finance than others: Larger project scale, longer gestation and cash harvest periods, and greater follow-on investment requirements may be the causes of a higher degree of DEF in some industries than in others.[8] They characterize these reasons as technological and fundamental although they could also be in part institutional/historical or a function of the rate of capacity expansion chosen by the firms in an industry for a particular time and country. By assuming that the technological differences persist and are best revealed in the world's most advanced capital market, RZ regard an industry's dependence on external funds in the United States during the 1980s as applicable to the same industry sectors in other countries.[9]

The conceptual indications just given point to fixed-investment financing needs that are not covered by cash flow. To derive a ratio measure, RZ chose to scale by investment in property, plant, and equipment so that RZ-DEF refers to the share of such investment that is not covered by their broad cash flow. That broad measure includes not only after-tax income plus depreciation and amortization but also the change in short-term liabilities (payables) minus the change in short-term assets (inventories, receivables). This measure may be expected to differ systematically between young and rapidly growing industries, and industries -- the same or others -- at maturity. The

[8] Nuclear power generation or oil refining requires such large and time-consuming investments, including investments in the approval process, that one would expect a high DEF. However, these power and fuel producing industry had a net cash throw-off in the United States during the 1980s as capital expenditures fell short of cash flow. This is shown by the negative value of RZ-DEF for industry 23 in Table 5. Hence long-term investment cycles, and not just industry fundamentals, may be reflected in the RZ measure of DEF. A commentator from the Deutsche Bundesbank suggested that the "excess" cash retention in industry 23 may be explained in part by set asides for future clean-up, radioactive waste disposal, and site decontamination expenses. Another remarked that international differences in industrial organization by type and size of firms can produce large differences in DEF between countries for the same industries.

[9] To the extent the planned rate of growth of industry investment, such as investment in ICT in recent years, is highly variable, flow-of-funds measures of dependence on external finance likely would depend on the firm's planned rate of growth of capital and on cyclical and other factors pertaining thereto. Hence statistical attempts to obtain DEF as a basic structural characteristic that can be used to characterize industry sectors in a stable fashion face considerable difficulties. At the very least, data must be combined over an extended period. RZ use a decade-long aggregation of firm data to construct their measure as subsequently explained in detail.

reason is that, cumulated over, say, the first ten years of operation or even the first decade after their IPO, the cash flow generated by start-ups is likely to be small in relation to their capital expenditures.

For their measure of DEF by industry, RZ (1998) take the COMPUSTAT sample of firms in each industry and first divide each of these firms' use of external finance (capital expenditures minus cash flow, for details see Table 1), summed over the 1980s, by the corresponding sum of its capital expenditures. Hence only firms that had been publicly listed for at least 10 years by the end of the 1980s entered their sample. Firms that were delisted during the 1980s on account of merger, bankruptcy, or being taken private were dropped from the sample. RZ then use the industry median of the decade-spanning firm-specific DEF ratios, rather than the (weighted?) average of these ratios, as their measure of an industry's DEF to reduce sensitivity to outliers. The same measure has been used by most other researchers identified in Table 1 although a number of refinements have been added. The most distant, but highly suggestive, application of the concept of DEF shown in that table is Barlevy's (2003) attempt to relate the rate of growth of firm, and then industry, output per worker to gross new debt taken on in the current period loosely scaled by net worth.[10]

2.2 Financial Development

FD interacts with DEF in determining the sectoral pattern of growth by industry and ultimately the relative size or share (Fisman and Love, 2004) of DEF-intensive industries in total manufacturing output or value-added. The key hypothesis advanced by RZ (1998, 562) is that there is a positive interaction effect between DEF and FD in determining the rate of growth of real value-added by industry: "Industries that are more dependent on external financing will have relatively higher growth rates in countries that have more developed financial markets."

As Fisman and Love (2004) have pointed out, this statement is to be interpreted with care; checking for correlates of both DEF and FD that relate to industry growth as

[10] This line of research inevitably raises the question of reverse causation of whether a high DEF value assigned to an industry sector drives that sector's growth in countries with rapid advances in, or high levels of, FD, or whether high growth in any manufacturing sector from any source results in that sector having high external financing needs. In the latter case, DEF would be induced by growth opportunities in any industry sector and not be a fundamental characteristic of particular industries.

a steady condition or only during an adjustment process will be important. The mere fact that countries with a higher FD tend to have a comparative advantage in DEF-intensive industries does not necessarily imply that such industries would be expected to grow *permanently* faster in such countries than other industries. Unless a higher level of FD is linked to a higher savings rate and to permanently higher growth, as in an AK model of output, or to a higher level of R&D or faster technological progress in the DEF-intensive industries than in others, the boost to the rate of growth of DEF-intensive industries could be short-lived. It will be observed only while industrial activity is shifting between countries to a distribution compatible with the new pattern of comparative advantage created, for instance, by unusually rapid FD in one country and trade liberalization in others. It is also possible, but not likely, that the composition of world demand will keep shifting to the output of DEF-intensive industries so that such industries, and the countries that harbor them, could grow faster than the others indefinitely. In volume terms, the output of DEF-intensive industries could also keep rising faster than that of others without an appreciable change in spending shares if the relative price of this output is secularly declining, as may be characteristic of high-tech industries.

Similarly, if demand for external funds arises on account of large and positive technology or aggregate demand shocks raising an industry's investment opportunities beyond what the internal flow of funds immediately can supply, a high degree of FD and of international capital mobility and FDI will tend to support a rapid rate of adjustment of the stock of capital to desired levels in all industries.[11] According to Fisman and Love (2004), this effect may benefit all industries, though perhaps unequally. DEF-intensive industries may benefit more from the acceleration of adjustment enabled by a higher FD so that their growth rates may, for a time, be higher than those of other industries. Nevertheless, given the several possible sources of

[11] In Poland, inward FDI averaged 4 percent of GDP per annum during the 1990s. This may have changed financing constraints especially if greenfield investments were involved but not if foreign investors simply acquired control of an existing business from domestic investors. Unless new equity is issued or intercompany loans are extended, takeovers do not immediately supply funds to the business although cash injections may follow at a later point. Guiso, Sapienza and Zingales (2002) have addressed the question of whether national financial institutions and markets still matter for growth once domestic agents have access to foreign markets. They find that even in a country that has been fully integrated in the last 140 years, Italy, local financial development still matters, so that not only the national level of FD, but even the FD of subnational regions, matters to their growth.

comparative advantage by industry, there is nothing to suggest permanently higher growth in DEF-intensive industries than in others that would tend to lead to high-FD countries specializing completely in such industries at the limit.

Already in RZ's (1998) own estimating equation for the rate of growth of real value added by industry, a stabilizing effect on industry shares is derived from industry j's share in country k's total value added in manufacturing entering with a negative sign in the growth equation. This allows the share of DEF-intensive industry to stabilize at a value of less than 1 by having its growth rate fall back toward the country average as such an industry's share of total manufacturing output is rising toward a new equilibrium. An interior solution implied for that share in RZ could represent such an equilibrium, conditional upon the new level of FD.

RZ (1998, 569) estimate FD, which they call the *capitalization ratio*, by two measures: the ratio of domestic credit plus stock market capitalization to GDP, and the ratio of domestic credit to the private sector to GDP. Both are measures of the relative size of the financial sector rather than of financial activity. The reason for tentatively dropping stock market capitalization from the second measure is that it does not represent funds actually obtained by issuers in the same way as domestic credit. Instead it reflects a composite of retained earnings, actual equity issuance, and investor revaluations of equity claims. The distinction between the total stock of domestic credit and domestic credit to the private sector shows how details of *Financial Structure* (FS) may be used to flesh out measures of FD.

Beck and Levine (2002) have provided a rich variety of FS measures. Among them is the log of the ratio of (i) value traded or (ii) stock market capitalization to commercial bank claims on the private sector. Commercial bank claims on general government and government enterprises are not included in the above measures, both of which are designed to test for differences in the contribution of market-based versus bank-based financing systems to industry growth. A broader measure of financial institutions' claims on the private sector is used also. Called *private credit*, it includes credit by both bank and nonbank intermediaries to the private sector. Beck and Levine (2002) in fact use the log of the ratio, to GDP, of private credit plus either the annual value traded on the stock exchange or market capitalization as their measures of overall

FD. These types of accounting measures are not suited to catching the nuances of continuing financial development in the most advanced countries, but they may still track FD reasonably well for countries starting out from low levels of financial development, such as Poland.

Returning to measures of financial structure (FS), Cetorelli and Gambera (2001) investigate whether the competitive structure of the banking industry is important to the growth effect of FD for DEF-intensive industries and for others. They find that market power of banks favors the former at the expense of the latter. Supplementary FS measures proposed by Beck and Levine (2002) are the share of bank assets owned by the government. In addition, non-parametric measures of FS that relate to bank powers, such as the degree to which banks are restricted in security-market activities, insurance, real-estate markets, and ownership of nonfinancial firms, provide further distinctions that may be relevant to the efficiency of bank-based systems.

FD (and FS) are country characteristics and thus can vary within a country only over time, but over both time and country in time-series, cross-section estimates for several countries. If fixed effects were used for time, i.e., the period of observation, the marginal effects on the structure of industry growth of national differences in FD could still be determined, though the next section tries to capture such marginal effects in another way. In what follows, time-series data for annual rates of growth by manufacturing sector are used to estimate growth-rate differences characteristic of an entire period between Poland and a comparison country. Possible determinants of these estimated differences by industry sector are then analyzed in Section 4.

3 FD in Poland and its Effect on the Industry Structure of Growth in Manufacturing

Several measures of FD, all expressed in percent of GDP, are shown for Poland in Table 3. Among the least conventional measures included are the growing flow of annual premiums into life and non-life insurance products and the resulting investments by these insurance sectors. In addition, M2, and a measure of domestic credit that excludes general government but not credit to state-owned enterprises are used. A notable omission, based on the previous discussion, is a measure of stock market capitalization. At the end of 2002, 216 Polish companies were listed on the Warsaw

Stock Exchange but their combined capitalization was equal to less than 15 percent of 2002 GDP and valuations had been quite volatile.[12] As a result, the Polish stock market appeared as yet too immature to contribute reliably to structural measures of financial development during the1990s.

3.1 Rapid Financial Development in Poland since 1995

Table 3 has a clear message: If growth in FD is indicated by rising ratios of financial stocks and flows to GDP, then there was no consistent financial deepening in the first half of the 1990s in Poland by any of the measures shown there. It took years to clear out bad debts and to clean up the balance sheets of Polish banks in advance of privatization and foreign takeover. All the ratios started to rise strongly and consistently only after 1995. Correlations among all the measures of financial development shown in Table 4 are high throughout the entire period 1995-2001 for which all the series analyzed in the table were available. Those available already earlier tend to display the same pattern of movement, remaining stalled through 1995 and then growing jointly, though at rates that may be fixed fractions or multiples of each other, after 1995. Herrmann and Jochem (2003) have analyzed the implications of the gradual resolution process for interest rate relationships in Poland's opening economy and for its cost of finance. It appears that, by any measure, a surge in financial development -- to catch up with conditions in surrounding advanced countries such as Germany or Austria -- that would be expected to favor DEF-intensive industries disproportionately occurred only after 1995. As a consequence, there is a structural break between the period 1990-1995 and the subsequent period, 1995-2001, in regard to the expected relation between industry growth and DEF in Poland, with no such relation expected in the earlier period.

Because all the measures of financial deepening used above are highly correlated with each other, there is no need to choose between these complementary indicators of broad money, domestic credit, and insurance growth to characterize the progress of FD. This, of course, does not mean that each of the types of financing and intermediation behind these measures must be equally important or indispensable for nourishing the growth of DEF-intensive industries. Rather, detailed micro-data and -analyses by industrial sector would be necessary to gauge the potential contribution of the different

[12] The underlying data are shown from January 2000 on in National Bank of Poland (2003, p. 14).

types of financial services to particular business functions. Some of these types would be in addition to, or complementary with, external financing as a share of fixed capital expansion, which is RZ's measure. An example of complementarity is property, liability, and business-interruption insurance without which some businesses might not qualify for an adequate supply of loans form banks. There is a host of other financial services that may be important in some industries regardless of their DEF. These services include current-account and customer financing, and accounting, marketing, management and analysis services. Hence there is a need for future analyses to clarify how financial development can be represented, and its contribution to the structure of industry growth deduced, more effectively.

3.2 National Differences in Industries' Growth Opportunities and the Role of DEF

The ratio measures of financial stocks to output flow previously considered already have indicated that rapid FD did not begin immediately after Poland's emergence from socialism in 1989-90. Rather, FD began to surge only after 1995 once privatizations of manufacturing and financial-service corporations and reconstruction of financial institutions and markets, and their infrastructure, had progressed sufficiently to sustain rapid growth of the financial business. Hence the question arises whether those industries most dependent on external finance have reaped disproportionate benefits from the high rate of FD after 1995. If so, they might have received an extra boost in Poland compared with their growth in financially already mature neighboring countries such as Austria from 1996 on, but not before.

Clearly some industries grow faster than others on a regional and global basis and it may very well be that those that grow fastest globally are also among the most technology, R&D, ICT and perhaps DEF intensive as shown by the correlation analysis in the Appendix. To strip away such underlying differences in growth and demand-shift factors, the estimated trend excess (usually positive in Table 5) of the Polish over the corresponding Austrian rate of growth is the dependent variable constructed for each 2-digit manufacturing industry. That estimated variable then is regressed with constant on RZ's (1998) measure of young companies' DEF, and on other characteristics, by industry sector to determine the extent to which excess growth in Poland's manufacturing sectors if linked positively to their level of DEF on account of the rapid

growth in its FD after 1995. The constant term, reflecting the average difference in industry growth rates between Poland and Austria, is of no particular interest here and thus not shown. The focus of this analysis instead is on whether and by how much the difference in national sectoral growth rates rises with the degree of industry DEF.

Many of the state combines and state monopolies that existed under socialism have been broken up in the process of privatization, and new private enterprises have formed in recent years. Hence for Poland as for other CEE countries, the appropriate measure of DEF is that for young companies, which RZ define as firms in their database that have gone public less than 10 years prior to the start of their sample period, i.e., from 1971 to 1980. As already mentioned, RZ (1998, 563-564) argue that, for reasons of near perfection in the capital markets of the United States, external dependence measures by industry taken in the U.S. may be regarded as revealing fundamental technological characteristics also of the intensity of demand for external financing by the same industries in other countries, even if such demands can not be met in full or without encountering non-price rationing in those other countries. As the severity of these overall constraints is reduced through catch-up financial development in one country (Poland) more than in another (Austria) where constraints are already low, DEF-intensive industries should benefit disproportionately over other industries in the first country compared with the same industries in the second. This inference is the hypothesis tested next.

3.3 Estimating Sustained Differences in Manufacturing-Sector Growth Rates, Poland – Austria

On average, the volume of output in the manufacturing sector as a whole grew almost twice as rapidly in Poland as in Austria from 1990 to 2001: 7.3 percent compared with 3.9 percent on average per annum. The excess of Poland's two-digit manufacturing-industry rates of growth over the corresponding rates of growth in Austria averaged about 4.4 percent per annum for the period as a whole whether estimated with value-added-share weights or equal weights for each of the 19 two-digit industry sectors in the sample. Weighted, the excess averaged 8.2 percent during the period 1990-95 as Poland was recovering from the shock of the socialist system's collapse, and only 0.7 percent during the period 1995-2001. Nevertheless, over the period 1990-2001 as a whole, the correlation between Poland's and Austria's volume

indexes for the total manufacturing sector was 0.968 on account of common trends, and the pseudo-elasticity of the Polish volume index with respect to the Austrian index was 1.4112 (SE=0.1135) for the full period. For the years 1991-2000, for which complete data were available for all of the four countries, the close correlation between Poland and Austria (0.973) was greater than between Poland and France (0.933) and Poland and Germany (0.884).

Because "cyclical" industries inevitably grow at different rates in countries whose cycles are not synchronized, close cyclical synchronization was critical to the choice of comparator country for Poland in order to conserve degrees of freedom for other, structural, factors that could account for underlying differences in national rates of growth by industry sector. In both Austria and Poland, the industrial production index for total manufacturing was about 7 percent lower in 1992 than in 1990, while Germany experienced a reunifications-payment driven boomlet during that period. By 1994, growth in manufacturing output volume had resumed in both Austria and Poland. Manufacturing output continued to grow smartly in both countries until slowing to a crawl in 2000.

Hence during 1990-2001, manufacturing output movements appear, perhaps fortuitously, to have been extremely well synchronized between Austria and Poland, much more so than between Poland and Germany. Thanks to this "cyclical" overall alignment between Austria and Poland, differences in the growth rates of their two-digit manufacturing industries can reflect durable and structural factors one of which may be the activation of extra growth in the DEF-intensive sectors in Poland through exceptionally rapid FD from 1995 on.

To obtain characteristic differences in industry growth rates from the 11 annual rates of growth that can be constructed for each of the 19 industrial sectors distinguished in Table 5, let Poland's volume index at time t, X_t, relative to its (1990 or 1995) starting level at time $t_0 = 0$, and the equivalent ratio for Austria, Y_t/Y_0, be given by the equations:

$$X_t/X_0 = Ae^{(gpl)t}, \qquad Y_t/Y_0 = Be^{(ga)t},$$

and hence:
$$\ln(X_t/Y_t) = \ln[(A/B)(X_0/Y_0)] + (g_{pl} - g_a)t , \qquad (1)$$

where $\ln[(A/B)(X_0/Y_0)]$ is a sample-period specific intercept.

The coefficient of t -- which is the systematic difference in growth rates, (g_{pl} - g_a), between Poland (pl) and Austria (a) during 1990-2001, or sub-periods thereof -- and its standard error are shown in the last column of Table 5. Although the difference is significantly greater than 0 for 12 out of the 19 industries[13] at the 5 percent level and negative significant only for two industry sectors, the main interest is not in the Null of no difference but in the stability of the difference, whatever it is, that is measured by the standard error of estimate. It turns out that the standard errors of the estimated full-period differences in (Poland - Austria) industry growth rates range from 0.0065 to 0.0193 while clustering around 0.011, or 1.1 percentage point. Hence differences in industry growth rates between Poland and Austria appear statistically well-established and persistent and therefore suitable for analysis of the degree to which industry-specific differences in DEF and other factors could have contributed to the difference in growth rates, given Poland's rapid catch-up financial development after 1995.

It will subsequently be useful to include the full-period results even though a positive relation between DEF and differential rates of industry growth would be expected ceteris paribus only from 1995 on. For instance, if the industry characteristic DEF is correlated with industries being technology intensive and hence standing to benefit most from both financial and non-financial technology catch-up after their emergence from socialism, there could be a spurious positive cross-sectional correlation between DEF and differential rates of industry growth in Poland over Austria that would start even before Poland's FD had begun to surge. The Appendix to this paper carefully considers the several possible correlates of DEF in this regard. From the viewpoint of rapid financial development alone, however, we would expect an appreciably positive link between differential growth and DEF only during the second half of the 1990s. Hence our more narrowly FD-focused hypothesis is that the

[13] The clothing industry, ISIC 18, was omitted from the analysis because its annual growth rate in Poland exceeded that in Austria by an estimated 23 percentage points not because the industry grew rapidly in Poland but because the Austrian clothing industry shrank to almost one-fourth of its initial size from 1990 to 2001. What happened in that industry is characteristic of industrial succession, with labor-intensive production migrating from developed to developing countries. The industry's comparatively low degree of DEF (the RZ measure is 0.27) is likely to have left it less adversely affected by the initially very low level of FD even though it would also stand to benefit less from the subsequent rise in FD. However, unlike in this isolated instance, the correlation between RZ-DEF and labor intensity (the latter established with data for Austria) unexpectedly turned out to be positive in the industry sample as a whole, as discussed later.

coefficient on DEF should be significantly greater in the second sub-period (1995-2001) than in the first (1990-1995), and eventually positive.

This hypothesis is conceptually robust to assuming a severe and sustained initial disequilibrium that keeps DEF-intensive industries from adjusting right away. In view of the low level of FD and the desolate state of the Polish banking system at the 1990 threshold, many enterprises could have been financially non-price constrained, while RZ explicitly assumed no such constraints in the United States. These constraints would be felt most severely by DEF–intensive industries and slow their adjustment to optimal capacity as von Kalckreuth (2004) has found to be the case even for German firms that report being financially constrained. Nevertheless, as rapid FD in Poland would make these constraints less severe, rates of growth of DEF-intensive industry sectors should overtake their corresponding levels in Austria.

Using the latest data obtained from *UNIDO's International Yearbook of Industrial Statistics 2004* and other sources as explained in the note to Table 5, the trend rates of differential growth for the first half of the past decade then were estimated from six ratios of Polish over Austrian volume indexes (1990 through 1995) while there were seven such ratios for the more recent sub-period, 1995-2001. From these input data, two differential sub-period trend rates of growth, $g_{pl} - g_a$, for 1990-1995 and 1995-2001, were obtained for each of the 19 two-digit manufacturing industries as regression estimates as previously explained for the full sample; they are shown with their standard errors in the last two columns of Table 6. These estimates, in turn, are used in a second step as sectoral regressands whose behavior is to be explained by DEF in conjunction with additional two-digit industry characteristics considered next.

4 Testing for the Influence of Additional Variables in Conjunction with DEF

An expanded list of possible explanatory variables of industry differences in $g_{pl} - g_a$ was derived with data from several countries. The complete list includes data from:

the United States (DEF, by RZ)

- Austria (capital formation and labor compensation, both divided by value added)

- Austria and Poland (the difference in the relative importance of a two-digit industry in Austria and Poland, measured by the respective industry shares in manufacturing value added)
- Poland (the share of each two-digit manufacturing industry in the total value added by all 19 such industries in Poland; this is used for weighting the regression observations).

The reason for sourcing data, that could help explain industry growth-rate differences between Poland and Austria, from outside Poland is that fundamental characteristics of industries such as their normal dependence on external finance, their normal capacity growth, and their labor intensity are best revealed by conditions in more advanced countries. As a country that is integrating into a new market and production structure, Poland thus is seen engaged in a process of transformation oriented on industry characteristics that may not yet have revealed themselves fully in Poland, given its prior history under socialism and financial repression.

Because RZ explain high degrees of dependence on external finance as likely to arise for industries dominated by projects of long gestation requiring extensive follow-up investment before significant cash flow can be obtained, they would generally expect DEF to be positively correlated with the capital intensity of production. In addition, the more rapidly a business expands, ceteris paribus, the greater is its dependence on external finance.[14] Both of these effects -- the latter subsequently appears to dominate empirically -- could be captured jointly by adding the ratio of gross fixed capital formation to value added, CapForm/VA, from the country page for Austria[15] in UNIDO's *Industrial Statistics*, identified before, to characterize industry fundamentals

[14] If the exponential depreciation rate of the net stock of capital is δ, g is the rate of growth of that stock, and r is the net rate of return, then for a company that pays no dividends, the RZ measure of DEF is $(g-r)/(g+\delta)$. Hence an increase in g, unless contemporaneously strongly correlated with a rise in r, will raise the numerator by a greater percentage than the denominator, causing DEF to be a positive function of g. Only the facts that fast-growing companies are more likely than slow-growing companies not to pay any substantial dividends and to have high depreciation rates as is characteristic of operations that are intensive in the use of equipment rather than structures, including ICT equipment, then can reduce the extent of the positive association between growth rate g and DEF.

[15] Because no data were reported for industry sector ISIC 23 for Austria, we used data for France to calculate the required ratios CapForm/VA and Labor Share for that manufacturing sector instead. For calculating the difference in an industry's weight in total manufacturing output between Austria and Poland, the correct weight given to industry 23 in Austria was zero. Total manufacturing output was taken to be the sum of the manufacturing value added values reported for the 19 industry sectors used in this study so that the weights of the respective industries in the total for each country added up to 1.

relevant for Poland. Hence CapForm/VA could vie with DEF in identifying industries whose growth rate in Poland over Austria would benefit most from Poland's catch-up FD.

Specifically, the coefficient expected on CapForm/VA, as on DEF, is negative for the first sub-period when FD remained low in Poland compared with Austria and industries that grew fast in Austria should not have been the ones growing as fast in Poland after allowing for overall differences in the rate of growth of manufacturing output between the two countries. However, that coefficient is expected to be significantly greater, and presumably positive, in the second sub-period when FD was rising rapidly in Poland, causing an expected change in the structure of its manufacturing toward DEF-intensive industries.

While the variable CapForm/VA relates positively both to capital intensity and to the rate of growth of the capital stock -- mostly the latter -- dividing wages and salaries paid to employees by value added relates only to the labor share, i.e, to the complement of the capital intensity of production. Rapid advances in FD should dampen the growth of Poland's labor-intensive relative to its capital-intensive industries in moving equilibrium. However, in the early 1990s, Poland's industrial structure still must have been far from corresponding to the new production and trade opportunities created by the 1989-1990 opening to the "West" and the opportunity to become integrated into the European Union's (EU) supply chain. At least up to 1995, CEE countries had to be heavily engaged in adjusting to entirely new conditions of comparative advantage as they had previously been more integrated into the Eastern (COMECON) block than into Western regional and global markets. As indicated by the initial downward sweep of the adjustment curve from point C in Figure 1, this may very well have meant at first taking advantage of their low labor costs and labor-intensive raw materials and materials-using industries, such as lumber and wood products, to expand the output of industries that were not capital, R&D, or DEF intensive.[16]

Hence the coefficient on LaborShare should be positive in the first sub-period, 1990-1995, and negative, or at least significantly *lower*, for the second sub-period, 1995-2001.

A third variable added to DEF for each two-digit industry is its share in total manufacturing value added in Austria minus its share in Poland. The label used for this variable is Weight:AU - PL. Its purpose is to test whether the process of "financial convergence" might also have been accompanied by a process of "industrial convergence" whereby the industrial structure of Austria and Poland would become increasingly similar over time. If so, the excess of an industry sector's rate of growth in Poland (Poland minus Austria) would have to be positively related to its excess share in Austria (Austria minus Poland). In other words, an industry's growth in Poland would be expected to be faster the smaller its relative size in its own total manufacturing sector compared with the relative size of that same industry in Austria. That country continues to represent the advanced pattern of industrial development toward which Poland would be moving with improved FD. Hence the coefficient on Weight:AU-PL should be significantly greater in the 1995-2001 than in the 1990-1995 sub-period, and positive in the end.

This supplementary hypothesis too, like all its immediate predecessors, was not sustained by the unweighted and weighted regression results presented in Panels (A) and (B) of Table 7. Table 8 contrasts all the expected and actual (weighted-regression) findings relating to the four variables used to explain differences in $g_{pl} - g_a$ by industry sector, where $g_{pl} - g_a$, to recall, was estimated as a regression coefficient per (sub-)period for each industry sector as described earlier.

4.1 The Implications of Starting in Disequilibrium

When a major regime change, such as the exit from pervasive state socialism, occurs, it is inevitable that the configurations inherited from the old regime are in disequilibrium with the new, market-based regime. For instance, under socialism, the growth of capital-intensive industries commonly has been subsidized, and this may have favored those industries that would have had a high DEF in market economies. These industries would not have developed under a market system to any such extent given Poland's initially low level of FD. Hence the first observation on Poland around 1990 in Figure 1 could be represented by point C, well above point A. The latter point shows the

[16] Indeed, Table 6 shows that industries ISIC 20 and 21 stand out in this regard by having among the lowest DEF and highest differential trend rates of growth in Poland over Austria.

average capital intensity of manufacturing industries that would be consistent, in a market economy, with the low starting level of FD.

In Poland, such an economy took some time to re-emerge after 1990 and FD did not start to grow appreciably until 1995. Hence there was little rightward movement from the origin of Figure 1 during 1990-1995. During the transition to a market economy through privatization of state-owned enterprise and numerous supporting measures, the labor-intensive manufacturing sectors of Poland's economy thus would be expected to grow more rapidly than the capital-intensive sectors to gradually eliminate the inherited disequilibrium that was due to excess capital intensity under socialism. As a result, the average capital intensity of Poland's manufacturing industries would fall toward the market-economy equilibrium in the early to mid 1990s before bottoming out and beginning to rise when FD finally took off. In Figure 1, moving equilibrium is first reached at point D where the average level of capital intensity in Poland's manufacturing sector would still be below the disequilibrium starting level at point C. However, the composition effect of capital- and DEF-intensive industries growing faster than the others would cause average capital intensity to rise further as FD keeps advancing rapidly.

The foregoing conjectures are intended merely to illustrate the point that relations expected when moving from a substantial starting disequilibrium toward the equilibrium appropriate for a new regime may yield data correlations quite different from those expected in moving equilibrium alone, which is the condition subsumed by RZ throughout. However, because the Polish economy must have been much closer to equilibrium in the years after 1995 than before, the hypothesis, that the coefficient on DEF should have been significantly greater in the period 1995-2001 than the period 1990-1995 survives. Indeed that hypothesis is strengthened by allowing realistically for a disequilibrium starting position. The reason is that working off the initial disequilibrium would set back the growth of capital-intensive industries initially while rapid FD would stimulate it subsequently.

5 End Results

The finance literature is famous for generating lists of real-world "puzzles" about observed financial-asset price spreads and portfolio composition being difficult to reconcile with reasonable functional and parameter specifications. The price of success in reducing one puzzle often is to increase the extent of another puzzle or discrepancy.[17] Empirical findings, too, often contradict prior expectations.[18] Furthermore, detailed tests of the significance of FD for the *structure* of economic growth within a country are not nearly as common as wholesale tests of the importance of FD for economy-wide rates of growth across countries, although the structural tests could well be more discriminating. For instance, even if an increase in FD should not raise the economy-wide rate, it would still be expected to affect the industrial structure of economic growth.

This paper has added to the list of doubts and unanswered questions in a way that may ultimately be constructive. The hypothesis was that once the severe socialist repression of the private financial sector had been lifted, the benefits of a rapid catch-up process of financial development for DEF-intensive industries, clearly expected from past literature, would stand out. Because Poland's total manufacturing output has shown much closer co-movement with that of Austria than of Germany during the 1990s, Austria was chosen to represent the global market forces affecting the growth of industries in the most advanced countries in a way most relevant for orientation of Poland's own industrial development. Due to rapid financial deepening after 1995 in all the insurance, broad money, and domestic credit dimensions examined in this paper, the trend excess of Poland's rate of growth over that of Austria in the DEF-intensive

[17] Obstfeld and Rogoff (2000) are a prominent exception as they endeavor to reduce several puzzles jointly.

[18] A recent example of counterintuitive findings is McGuire (2004) who reports that the cash-flow sensitivity of investment in Japan is *greater* for firms with access both to the bond market and to main bank financing than for firms without bond market access. One general lesson is that strong priors do not obviate the need for empirical tests of financial relations since these tests often fail to confirm those priors or raise new doubts. Frame and White (2004) have noted that "everybody talks about financial innovation, but (almost) nobody empirically tests hypotheses about it." According to the authors (p. 118), financial innovation "represents something new [a new financial product, service, "production" process, or organizational form] that reduces costs, reduces risks, or provides an improved product/service/instrument that better satisfies participants' demands." Financial innovation thus may be viewed a normal part of FD although catch-up development, as in Poland, does not require original financial innovation.

industries should have been significantly lower in 1990-1995 than in 1995-2001 by when it should have turned positive. In addition, the rise of Poland's FD toward the Austrian level should have promoted convergence in the industrial structures of the two countries so that the coefficient on Weight:AU-PL should have been positive in the more recent of the two sub-periods.

Inability to find confirmation for this key hypothesis in the empirical work examining the structure of growth over 19 manufacturing sectors in post-socialist Poland led to further analysis. It showed that while capital intensity is one of the factors hinted at implicitly by RZ to explain why companies, especially young companies, in some industry sectors should have a higher DEF, and hence profit more from FD, than others, RZ-DEF is highly *positively* correlated with two-digit manufacturing industries' share of labor compensation in value added in Austria taken as the lead country for Poland's industrial development.[19] The labor share comes close to being positive significant in explaining the excess of Polish over Austrian industry sectors' growth in Panel B of Table 7 but its unexpected correlate, RZ-DEF, by itself, does not contribute to that effect at all. To resolve this inconsistency requires choosing between (1) giving up on finding FD significant for the structure of growth in Poland and, by extension, other CEE countries, and (2) giving up on the RZ measure of DEF for Poland.

Even after making allowance for a disequilibrium starting position in Poland, the key hypothesis and all its supplements were soundly rejected by the data as was detailed in Table 8. Nevertheless, the appropriate conclusion to draw surely is not that FD does not matter to the evolution of industry structure and to industrial development of sectors most dependent on external finance and insurance. The question rather is to what extent

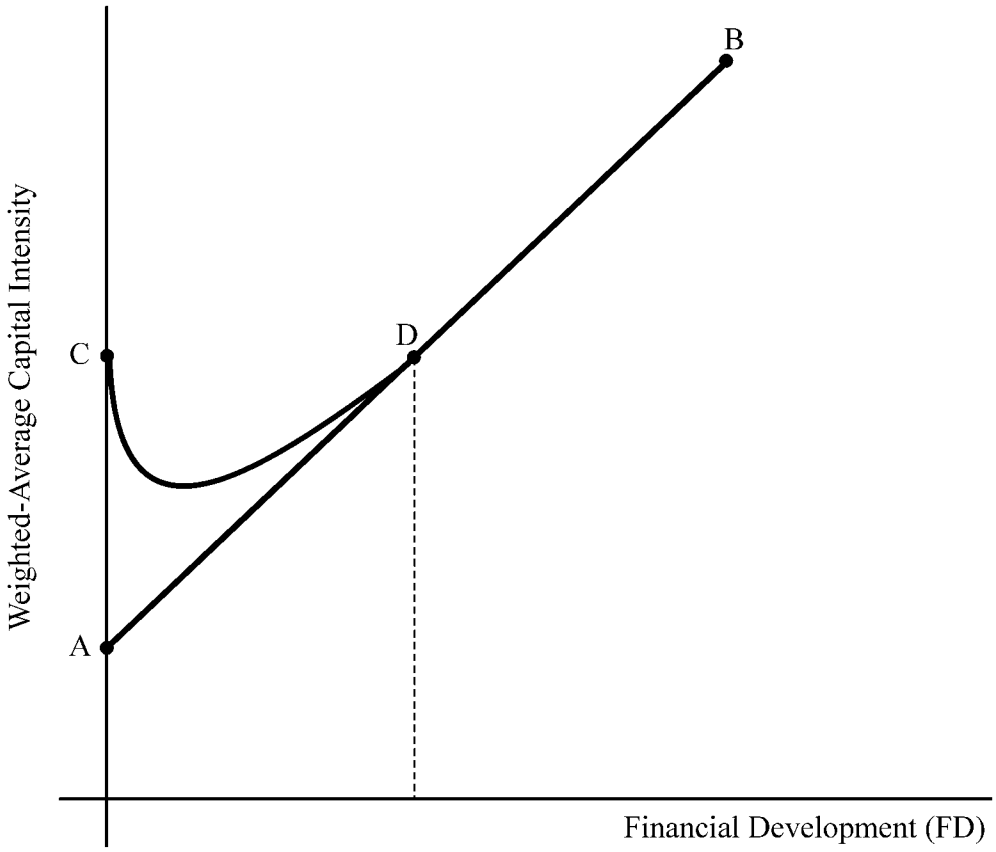
[19] As shown in the upper-diagonal results in Panel (C) of Table 7, this result comes through even more strongly, with a correlation coefficient of almost 0.8, when all variables are weighted by the value-added share of the respective two-digit manufacturing industries in their combined total in Poland. Indeed, additional correlations of 0.6 or more appear between DEF and the ratio of gross fixed capital formation to value-added and between the latter and the share of labor. Jointly these two positive correlations suggest that the CapForm/VA variable is more indicative of the rate of growth of an industry's capacity than of its capital intensity. However, industries with a high rate of gross fixed capital formation (in Austria) did not grow differentially faster in Poland.
In a biotech or magazine-publishing start-up, the salaries and employment-related expenses of highly paid researchers or staff writers and their retinue may have to be paid for years before these ventures generate positive cash flow. Regardless of whether these expenses are capitalized as (intangible) investments in development, there thus could be isolated examples of high-DEF industries that are labor intensive when labor intensity is measured by the ratio of labor compensation to value added.

RZ's measure of dependence on external finance reveals fundamental technological characteristics as they claim, or just the growth prospects, depreciation intensity, and actual and expected profitability of particular industries at particular stages of development in particular countries. For instance, the greater is the factor-specific division of labor between countries, the more the fast-growing industries in one country differ from those in another. Then the DEF values assigned to an industry in one country, the United States, could be quite wrong for that same industry in another country.

The "positive" hypothesis, to be tackled in future work, therefore is that the RZ measure is not equally suitable, any time -- any place, as assumed by those who have continued to use it all over the world. Instead, the most apt measures of DEF may be highly dependent on specifics of industrial-sector growth and financial organization that are not constant or identical through time or across regions or countries. The notion that U.S. financial structures of the 1980s reveal the efficient universal endpoint by which countries will define their FD, their DEF-intensive industries, and the extent to which they have a comparative (dis)advantage in such industries may be the ultimate casualty of research showing that RZ-DEF does not work equally well everywhere, and sometimes does not work at all. The measure of dependence on external finance by industry sector may be a powerful beacon – illuminating its own neighborhood.

Even for start-ups, finance-capital intensity and factor-capital intensity as measured thus may not coincide.

Figure 1. Overcoming Disequilibrium Between Capital-Intensity and FD in Poland



Notes: Line AB can be viewed as the locus of cross-sectional equilibrium combinations of capital intensity and FD for countries whose industries have different average levels of capital intensity and DEF on account of differences in FD. The line can also represent moving equilibrium combinations for a country with growing FD, a feature that favors more capital-intensive industries with successively higher average levels of DEF. Applying this dynamic interpretation, curve-to-line CB represents the initial disequilibrium descent from average levels of capital intensity built up under socialism that would be recognized as entirely excessive in a market economy given that FD was low. However, because FD, and hence the expected weighted-average value of DEF by industry, keep on growing (from 1995 on), the observed covariation between the industry average levels of capital intensity and DEF would become increasingly positive as the pre-existing disequilibrium is being eliminated. Differential industry growth rates contribute to these changes as growth in the average industry level of capital intensity or DEF is produced by capital-intensive and DEF-intensive industries growing faster than those making less use of capital and having a lower DEF.

Table 1: Industrial Sectors and Financial Structure: Coverage, Databases, and Sources

	Industry Sectors	Financial Databases
	Coverage and Database	Coverage and Sources
(1) Rajan and Zingales 1998	Industrial Statistics Yearbook UN (1993), covers 1980-1990 Manuf. firms: ISIC 2000-3999 Company Data Aggregated to 36 Industries for 42 Countries	IFC, Emerging Stock Markets Factbook; IMF, IFS, lines 32a - 32f, x 32e Compustat, Listed U.S. Cos.
(2) Neusser and Kugler 1998	Internat. Sector Database ISDB, >30 Manuf. Sect. in 14 OECD Countries,OECD	Financial Sector Real GDP Converted to 1990 USD-PPP from OECD. ISDB
(3) Cetorelli and Gambera 2001	Augmented Data Set of (1) 36 Manufacturing-Sector Industries, 41 Countries	IBCA-Bankscope Balance-Sheet Information on Individual Banking Institutions
(4) Beck and Levine 2002	Same as (1): UNIDO and OECD Main Industrial IndicatorDB For US Labor and R&D Intensity. Investment Intens: Wurgler 2000	Judicial Efficiency Index to 1990 Business International Corp. International Country Risk Guide ICRG
(5) Barlevy 2003	4-Digit Industry ISIC 2000-2999 Nondurable Manuf. 1984-1994 NBER Price Deflators by Ind.	Compustat
(6) Fisman and Love 2004	Industrial Statistics Yearbook UN (1993), covers 1980-1990 37 Manuf. Indust., 42 Countries	Compustat

Table 2: Industrial-Sector Dependence on External Finance (DEF), and a Country's Financial Development (FD)

	Industrial Sectors' DEF Coverage and Database	Country's FD Coverage and Sources
(1) Rajan and Zingales 1998	I. (Capital Expend. (CE) - [Cash Flow from Operations + Decr. in Invent. and Receivables + Incr. in Payables])/CE, Aggreg. to Indust. II. (Net Amt. of Equity Issued)/CE III. CE/(Net Property, P&E) ALL: U.S. (Compustat) Only Sum Numerator, and Denom., by Co. Use Industry Median of Co.Ratios	I. Total Capitalization: (Domestic Credit + Stock Market Cap.)/GDP II. (Domestic Credit to Private Sector)/GDP 42 Countries
(2) Neusser and Kugler 1998		Growth Rate of Real GDP orig. in Financial Sector related to TFP Growth in Manufacturing, Annual Series, analyzed by Country
(3) Cetorelli and Gambera 2001	Same as (1)-I.	I. Bank Development: (a) (Private Domestic Credit)/GDP (b) Interest Margin of Banks (c) Foreign Bank Share II. (Stock Market Valuation)/GDP
(4) Beck and Levine 2002	Same as (1)-I.	I. (Value Traded)/GDP II. (Market Cap.)/GDP III.(Bank Credit toPriv.Sec.)/GDP IV.(Fin.Instit.(banks & nonbank) Claims on Priv. Sector)/GDP I./III. and II./III.: Fin. Structure (I. + IV.) = Finance Activity (II. + IV.) = Financial Size Subsidary: % Banking Assets Priv Owned, Judicial Efficiency Index, R & D Intensity
(5) Barlevy 2003	Current Debt (Due in 1 Yr.) and Yr.-Yr. Change in Total LT Debt Deflated by PPI. Scaling: Via log-Transf. and grouping by net worth	Compustat, Publicly listed U.S. Companies Only: Use of Fixed Effects (year, 1984-94 sample) Precludes Use of FD
(6) Fisman and Love 2004	Same as (1)-I: U.S. data. Also Calculated for 1970-1980.	Country-Specific FD from (1): (Market Cap. + Total Domestic Bank Credit to Priv. Borr.)/GDP

Table 3: Indicators of Financial Development (FD) for Poland, 1991-2002 where vailable

Fractions of GDP: Year	*Net Life Premiums*	*Net Non-Life Premiums*	*Net Total Premiums*	*Life Insurance Investment*	*Non-Life Insurance Investment*	*Total Insurance Investment*	*M2: Money + Quasimon.*	*Domes-tic Credit ex. Gen. Gov.*
1991							0.323	0.240
1992							0.358	0.217
1993	0.006	0.009	0.015		0.005		0.359	0.214
1994	0.006	0.008	0.013		0.006		0.343	0.186
1995	0.005	0.009	0.014	0.007	0.006	0.013	0.339	0.185
1996	0.006	0.010	0.016	0.009	0.007	0.017	0.352	0.210
1997	0.008	0.014	0.022	0.014	0.011	0.025	0.413	0.251
1998	0.008	0.015	0.023	0.017	0.013	0.031	0.399	0.245
1999	0.009	0.015	0.024	0.022	0.017	0.039	0.428	0.276
2000	0.010	0.015	0.025	0.027	0.019	0.046	0.413	0.277
2001	0.010	0.016	0.026	0.033	0.022	0.055	0.451	0.283
2002							0.427	0.287

Sources: Zloty amounts of net life and non-life insurance premiums written, and their total, and the totals of life insurance and non-life insurance investments, and their total, are taken from the country pages for Poland in OECD, Insurance Statistics Yearbook, 1993-2000, Paris: OECD: 2002, for 1993 and in OECD, Insurance Statistics Yearbook, 1994-2001, Paris: OECD, 2003, for 1994-2001. Money plus Quasi-Money (IFS line 35l, M2 in Table 4), Domestic Credit except claims on General Government (net) (IFS line 32d, DC in Table 4) and GDP in current zloty (IFS, line 99b), which was the universal denominator, are from the country pages for Poland in International Financial Statistics Yearbook 2003, Vol. 56, Washington, D.C.: International Monetary Fund, 2003. Note that the measure of the stock of domestic credit used here still includes credit to state-owned enterprises. Commercial bank credit to such enterprises outstanding amounted to 12.8 percent of GDP in 1991 when such credit to private firms was only 10.2 percent of GDP. In 1995, the outstanding stock of commercial bank credit to state-owned enterprises had fallen to 6.6 percent of GDP and it declined further to 5.1 percent in 1999. By contrast, commercial bank credit to private firms outstanding remained near 10 percent of GDP until 1995 and then surged from 9.8 percent in 1995 to 16.0 percent by 1999. The data used for the distribution of commercial credit outstanding in these years are from OECD, OECD Economic Surveys: Poland, Paris: OECD, May 2001, p. 192.

Table 4: Correlation Coefficients Between Financial Flows or Stocks, all as Shares of GDP Poland, 1995-2001

	Net Life Premium	*Net NL. Premium*	*Net Total Premium*	*Life Invest.*	*Non-Life Investment*	*Total Ins. Investment*	*M2/GDP*
Net NL. Premiums	0.898	1					
Net Total Premiums	0.964	0.982	1				
Life Investment	0.946	0.793	0.879	1			
Non-Life Investment	0.970	0.824	0.908	0.994	1		
Total Ins. Investment	0.957	0.807	0.892	0.999	0.998	1	
M2/GDP	0.929	0.886	0.927	0.856	0.867	0.862	1
DC/GDP	0.992	0.890	0.956	0.903	0.934	0.916	0.938

Sources: See Table 3.

Table 5: Correspondence for Rajan and Zingales' (1998) Estimate of Young Companies' Dependence on External Finance (DEF) by Industry in the United States during the 1980's and Estimated Growth Rate Difference, for Poland minus Austria, 1990/91-2000/01

Industrial Sector	*ISIC Rev. 3*	*ISIC Rev. 2*	*DEF*	*Growth Rate Diff.*
	(VA99 Weight)			(Standard Error)
Food and Beverages	15 (0.183)	0.5(311 + 313)	0.645	0.0559 (0.0107)
Textiles	17 (0.035)	321	0.66	0.0412 (0.0101)
Leather and Footwear	19 (0.016)	324	0.65	0.0329 (0.0193)
Wood Products excl. 36	20 (0.043)	331	0.34	0.0313 (0.0128)
Paper and Paper Products	21 (0.021)	0.5(3411+ 341)	0.395	0.0971 (0.0083)
Printing and Publishing	22 (0.058)	342	0.60	0.1307 (0.0161)
Coke and (Pet.,Nuc.)Fuels	23 (0.024)	354	-0.26	0.0263 (0.0095)
Chemicals and -Products	24 (0.077)	(3511+3513+352)/3	0.977	0.0001 (0.0091)
Rubber and Plastics	25 (0.055)	355	0.50	0.1139 (0.0095)
Non-Metallic Min. Prod.	26 (0.069)	0.5(362+369)	0.745	0.0249 (0.0132)
Basic Metals	27 (0.047)	.56(371)+.44(372)	0.348	-.0235 (0.0103)
Fabricated Metal Products	28 (0.073)	381	0.87	0.0961 (0.0065)
Machinery and Equip. nec	29 (0.081)	382	0.75	-.0494 (0.0118)
Elec. Machinery & Appara.	31 (0.041)	383	1.22	-.0543 (0.0102)
Radio, TV, Commu. Equip.	32 (0.026	3832	1.35	0.0992 (0.0083)
Med., Precis., Optic. Instr.	33 (0.028)	385	1.63	0.0549 (0.0160)
Motor Vehicles, Trailers	34 (0.031)	3843	0.76	0.0763 (0.0174)
Other Transport Equipment	35 (0.032)	.37(384)+.63(3841)	0.876	0.0097 (0.0118)
Furniture and Manuf. nec	36 (0.060)	332	0.68	0.0964 (0.0103)

Notes and Sources: Rajan and Zingales (RZ) (1998, pp. 566-567) define external dependence as the median level of external financing for industries during the 1980's that are classified by ISIC, Revision (rev.) 2. External dependence is the fraction of capital expenditures not financed with cash flow from operations. For further details on the definition of industry sectors' DEF see Table 2. In order to match up the industries classified by Rev. 2 with the classifications given by Rev. 3 (effective 1989 and amended 1994) and the, for our purposes, equivalent classification Rev. 3.1, effective 2002, we used the *Correspondence between ISIC Rev. 2 and ISIC Rev. 3,* available online from the United Nations Statistics Division - Classifications Registry, as a guide. Correspondence can be only approximate since several of the Rev. 2 classes in RZ contain elements of more than one two-digit Rev. 3 classification, so that the most suitable assignment to a single sector had to be made. Conversely, in some cases more than one of the Rev. 2 classes for which young companies' DEF is reported in RZ belong to a single two-digit Rev. 3 category. In those cases the distribution of Manufacturing Value Added at Current Prices in 1999 (VA99) shown for Poland in the OECD, DSTI, *STAN Industrial Database 2002*, accessed February 20, 2004, by, in a few cases, more detailed (3- or 4-digit) Rev. 3 classifications was used to obtain appropriate weights. Where no such additional information was available, simple averages (of up to three RZ sector estimates of DEF) were used to translate RZ estimates of DEF into the newer international standard industrial classification scheme, Rev. 3, in a way most suitable for Poland.

Input data for estimating the growth rate differences shown in the last column above were the index numbers of industrial production (1995=100), 1990-2001, given in United Nations Industrial Development Organization, *International Yearbook of Industrial Statistics 2004*, Vienna: UNIDO, p. 484 for Poland, and an update of *International Yearbook of Industrial Statistics 2003*, p.144, for Austria, dated 2004/01/08, kindly supplied by Veronique Pecenka of UNIDO, since Austria is not shown in the country pages of the 2004 *Yearbook.*

Table 6: Estimated Annual Growth Rate Differences between Poland and Austria for 1990/91-1994/95 and 1995/96-2000/2001 by Industry Sectors Related to DEF

Industrial Sector	*ISIC Rev.3.1*	*DEF*	*Growth Rate Difference 1990-1995*	*Growth Rate Difference 1995-2001*
	(Weight)		(Standard Error)	(Standard Error)
Food and Beverages	15 (0.183)	0.645	0.1260 (0.0113)	-.0022 (0.0039)
Textiles	17 (0.035)	0.66	0.1068 (0.0310)	0.0033 (0.0079)
Leather and Footwear	19 (0.016)	0.65	0.0824 (0.0400)	-.0878 (0.0126)
Wood Products excl. 36	20 (0.043)	0.34	0.0865 (0.0615)	0.0502 (0.0045)
Paper and Paper Products	21 (0.021)	0.395	0.0834 (0.0285)	0.0550 (0.0053)
Printing and Publishing	22 (0.058)	0.60	0.2223 (0.0434)	0.0557 (0.0146)
Coke and (Pet.,Nuc.)Fuels	23 (0.024)	-0.26	0.1006 (0.0085)	0.0059 (0.0181)
Chemicals and -Products	24 (0.077)	0.977	0.0123 (0.0346)	-.0399 (0.0132)
Rubber and Plastics	25 (0.055)	0.50	0.1558 (0.0366)	0.0809 (0.0135)
Non-Metallic Min. Prod.	26 (0.069)	0.745	-.0116 (0.0558)	0.0749 (0.0158)
Basic Metals	27 (0.047)	0.348	0.0234 (0.0057)	-.0836 (0.0145)
Fabricated Metal Products	28 (0.073)	0.87	0.1267 (0.0272)	0.0735 (0.0042)
Machinery and Equip. nec	29 (0.081)	0.75	-.0144 (0.0586)	-.0718 (0.0137)
Elec. Machinery & Appara.	31 (0.041)	1.22	-.0825 (0.0268)	-.0808 (0.2810)
Radio, TV, Commu. Equip.	32 (0.026	1.35	0.0617 (0.0980)	0.0730 (0.0209)
Med., Precis., Optic. Instr.	33 (0.028)	1.63	0.1047 (0.0175)	-.0427 (0.0224)
Motor Vehicles, Trailers	34 (0.031)	0.76	0.1418 (0.0385)	-.0179 (0.0253)
Other Transport Equipment	35 (0.032)	0.876	0.0690 (0.0469)	0.0004 (0.0215)
Furniture and Manuf. nec	36 (0.060)	0.68	0.1329 (0.0353)	0.0527 (0.0162)

Sources: See Table 5, last paragraph.

Table 7: Explanatory Variables of Estimated Growth-Rate Differences by Industry Sector, Poland minus Austria

(A) Regression Coefficients with All 19 Industry Sectors' Observations Weighted Equally ("unweighted")

	1990-2001	1990-1995	1995-2001
DEF	0.0002	-0.0517	-0.0326
Mean: 0.7229	(0.00)	(-0.84)	(-0.61)
CapForm/VA	-0.0776	-0.1691	0.3312
Mean: 0.1596	(-0.23)	(-0.41)	(0.93)
LaborShare	-0.0418	0.0867	0.1229
Mean: 0.5144	(-0.17)	(0.29)	(0.48)
Weight:AU - PL	-0.0192	-0.6316	0.0977
Mean: 0	(-0.03)	(-0.67)	(0.12)

t-statistics in parentheses. The intercept, that in effect captures differences in country fixed effects, i.e., in overall growth rates, is included in the estimation but not shown.

(B) Regression Coefficients Using 1999 2-Digit Industry Sectors' Value-Added Weights, PL ("weighted")

	1990-2001	1990-1995	1995-2001
DEF	-0.0362	-0.1012	-0.0514
Mean: 0.7213	(-0.60)	(-1.35)	(-0.82)
CapForm/VA	-0.1722	-0.2159	-0.1141
Mean: 0.1663	(-0.72)	(-0.73)	(-0.46)
LaborShare	0.1712	0.3157	0.1662
Mean: 0.5266	(1.41)	(2.08)	(1.31)
Weight:AU - PL	-1.5309	-1.7685	-1.4805
Mean: 0	(-1.75)	(-1.62)	(-1.62)

Means of dependent variable are 0.0440, 0.0825, and 0.0071 for the 3 periods shown.

(C) Correlation Matrix Between Specified Characteristics of 19 Industry Sectors (lower-triangular: "unweighted"; upper-triangular: "weighted")

	DEF	CAPForm/VA	Labor Share	Weight:AU-PL
DEF	1	0.632	0.797	0.222
CapForm/VA	-0.217	1	0.657	-0.073
LaborShare	0.678	-0.360	1	0.344
Weight:AU-PL	0.218	-0.124	0.150	1

Notes: The dependent variable is shown in the last column of Table 5 for the full period and in the last columns of Table 6 for the two subperiods. The estimating equation is:

$g_{pl} - g_a = a_0 + a_1 DEF + a_2 CapForm/VA + a_3 LaborShare + a_4 (Weight:AU\text{-}PL)$, where the estimated values of a_1 through a_4 are shown in Panels (A) and (B) above.

The weights used for estimating the weighted regressions are shown in column1 of Table 5.

Table 8: Expected & Actual Coefficient Signs and Size Relations by Sub-Periods

Coefficient on:	Expectation	Finding ("Weighted")
DEF	Greater in second than first part of the sample period and positive only in the second	Not significantly different between sub-periods and negative in both
CapForm/VA	As this variable reflects the rate of growth of capacity (and the level of capital-intensity): Same as DEF	Negative insignificant in both sub-periods
Labor Share	Significantly lower in second than first part of the period and negative in the second	Insignificantly lower in the second than first part of the period and still positive in the second part
Weight:AU-PL	To the extent the Polish industrial structure is helped to convert to the more advanced structure by rapid FD: Positive in the second part	Negative insignificant in both sub-periods, suggesting nonconvergence or or possible divergence and the choice of different specializations

Note: The coefficients are a_1 through a_4 as shown in the notes to Table 7.

Appendix. Dependence on External Finance and Its Correlates

Several reasons have already been given for firms in one industry to be more dependent on external finance than those in another. Among them were higher scale requirements for the start of operations and longer lead-times required to plan and build a business until it can generate positive cash flow or at least positive EBITA (earnings before interest payments, taxes, and amortization). Industries characterized by capital, technology, and R&D intensive methods of production might fit these specifications. For building or assembling large and complex amounts of physical and human capital into a high-tech production organization requires time to build and debug and to bring on stream. Furthermore, the organization of R&D projects is inherently slow, their execution time-consuming, and fruition uncertain. Although start-ups and young firms are particularly dependent on external finance in such industries, even well-established, on-going concerns may find it difficult to rely mainly on internally generated cash flow to finance continuous investment in new production and research facilities whose pay-off is long delayed. Aghion *et al.* (2004, 5) provide some support. These authors also report that reliance on equity rather than debt finance is positively related to the R&D intensity of the firm and to the portion of balance-sheet assets that are intangible.

Although DEF is often treated as if it were synonymous with dependence on bank finance, in general, there are several external sources that can be tapped by at least some firms. External financing also can take the form of equity or debt instruments placed in securities markets, with nonbank financial institutions, with venture funds, or as private placements. In addition there are trade credits from suppliers or customers, including in subcontractor arrangements, or foreign or domestic investment by another company acquiring an ownership share directly. Some of these external sources of funds, such as inward FDI, have in turn been linked to technology transfer.[20] Furthermore, subsuming

[20] Given the growing importance of "fragmentation" trade as opposed to complete (final) goods trade, a distinction is often made between *modular* and *integral* production technologies. These technologies have very different implications for the organization of international trade in components and for its technology content and diffusion. Modular technology applies when it is possible to separate standardized fungible components from other components of production so that they can be sourced competitively worldwide. In the case of integral technology, all parts and components are firm- or even product-specific and such specificity, coupled with rapid innovation and continuous technological change, require direct and continuous interaction between industrial customers and their dedicated or captive suppliers. To control this tied technology transfer, FDI in the foreign supplier is preferred. See Torlak (2003).

the stylized facts underlying the Balassa-Samuelson theorem, that nontraded goods are (i) more labor intensive than traded goods and (ii) subject to lower rates of productivity growth, implies that industries highly dependent on external finance are also the industries most open to international competition and to international financial markets and R&D.

It is likely therefore, that firms with a high DEF, and the industries in which they cluster, differ systematically from other firms, and hence industries, in a number of nonfinancial respects as well. Some of these other characteristics, such as high-tech and R&D intensity, tend to relate positively to industrial succession and industry growth. Others, such as capital intensity of production, whether or not ICT-capital intensity is involved, may relate positively to the rate of growth of total factor productivity as subsumed in applications of the Balassa-Samuelson theorem already noted. Hence once the CEE countries have achieved moving equilibrium, they may benefit disproportionately not only from rapid FD but also from capital intensity in production, modernization of their capital stock, and technology catch-up whether or not mediated through FDI. Under continued financial repression perhaps few of these other benefits could be realized. But it is unlikely that all the sources of growth of DEF-intensive industry sectors, particularly those linked to growth in total factor productivity, would have to wait for higher levels of FD before they could assert themselves to any degree.

A.1 Modeling Interindustry Equilibrium Correlations to Expect in Advanced Countries not *Subject to a Major Change in Economic Regime*

Before turning to the empirical evidence, it is useful to explain what interindustry correlations between industry input and output characteristics to expect in equilibrium. The focus here is on the relation between the average productivity of labor, $(Q/L)_i$, and the capital-to-labor ratio, $(K/L)_i$, where, by choice of units, $(K/L)_i \geq 1$ for all industries i. Adopting industry-specific Cobb-Douglas production functions, $Q_i = A_i K_i^{\alpha(i)} L^{(1-\alpha(i))}$, with a total factor productivity (TFP) term A_i and capital share α_i, the required rate of return on capital which, in equilibrium, is equal to its gross marginal product, R, is taken to be the same for all industries. This means that differences in industry risk premia are ignored even though chances are that they are correlated with some of the other factors of interest. Then:

$$R = \alpha_i A_i (K/L)_i^{(\alpha(i)-1)} \text{ , and hence} \quad (A1)$$

$$(Q/L)_i = R(K/L)_i/\alpha_i \text{ .} \quad (A2)$$

From Eq. (A1) a sufficient condition for a positive log difference in the share of capital α between industries to be associated with a larger log difference (operator d) in the capital labor ratio (K/L) of the two industries cross-sectionally is that the factor A should either be the same in both industries or rising with α so that $dln(A)/dln(\alpha) \geq 0$. For then:

$$dln(K/L)/dln(\alpha) = [1/(1-\alpha)]\,[1+\alpha ln(K/L) + dln(A)/dln(\alpha)] > 1. \quad (A3)$$

Then if $(K/L)_i$ differs by a greater positive percentage than α_i between the two industries, it is clear from Eq. (A2) that $(Q/L)_i$ must be greater for the industry with the higher α_i. Conversely, multiplying through by dln(α) before setting dln(α) = 0 so as to compare two industries with the same capital intensity but different total factor productivity (A) in Eq. (A3) shows that $dln(K/L)/dln(A) = 1/(1-\alpha)$, with prefix *d* here again just a cross-sectional difference operator, not a time derivative. Greater capital intensity of production in the industry with the higher A would keep R the same between them but imply a higher wage level at equal α. Such a difference in employee compensation could be compatible with competition in the labor market only if inter-industry differences in the average level of skills and human capital endowments of workers were involved.[21]

At this point it thus appears that whether capital intensity by industry is measured correctly by the production function parameter α_i or incorrectly by the capital-labor ratio, $(K/L)_i$, $(K/L)_i$ and $(Q/L)_i$ correlate positively unless industry values of A_i and α_i correlate strongly negatively. However, a pattern of capital intensive industries having a lower level of TFP and lower wages than labor intensive industries appears unlikely to be found anywhere. Hence it is no surprise that the correlation between capital intensity and the level of average labor productivity across industries is found to be almost 1 in panel 2 of Table A1.

Other expectations are not validated nearly as decisively although the respective positive correlation coefficients may be statistically significant at the 5 percent level as

indicated in bold type in Table A1. For instance, the correlation between capital intensity (as measured by K/L rather than α) and *the average annual rate of growth* of TFP in the entire decade of the 1990s, or halves thereof, is weaker both in panels 1 (for manufacturing industries only) and 3 (for a broader set of industries) than commonly assumed in conjectures based on the Balassa-Samuelson theorem. In panel 3 there are indications that among the factors contributing to growth of average labor productivity, ICT-capital deepening and TFP growth are correlated on a simultaneous, five-year average, basis, but the size of the correlation coefficients, 0.354 and 0.503, is hardly overwhelming.

Surprisingly, research intensity provides no significant traction for TFP growth in panel 1 nor was the level of labor productivity significantly higher in industries with greater research intensity in panel 2. Temporal mismatch is unlikely to have been responsible for the low and insignificant correlations since panel 4 shows R&D intensity, whether defined by dividing research expenditures by value added or total output, to be a highly persistent industry characteristic from at least 1991 to 1999. While all but uncorrelated with TFP growth, R&D intensity correlates positively with an industry's export share (X/Y) in panel 1 and with both the export and import shares (X/Y and M/D) in panel 4 which in turn are highly correlated.

The industry distribution of FDI in Poland does not fit the expected equilibrium pattern of inward FDI being attracted to industries that are comparatively research-intensive. Rather, the advantage of Polish industry compared with the EU countries, with whose economies it began to mesh after emerging from the comparative isolation of socialism, lay elsewhere. Finally, the level of capital intensity, which again is a persistent industry characteristic, in Panel 3 is consistently correlated with the contribution of non-ICT-capital deepening to the rate of growth of average labor productivity by industry, 1990-95 and 1995-2000, but not with ICT-capital deepening.

Overall, the most salient results are these:

[21] Allowing for industry differences in the quality of labor inputs would require distinguishing efficiency units from physical units of labor in more complete modeling,

- Capital intensity is strongly correlated with the level of labor productivity and weakly correlated with the rate of growth of TFP and with the contribution of XICT-capital-deepening to labor productivity growth.
- Research intensity is not significantly correlated with capital intensity, TFP growth, or even with the contribution of ICT-capital-deepening to the rate of growth of labor productivity. Research intensity is however, significantly greater for industries more involved in international trade.
- These results are insensitive to whether data for 1991 or 1999 or for research expenditures in relation to value added or output are used to characterize research intensity by industry since the resulting four measures all are highly correlated.

Other correlations appear less robust, with results involving the growth of productivity often differing appreciably depending on whether they are obtained from cross-sectional data for the first or the second half of the 1990s.

Table A-1: Cross-Sectional Correlations Between Industry Characteristics Linked to Growth

(Notes to Table A-1 appear on the next pages)

Panel 1. 13 (Combinations of) Two-Digit Manufacturing-Industry Sectors from Source (c)

	Capital Int	TFP 90-95	TFP 95-00	R&D Int 99	ICT 90-95	ICT 95-00	M/D 99
CapitalInt 00	1						
TFP 90-95	**0.672**	1					
TFP 95-00	-0.165	0.296	1				
R&D Int 99	0.053	0.301	0.289	1			
ICT 90-95	**0.702**	0.253	0.063	0.159	1		
ICT 95-00	-0.651	-0.260	**0.502**	0.144	-0.123	1	
M/D 99	-0.267	-0.155	0.328	0.059	-0.162	0.123	1
X/Y 99	-0.145	0.098	0.247	**0.518**	-0.063	0.212	**0.653**

Source (c). In a one-tailed test with 11 df the critical value of r at the 5% significance level is 0.477.

Panel 2. 11 (Combinations of) Two-Digit Manufacturing-Industry Sectors, excl. 30-33 and 36-37, from Source (c), and Data from Source (a)

	Capital Int	TFP 90-00	R&D Int 99	EU LP 98
CapitalInt 00	1			
TFP 90-00	0.466	1		
R&D Int 99	0.038	-0.042	1	
EU LP 98	**0.986**	0.424	0.024	1

In a one-tailed test with 9 df the critical value of r at the 5% significance level is 0.522.

Panel 3. 13 Manufacturing-Industry and 13 Other Sectors from Source (c)

	Capital Int	TFP 90-95	TFP 95-00	TFPAVG	ICT 90-95	XICT 90-95	ICT 95-00
CapitalInt00	1						
TFP 90-95	**0.369**	1					
TFP 95-00	0.233	**0.393**	1				
TFP AVG	**0.354**	**0.804**	**0.863**	1			
ICT 90-95	0.143	-0.030	**0.354**	0.212	1		
XICT 90-95	**0.465**	**0.540**	0.092	**0.356**	-0.062	1	
ICT 95-00	-0.041	-0.136	**0.503**	0.250	**0.834**	-0.106	1
XICT 95-00	**0.639**	**0.422**	0.165	**0.339**	-0.126	**0.813**	-0.053

In a one-tailed test with 24 df the critical value of r at the 5% significance level is 0.330.

Panel 4. 19 Industry Sectors Ordered by Technology Intensity from ISIC 15-16 through 36-37 from Source (b)

	M/D 1999	X/Y 1999	R&D/out 99	R&D/VA 99	VA/OUT 99	R&D/out 91	R&D/VA 91
M/D 1999	1						
X/Y 1999	**0.689**	1					
R&D/out99	**0.611**	**0.717**	1				
R&D/VA 99	**0.711**	**0.720**	**0.964**	1			
VA/OUT 99	0.026	0.209	0.329	0.142	1		
R&D/out91	**0.731**	**0.714**	**0.932**	**0.963**	0.163	1	
R&D/VA 91	**0.721**	**0.670**	**0.875**	**0.954**	-0.011	**0.977**	1
VA/OUT 91	0.291	0.398	**0.527**	**0.410**	**0.840**	**0.452**	0.295

In a one-tailed test with 17 df the critical value of r at the 5% significance level is 0.389.

Notes to Table A-1

Manufacturing Industries are classified as:

ISIC	Industry	Notes
15-16	Food, Drink (15) & Tobacco (16)	
17-19	Textiles (17), Clothing (18), Leather and Footwear (19)	
20	Wood & Products of Wood and Cork (excl. Furniture)	
21-22	Pulp, Paper & Products (21), Printing & Publishing (22)	
23*	Mineral Oil Refining, Coke & Nuclear Fuel	
24*	Chemicals	2423 Pharmaceuticals
25	Rubber and Plastics	
26	Non-Metallic Mineral Products	
27-28	Basic Metals (27) and Fabricated Metal Products (28)	
29	Mechanical Engineering: Machinery & Equipment n.e.c.	
30-33	Office, Accounting and Computing Machinery (30) Electrical Machinery and Apparatus (31*) Radio, Television and Communication Equipment (32*) Medical, Precision, and Optical Instruments (33*)	30: No Polish Data
34-35	Motor Vehicles, Trailers and Semi-Trailers (34*) Other Transport Equipment (35*)	Aircraft &Spacecraft 353, Railroad&Trans-port Equip. 352 + 359, Ships and Boats 351
36-37	Furniture, Manufacturing n.e.c. (36), Recycling (37)	37: No Polish Data

* Identified as "dynamic IT users with a high and growing IT-labor intensity" in (c) p. 52, where (c), identified below, is the basic source followed in this table.
For comparison, (b1), Annex 1.1., identifies industries 353, 2423, 30, 32, and 33 as high-tech, 31, 34, 24 excl. 2423, 352 + 359, and 29 as medium-high-tech, 351, 25, 23, 26, and 27-28 as medium-low-tech, and 36-37, 20-22, 15-16, and 17-19 as low technology industries, with intensities declining progressively within and between the industry sectors as ordered.

Sources:

(a) OECD. 2001. Science, Technology, and Industry Scoreboard 2001. Paris: OECD.
(b) OECD. 2003. Science, Technology, and Industry Scoreboard 2003. Paris: OECD.
(c) European Commission (EC). 2003. EU Productivity and Competitiveness: An Industry Perspective, Mary O'Mahony and Bart van Ark (eds.) for Enterprise Directorate-General, EC. Luxembourg: European Communities.
(d) OECD. 2002. International Direct Investment Statistics Yearbook, 1980-2000. Paris: OECD. (Poland: Pp. 310-324, inflow of FDI by industrial sector, pp. 312-313, shows that the share of services, in particular telecommunications and financial activities, shot up from 34 percent of total inward FDI in 1998 to 75 percent in 1999 and 2000 after large-scale FDI in telecommunications had been authorized in 1999.)
(e) United Nations Industrial Development Organization, International Yearbook of Industrial Statistics 2004, Vienna: UNIDO, pp. 477-484 for Poland, and an update of International Yearbook of Industrial Statistics 2003, p.144, for Austria, dated 2004/01/08, kindly supplied by Veronique Pecenka of UNIDO, since Austria is not shown in the country pages of the 2004 Yearbook. For Poland, annual index numbers (1995=100) of industrial production are shown for 1990-2001 for all but two (30 and 37) of the 23 two-digit manufacturing industry sectors from 15 through 37 on p. 484.

Industry Correspondence of (b1) to (c) or of (b2) to (b1):
I used (20-22) in (b1) for both (20) and (21-22); (24 excl. 2423) in (b1) for (24);
(31) in (b1) for (30-33); and (34) in (b) for (34-35), all in the classification (c) scheme adopted in the table above.
To make data reported for 21 industry sectors for EX/Y and IM/D (see below), fit with the 19 sectors reported in (b1), I used the simple average of (27) and (28) in (b2) to obtain (27-28) and similarly, the simple average of (20) and (21-22) of (b2) to construct the entry for (20-22), all in the (b1) data grid identified in the note to the table above.

Data

Source (a): Table D4.3: Labor productivity, **LP**, relative to total non-agricultural business sector, 1998, EU. Excludes industry sectors 30-33 and 36-37 from those identified in the table above.
Source (b): **b1.** Annex 1.1.: Classification of Manufacturing Industries Based on Technology,
Aggregate R&D Intensity divided by either production value, **R&D/OUT**, or value added, **R&D/VA**, after converting R&D expenditures, value added and production using GDP PPPs. Based on 1999 data for 12 OECD countries (G7 + Scandinavia excl. Nor.,+ Ireld. and Spain). **b2.** Data for Figure C2.2.4: Exposure to International Trade Competition by Industry, Exposure of Manufacturing Industries, selected EU countries, 1999. Value of Exports divided by Output, **X/Y**, and Value of Imports divided by Domestic Demand (D = Y-X+M), **M/D**, a ratio known as import penetration.
Source (c): **c1.** Table II.6, p. 46: Capital (stock not further defined) per Hour Worked: Industry to Total Economy Ratios, 2000, EU-4 (France, Germany, Netherlands, UK). The measure is an index of capital intensity, **CAPINTENS**.
c2. Appendix Table III.C.1 cont., pp. 131-132: Decomposition of Annual Labor Productivity Growth, EU-4, 1990-95 and 1995-2000. Decomposition includes the contribution of **ICT** and non-ICT, **XICT,** capital deepening and of Total Factor Productivity Growth, **TFP**. The resulting variable names are **ICT90-95, XICT90-95, TFP90-95,** and **ICT95-00, XICT95-00, TFP95-20.** In addition, **TFP AVG=TFP 90-00** was constructed as a simple decade-long average of the average annual rates of growth given by TFP90-95 and TFP95-20.
Sources (d) and (e): Inward FDI flows to Poland by industry sector from (d) were summed for 1998 and 1999 and converted from US dollars to Zlotys by multiplying by 3.721, the 1998-1999 average exchange rate. The sectors available were food products (15-16), textiles and wood activities (17-22), petroleum, chemical, rubber and plastics products (23-25), metal and mechanical products (27-29), Office machinery, computers, radio, TV and communication equipment (30-33), and vehicles and other transportation equipment (34-35). After dividing by the corresponding gross fixed capital formation or total investment (I) in these sectors, aggregated from (e), the ratio of FDI/I was for industry sector (15-16): 30.87%, (17-22): 19.17%, (23-25): 18.96%, (27-29): 18.34%, (30-33): 9.38%, (34-35): 36.46%. No clear pattern with regard to either capital or R&D intensity or level of technology was apparent from these percentages on FDI participation. We note, however, that Huizinga and Denis (2004, 36) find capital intensity (log of ratio of firm's total assets to their employment) to be higher for foreign-owned (3.9) than domestically-owned (2.9) firms.

References

Aghion, Philippe; Bond, Stephen; Klemm, Alexander, and Marinecu, Ioana (cited as Aghion *et al*.). 2004. Technology and Financial Structure: Are Innovative Firms Different? Paper presented at the Sixth Bundesbank Spring Conference, Financial Innovation, Deutsche Bundesbank Training Center, Eltville, Germany, April 30 - May 1.

Andersen, Thomas B., and Tarp, Finn. 2003. *Journal of International Development* 15: 189-209.

Bandiera, Oriana; Caprio, Gerard; Honohan, Patrick, and Schiantarelli, Fabio. 2000. "Does Financial Reform Raise or Reduce Saving?" *Review of Economics and Statistics* 82(2), May: 239-263.

Barlevy, Gadi. 2003. "Credit Market Frictions and the Allocation of Resources over the Business Cycle," *Journal of Monetary Economics* 50(8), November: 1795-1818.

Baur, Esther; Birkmaier, Ulrike, and Rüstmann, Marco. 2001. *The Economic Impact of Insurance in Central and Eastern Europe and the Impact of Globalisation and e-Business.* Distributed by United Nations, Economic and Social Council, Economic Commission for Europe, Committee for Trade, Industry and Enterprise Development, as TRADE/2001/15, May 1.

Beck, Thorsten, and Levine, Ross. 2002. "Industry Growth and Capital Accumulation: Does Having a Market or Bank-Based System Matter?" *Journal of Financial Economics* 64(2), May: 147-180.

Cetorelli, Nicola, and Gambera, Michele. 2001. "Banking Market Structure, Financial dependence and Growth: International Evidence from Industry Data," *Journal of Finance* 56(2), April: 617-648.

Demetriades, Panicos O., and Luintel, Kul B. 1996. "Banking Sector Policies and Financial Development in Nepal," *Oxford Bulletin of Economics and Statistics* 58(2), May: 355-372.

Demetriades, Panicos O., and Luintel, Kul B. 1997. "The Direct Costs of Financial Repression: Evidence from India," *Review of Economics and Statistics* 79(2), May: 311-320.

Fecht, Falko. 2004. On the Stability of Different Financial Systems, Deutsche Bundesbank Working Paper, March 29.

Fisman, Raymond, and Love, Inessa. 2004. Financial Development and Growth in the Short and Long Run. *NBER Working Paper 10236*, January.

Frame, W. Scott, and White, Lawrence J. (2004) "Empirical Studies of Financial Innovation: Lots of Talk, Little Action?" *Journal of Economic Literature* 42(1), March: 116-144.

Frankel, Jeffrey A., and Rose, Andrew K. 1998. "The Endogeneity of the Optimum Currency Area Criteria," *Economic Journal* 108, July: 1009-1025.

Guiso, Luigi; Sapienza, Paola, and Zingales, Luigi. 2002. Does Local Financial Development Matter? *NBER Working Paper 8923*, May.

Herrmann, Sabine, and Jochem, Axel. 2003. The International Integration of Money Markets in the Central and East European Accession Countries: Deviations from Covered Interest Parity, Capital Controls, and Inefficiencies in the Financial Sector, *Deutsche Bundesbank Discussion Paper* No. 7/2003, March.

Huizinga, Harry, and Denis, Cécile. 2004. Are Foreign Ownership and Good Institutions Substitutes? The Case of Non-Traded Equity. Draft, Tilburg University and European Commission, February.

Japelli, Tullio, and Pagano, Marco. 1994. "Savings, Growth, and Liquidity Constraints," *Quarterly Journal of Economics* 109(1), February: 83-109.

Japelli, Tullio, and Pagano, Marco. 1999, "The Welfare Effect of Liquidity Constraints," *Oxford Economic Papers* 51(3), July: 410-430.

Kelly, Roger, and Mavrotas, George. 2003. "Savings and Financial Sector Development: Panel Cointegration Evidence from Africa," United Nations University, World Institute for Development Research, WIDER Discussion Paper No. 2003/12, February.

Kenen, Peter B. 1969. "The Theory of Optimum Currency Areas: An Eclectic View." In Robert A. Mundell and Alexander K. Swoboda**,** eds., *Monetary Problems of the International Economy*. Chicago: University of Chicago Press, 41-60.

Koivu, Tuuli. 2002. Do Efficient Banking Sectors Accelerate Growth in Transition Countries? Bank of Finland *BOFIT Discussion Papers*, No. 14.

Levine, Ross; Loayza, Norman, and Beck, Thorsten. 2000. "Financial Intermediation and Growth: Causality and Causes," *Journal of Monetary Economics* 46(1), August: 31-77.

McGuire, Patrick. 2004. Bank Ties and Bond Market Access: Evidence on Investment-Cash Flow Sensitivity in Japan, *BIS Working Papers* No. 151, March.

Mavrotas, George, and Kelly, Roger. 2001a. "Old Wine in New Bottles: Testing Causality Between Savings and Growth," *The Manchester School*, 69(Supplement): 97-105.

Mavrotas, George, and Kelly, Roger. 2001b. "Savings Mobilisation and Financial Sector Development: The Nexus," *Savings and Development* 25(1): 33-66.

Merton, Robert C. 1992, "Financial Innovation and Economic Performance," *Journal of Applied Corporate Finance* 4, (4): 12-22.

National Bank of Poland. 2003. *Information Bulletin 8/2003*, Warsaw: National Bank of Poland, December.

Neusser, Klaus, and Kugler, Maurice. 1998. "Manufacturing Growth and Financial Development: Evidence from OECD Countries," *Review of Economics and Statistics* 80(4), November: 636-646.

Obstfeld, Maurice, and Rogoff, Kenneth. 2000. The Six Major Puzzles in International Macroeconomics: Is There a Common Cause? In Benjamin S. Bernanke and Kenneth Rogoff, eds., *NBER Macroeconomics Annual* 15. Cambridge, MA: MIT Press, 339-390.

Pulvino, Todd, and Tarhan, Vefa. 2004. Allocating a Dollar of Cash Flow: Investment, Financing, and Distribution Sensitivities. Paper presented at Athenian Policy Forum Conference, Deutsche Bundesbank, Frankfurt, July 30, 2004.

Rajan, Raghuram G., and Zingales, Luigi. 1998. "Financial Dependence and Growth," *American Economic Review* 88(3), June: 559-586.

Rose, Andrew K, and Engel, Charles. 2002. "Currency Unions and International Integration," *Journal of Money, Credit and Banking* 34, November: 1067-1089.

Rule, David. 2001. "Risk Transfer Between Banks, Insurance Companies and Capital Markets: An Overview," *Financial Stability Review*, December: 137-159.

Torlak, Elvisa. 2003. "Foreign Direct Investment and Productivity Growth in Transition Countries," Hamburg Institute of International Economics (HWWA), unpublished.

von Furstenberg, George M. 2004. Consumption Smoothing Across States and Time:

International Insurance vs. Foreign Loans, *Deutsche Bundesbank Discussion Paper*, Series 1: Studies of the Economic Research Centre No.13/2004, July.

von Kalckreuth, Ulf. 2004. Financial Constraints for Investors and the Speed of Adaptation: Are Innovators Special? *Deutsche Bundesbank Discussion Paper*, forthcoming.

von Kalckreuth, Ulf, and Murphy, Emma. 2004. Financial Constraints and Capacity Adjustment in the United Kingdom: Are Small Firms Really Different? Evidence from a Large Panel of Survey Data. *Deutsche Bundesbank Discussion Paper*, forthcoming.

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