Financial Dependence and Growth

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August 24, 2011

Abstract

This paper examines whether financial development facilitates economic growth by estimating the effect of financial development on reducing the costs of external finance to firms using data on value added and gross fixed capital formation for each industry in each country from the Industrial Statistics Yearbook database put together by the United Nations Statistical Division (1993). The data reveal substantial evidence of decreasing returns to scale with higher growth rates been achieved by industries that are more dependent on external finance and countries with less financial frictions. The basic specifications in this paper comprise the semiparametric growth rate function where the external financial dependence of an industry interacted with the financial development of a country enters non-parametrically and remaining variables are parametric. This paper relies upon non-parametric differencing techniques and extends a previous differencing test of equality of non-parametric regression functions to a cross sectional data setting. The findings in this paper suggest a fresh explanation for the pattern of industry specialization and growth across countries during a period of financial development. For countries that are financially underdeveloped, an improvement in their financial development leads to the greater increase in growth rates in the industries that are less dependent on finance. Financially underdeveloped countries can "catch up" to the rich countries faster by focusing on their less financially dependent industries and bettering their financial institutions, while financially developed countries have less to gain by furthering their financial development.

1. Introduction

There has been a growing literature on financial institutions and growth. Dating as far back as Joseph A. Schumpeter (1911), it has been shown that the development of a country's financial institutions has a positive influence on the rate of growth of its per capita income. In addition, Rajan and Zingales (1998) showed that this effect is more pronounced in the financially vulnerable industries, or industries that are more dependent on external finance.

Industry growth can be decomposed into the growth in new establishments and the growth in the average size of existing establishments. New establishments are more likely to depend more on external finance than established firms. So there is a natural tendency for

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financial development to disproportionately affect firms (or industries). The basic specification in this paper is a semiparametric growth rate function where the external financial dependence of an industry interacted with the financial development of a country enters non-parametrically and remaining variables are parametric. This paper provides evidence that the effect of financial development and external dependence on finance is non-linear and exhibits decreasing returns to scale with higher growth rates achieved by industries that are more dependent on external finance and countries with good financial institutions. For countries that are less financially developed, they can achieve a bigger increase in growth rates for industries that are least dependent on external finance.

This is evident in the case of China, where its measures of financial development, such as private credit to GDP ratio and market capitalization ratio, have grown over the years but initially started from a low point, and the fastest expanding industries in China are the apparel and footwear industries, which do not need much outside capital to finance their everyday operations. For countries that are already financially developed, improvement in their financial development leads smaller increases in growth rates and this effect is more pronounced in the financially dependent industries. This suggests for the financially underdeveloped countries, they should focus on producing products that do not depend on external finance while they are improving their financial institutions. Countries that are financially underdeveloped tend to be low and middle income countries. Sutton and Trefler (2011) also find that low and middle income countries can achieve higher GDP growth by improving on what they are already producing (i.e. low-tech products like footwear and textiles that tend to be not dependent on external finance) instead of copying what the rich countries are producing (high-tech products).

This paper also shows that welfare effects of positive shocks to the economy are substantially different if one estimates this financial development and external finance dependence effect non-parametrically rather than parametrically.

Finally, this paper considers the possibility that our measures of financial development for a country are endogenous. Countries that have higher growth rates are more likely to have better financial institutions in place. One might therefore expect the measures of financial development to be positively correlated with the residual in an equation where the dependent variable is growth rates or value added. This in turn would lead to underestimation of the effect of external financial dependence and financial development. In the concluding section this paper conducts a simple test of the endogeneity hypothesis.

In summary, we have three main objectives; to estimate a semiparametric model of growth rate in value added using the Industrial Statistics Yearbook database put together by the United Nations Statistical Division (1993); to determine whether separate estimation of growth in the number of new establishments and the growth in the average size of existing establishments yields different results; and to test whether our measure of financial

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development is endogenous. Section 2 describes the model and provides additional details about the data. Section 3 uses single-equation differencing techniques (Yatchew (1997, 1998, 1999)) to analyze the effect of external financial dependence and financial development on growth rates. Section 4 reports results. Section 5 utilizes the panel data and reports semiparametric results using time changing measurements of financial development and external finance, and the concluding Section 5 compares the results in this paper to those of previous studies.

2. Model and Data

This paper uses the dataset provided by Rajan and Zingales (1998). Growth in value added for an industry is defined as the change in the log of real value added in that industry between 1980 and 1990. External financial dependence of an industry is measured as the median firm's capital expenditures minus cash flow from operations divided by capital expenditures in that industry. There are several measures available for financial development of a country. The first measure this paper uses is fairly traditional—the ratio of domestic credit plus stock market capitalization to GDP. The second proxy for financial development used in this paper is the accounting standards in a country. A higher score in the accounting standards indicates more disclosure.

The main empirical objective of this paper is to estimate the effect of external financial dependence on financial development on the growth rates. A priori, the relationship between growth rates and external financial dependence interacted with financial development maybe flat, increasing, decreasing or U-shaped; it may be concave or it may have multiple inflection points. I propose therefore to estimate the effect using a semiparametric model.

In addition to an industry's external financial dependence and a country's financial development, a number of variables may influence growth rates and therefore need to be incorporated into the model. These covariates include the conventional arguments of growth rate function–an industry's share of manufacturing in a country, country indicators and industry indicators.

The basic econometric specification is given by:

$$\begin{aligned} Growth_{jk} = f\big(&External\ Financial\ Dependence_j * Financial\ Development_k\big) \\ &+ \beta_1\ share\ of\ manufacturing_{j,k}\ + \beta_2 Country\ Indicators \\ &+\ \beta_3\ Industry\ Indicators + constant +\ \varepsilon_{jk}. \end{aligned} \tag{1}$$

I assume little about the function f beyond smoothness, thus equation (1) is a growth rate function with the interaction between external financial dependence and financial development entering both non-parametrically (through f) and parametrically (through the country and

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industry indicators). The model has a partial linear structure $y = f(x) + z\boldsymbol{\beta} + v$ where the non-parametric variable x is the interaction term and the vector z is composed of the industry share and other variables which enter parametrically. Summary statistics are contained in Appendix 1.

Because the parametric and non-parametric portions of the model are additively separable, the simple differencing techniques can be applied to the partial linear structure easily. The essential idea is to reorder the data so that the values of the non-parametric variable are close to each other, then to take first- or higher-order differences to remove the non-parametric effect. This differencing technique is explained in details in Yatchew (2000).

3. Differencing Procedures

The model maybe written in the form:

$$y_{jk} = f(x_{jk}) + z_{jk}\beta + v_{jk} \tag{2}$$

where j indexes the industry and k indexes the country. Throughout the paper, the non-parametric variable x_{jk} is a scalar.

Let y be the column vector of the values of the dependent variable. Define x and v in a similar fashion. I assume the residuals are distributed independently and homoscedastically across industry-country pairs. For each industry-country pair, the jk-dimensional row vector z_{jk} contains data on the parametric variables. Data must be ordered so that within each year, the x's are in increasing order, i.e. $x_{11} \leq \cdots \leq . x_{JK}$. In matrix notation, this model is written as:

$$y = f(x) + Z\beta + v \tag{3}$$

Let m be the order of differencing and $d_0, d_1, \ldots, d_m$ the optimal differencing weights. The weights satisfy the conditions:

$$\sum_{j=0}^{m} d_j = 0 \sum_{j=0}^{m} d_j^2 = 1 \tag{4}$$

Define the differencing matrix:

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$$\underset{N\times N}{D} = \begin{bmatrix} d_0, d_1, d_2, \ldots, d_m, 0, \ldots\ldots\ldots\ldots, 0 \\ 0, d_0, d_1, d_2, \ldots, d_m, 0, \ldots\ldots\ldots\ldots, 0 \\ \vdots \quad \vdots \\ \vdots \quad \vdots \\ 0, \ldots\ldots\ldots\ldots, 0, d_0, d_1, d_2, \ldots, d_m, 0 \\ 0, \ldots\ldots\ldots\ldots, 0, d_0, d_1, d_2, \ldots, d_m \\ 0, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots, 0 \\ \vdots \quad \vdots \\ 0, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots, 0 \end{bmatrix} \tag{5}$$

where $N = J * K$. Application of the differencing matrix to equation (3) permits direct estimation of the parametric effect. In particular, take:

$$Dy = Df(x) + DZ\beta + Dv \tag{6}$$

Because the data have been reordered so that the x's are close, the application of the differencing matrix D in equation (6) removes the non-parametric effect in large samples. Under general conditions, the OLS regression of Dy on DZ exhibits the following large sample behavior (Yatchew (2000)).

$$\hat{\beta} = [(DZ)'DZ]^{-1}(DZ)'Dy \sim N\left(\beta, \quad \left(1 + \frac{1}{2m}\right)\frac{\sigma_v^2}{N}\right)\sum\nolimits_{z|x}^{-1} \tag{7}$$

where $\sum_{z|x}$ is estimated consistently using

$$\hat{\sum}_{z|x} = \frac{1}{N}(DZ)'DZ$$

The residual variance is estimated consistently using

$$s_v^2 = \frac{1}{N}\left(Dy - DZ\hat{\beta}\right)'(Dy - DZ\hat{\beta})$$

The estimator becomes asymptotically efficient by increasing the order of differencing m (Yatchew (1997)).

4. Empirical Results

Differencing estimates of the parametric component of equation (1) are presented in Table 1 (throughout the paper I use third-order differencing ($m = 3$). Results for other orders of

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differencing were similar.) Since we use U.S. data to identify the external dependence, we drop the United States in all regressions. We start with private credit to GDP ratio as the proxy for financial development. The estimated industry share effect is negative and significant. The rest of the columns of the table include different measures of financial development.

For comparison purposes we provide estimates of the parametric analogues of the models in Table 2. These are the different measures of financial development where the interaction term external finance dependence and financial development is modeled using a quadratic. Estimates differ substantially between parametric and semiparametric versions for different specifications of financial development. The R^2, which is defined as $R^2 = 1 - s_v^2/s_y^2$ is higher in the semiparametric specifications relative to the pure parametric ones.

Returning to the semiparametric specification, I remove the estimated parametric effect from the dependent variable and analyze the non-parametric effect. I use the estimates from the private credit to GDP ratio to remove the parametric effect. Figure 1 displays the ordered pairs $(y_{jk} - z_{jk}\hat{\beta}, x_{jk})$ as well as kernel estimates of f bordered by 95% uniform hypotheses may be tested against non-parametric alternatives using the static:

$$(mN)^{1/2}\frac{s_{res}^2 - s_v^2}{s_v^2} \xrightarrow{D} N(0,1) \tag{8}$$

under H_0, where s_{res}^2 is the estimate of the residual variance from the parametric regression. When I insert a constant function for f equation (8) constitutes a test of significance of the scale variable x against a non-parametric alternative. The resulting test statistic is 10.89 indicating a strong scale effect of external finance dependence and financial development on growth. Next I test a quadratic model for the interaction term. The resulting statistics is 5.80, suggesting that the quadratic model is still inadequate.

For robustness I repeated my estimation and inference procedures using various orders of differencing. Parameter estimates changed little and tests of significance and specification were consistent with the conclusions above.

It is possible that measures of financial development for a country are endogenous. Countries that have higher growth rates are more likely to have better financial institutions in place. One might therefore expect the measures of financial development to be positively correlated with the residual in an equation where the dependent variable is growth rates or value added. This in turn would lead to underestimation of the effect of external financial dependence and financial development. Rafael La Porta et al (1996) suggests that the origin of a country's legal system has an effect on the development of a domestic capital market and on the nature of the accounting system. Countries colonized by the British tend to have sohpisticated accounting system while countries colonized by the French tend to have poor standards. This suggests using colonial origin of a country's legal system as one instrument. The second instrument I use is rule of law, an index of efficency and integrity of legal system

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produced by Business International Corporation, a country-risk rating agency. I modify the specification in equation (1) to allow for a simple form of endogenity as follows:

$$y = f(External\ Finance\ Dependence * Financial\ Development) + \eta\gamma + z\beta + v \quad (9)$$

where η is defined by the instrumental variable equation $\text{Financial Development}=\text{Instrumental Variables} * \pi + \eta$ and $\text{E}(v\ |\text{External Finance Dependence*Financial Development}, \eta, z) = 0$. (See Blundell and Duncan (1998) and Newey, Powell, and Vella (1999).) After estimating η from an OLS regression, equation (9) is estimated using differencing. The coefficient of η is 0.0893 with a standard error of 0.1151, which would not result in the rejection of the null hypothesis that financial development is exogenous. Using instrumental variable in the pure parametric estimation resulted little change in the coefficient for the interaction between the external finance dependence and financial development and the Hausman (1978) test statistic ($\chi_1^2 = 0.66$) was also insignificant.

5. Panel Data Analysis

5.1 Panel Data Setup

The availability of several years of data permits me to assess the stability of parametric effects over time as well as the stability of non-parametric scale effect. The testing of these hypotheses will be the two main objectives of the panel data analysis. The basic model is given by $y_{jkt} = f_t(x_{jkt}) + z_{jkt}\beta_t + v_{jkt}$. Now the residual is:

$$v_{jkt} = u_{jk} + \varepsilon_{jkt} \quad (10)$$

where, conditional on x's, $E(u_{jk}) = 0$, $Var(u_{jk}) = \sigma_u^2$, $E(\varepsilon_{jkt}) = 0$, $Var(\varepsilon_{jkt}) = \sigma_\varepsilon^2$, $Cov(\varepsilon_{jkt}, \varepsilon_{jks}) = 0$ for all t.

The presence of country-industry specific effects requires keeping track of how data have been reordered. Data are ordered so that the x's are in increasing order in period 1. Data in all subsequent periods are initially in the same order as the data in the first period. This only ensures that the corresponding country-specific effects are in the same position in each year, but it's not longer the case that the corresponding x's are close. Permutation matrices are used to reorder data and quadratic forms to estimate variances, see details in Yatchew (2000). The permutation matrix reorders the data stacked across all periods so that corresponding x's are close within each period. The OLS estimator applied to the stacked, reordered and differenced data is identical to the estimator in equation (7) applied year by year. However, its asymptotic covariance matrix must account for correlations between residuals over time arising out of the individual specific effect. This requires consistent estimation of σ_u^2 and σ_ε^2. Estimates of σ_u^2 and σ_ε^2 will be used to test the stability of the non-parametric effect.

5.2 Empirical Results

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Figure 2 shows the estimation of the non-parametric component using the pooled data where the estimated parametric effects have been removed using private credit to GDP ratio as the measurement of financial development. After getting an estimate of β from the stacked, reordered and differenced data, I obtain $s_v^2 = 0.21$, $s_u^2 = .18$ and by subtraction $s_\varepsilon^2 = 0.11$. Thus, about 86% of the variance of the residual is attributable to the country-industry specific effect. To test constancy of parametric effects over time, the estimated covariance matrix is used in the conventional asymptotic chi-square statistics for testing linear restrictions. The test statistic is 14.76, indicating rejection. Casual comparison of year by year estimation would suggest that they are not too different. However, since the residuals are dominated by a country-specific effect and the explanatory variables are highly correlated over time, coefficient estimates are also highly correlated over time. Therefore, even small differences are statistically significant. I also test the equality of non-parametric regression functions. The standardized statistic has a standard normal distribution under the null hypothesis. The test statistic is 0.48, indicating that the null cannot be rejected.

6. Conclusions

The central objective of this paper is to estimate the effect of external finance dependence and financial development under relatively weak functional form assumptions. Formal testing rejects the parametric function in favor of its semiparametric counterpart. The results indicate that the interaction between external finance dependence and financial development has a non-linear effect on growth rates, and exhibits decreasing returns to scale.

It may be useful to compare this paper's findings to those of other studies. Rajan and Zingales (1998) uses the same data averaged over ten year period. Looking at the industry at the 75th percentile of external finance dependence, Machinery, and the 25th percentile, Beverages, and the country at the 75th percentile of financial dependence, Italy, and the 25th percentile, Phillipines, Ranjan and Zingales (1993, p. 574) state that "Machinery should grow 1.3 percent faster than Beverages annually, in real terms, in Italy as compared to the Phillipines…the annual growth rate is, on average, 3.4 percent per year. So a differential of 1.3 percent is a large number." Using semiparametric estimation approach, this paper finds that Machinery should grow percent faster than Beverages annually in Italy as compared to the Phillipines. The difference between the two numbers is significant.

Apart from using the new semiparametric methodology, this paper's findings suggest that the change in financial institutions that leads to better financial development has the greatest influence on the rate of economic growth for countries starting with low financial development, by reducing the cost of external finance to financially dependent firms, or put simply, the cost of external finance to financially dependent firms is greatest for countries with more financial frictions. However, further financial development for already financially developed countries will only lead to smaller increases on the rate of economic growth for the

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financially dependent firms. The interaction effect of external finance dependence and financial development on growth rates exhibits a decreasing return to scale relationship.

This paper also suggests that financial development plays a disproportionate role in the rise of new firms in different countries. If the new firms are disproportionately the source of ideas, a positive change in financial development can enhance innovation and thus leads to growth and this effect is stronger in countries with weaker financial development.

Finally, the findings in this paper suggest a fresh explanation for the pattern of industry specialization and growth across countries. For a country starting out with a lot of financial frictions, it is easier to increase its growth rates in the industries that are not financially dependent when it chooses to improve its financial development. Therefore, for the financially underdeveloped countries, it is in their best interest to improve their financial institutions and focus on producing products that are least dependent external finance in order to speed up the process of "catching up" to the developed countries.

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References

Blundell, R., and A. Duncan. 1998. “Kernel Regression in Empirical Microeconomics.” *Journal ofHuman Resources* 33:62–87.

Hausman, J. 1978. “Specification Tests in Econometrics.” *Econometrica* 46:1251–1271.

Newey, W., J. Powell, and F. Vella. 1999 “Nonparametric Estimation of Triangular Simultaneous Equations Models.” *Econometrica* 67:565–603.

Rajan, R. and L. Zingales. 1998. “Financial Dependence and Grwoth.” *American Economic Review* 88:559-586.

Schumpeter, J. A. 1911. “A Theory of Economic Development.” Cambridge, MA; Harvard University Press.

Sutton J. and D. Trefler. 2011. “Capabilities, Wealth and Export Mix.” Working Paper.

Yatchew, A. 1997. “An Elementary Estimator of the Partial Linear Model.” *Economics Letters* 57:1135-143.

Yatchew, A. 1998. “Nonparametric Regression Techniques in Economics.” *Journal of Economic Literature*, 36:669-721

Yatchew, A. 1999. “Differencing Methods in Nonparametric Regression: Simple Techniques for the Applied Econometrician.” Manuscript, University of Toronto.

Yatchew, A. 2000. “Scale Economies in Electricity Distribution: A Semiparametric Analysis.” *Journal of Applied Econometrics* 15:187-210.

Yatchew A. 2001. “Household Gasoline Demand in Canada.” *Econometrica* 6:1697-1709.

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Table 1 Parametric Components of Equation 1

	Financial development measured as			
Variable	Private Credit	Total Capitalization	Accounting standards	Accounting standards in 1983
Industry's share of total value added in manufacturing in 1980	-0.89 (0.15)	-0.92 (0.15)	-0.59 (0.14)	-0.41 (0.14)
Country fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
R^2	0.31	0.31	0.41	0.28
Number of observations	1253	1253	1075	866

Notes: The dependent variable is the 3rd order differenced annual compounded growth rate in real value added for the period 1980-1990 for each ISIC industry in each country after the data is sorted by the interaction between financial development and external finance dependence. External finance dependence is the fraction of capital expenditures not financed with internal funds for U.S. firms in the same industry between 1980—1990. The interaction variable is the product of external finance dependence and financial development. Financial development is private credit to GDP ratio in the first column, total capitalization in the second column, accounting standards in 1990 in the third column, and accounting standards in 1983 in the fourth column.

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Table 2 Parametric Analogues of Equation 1

	Financial development measured as							
Variable	Private Credit	Private Credit	Total Capitalization	Total Capitalization	Accounting standards	Accounting standards	Accounting standards in 1983	Accounting standards in 1983
Industry's share of total value added in manufacturing in 1980	-0.90 (0.14)	-0.90 (0.14)	-0.87 (0.14)	-0.86 (0.14)	-0.41 (0.13)	-0.44 (0.13)	-0.30 (.13)	-0.31 (0.13)
Interaction (external dependence x financial dependence)	0.07 (0.02)	0.10 (0.03)	0.06 (.02)	0.10 (0..03)	0.14 (0.03)	0.24 (0.07)	0.08 (.04)	0.10 (.08)
Interaction (external dependence x financial dependence)^2		-0.02 (0.01)		-0.03 (0.02)		-0.08 (0.05)		-0.02 (0.05)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.29	0.29	0.28	0.28	0.42	0.42	0.30	0.30
Number of observations	1253	1253	1253	1253	1075	1075	866	866

Notes: The dependent variable is the differenced annual compounded growth rate in real value added for the period 1980-1990 for each ISIC industry in each country. External finance dependence is the fraction of capital expenditures not financed with internal funds for U.S. firms in the same industry between 1980—1990. The interaction variable is the product of external finance dependence and financial development. Financial development is private credit to GDP ratio in the first two columns, total capitalization in the third and fourth column, accounting standards in 1990 in the fifth and sixth column, and accounting standards in 1983 in the seventh and eighth column. The interaction variable is the product of external dependence and financial development. Interaction term alone is the linear parametric analogue of equation 1. Interaction and interaction term squared are the quadratic parametric analogue of equation 1.

Figure 1. Single-equation analysis of averaged growth rates over ten years – non-parametric component.

Notes: The y-axis is the average annual compounded growth rate in real value added for the period 1980-1990 for each ISIC industry in each country after differencing with order m=3. External finance dependence is the fraction of capital expenditures not financed with internal funds by firms in the same industry during the 1980's. This ratio is set to 0 if it is negative. Financial development is private credit to GDP ratio. This ratio is positive for all countries. The negative external finance dependence is set to zero for ease of interpretation. The following picture becomes V-shaped if negative external finance dependence is not set to zero, with the bottom part of V pointing around 0 and linear fitted line does not change much. A V-shaped curve still implies that for financially underdeveloped countries, an improvement in their financial institutions will lead to higher increases in growth rates in industries that are least dependent on finance. It is also possible to make the fraction of capital expenditures not financed with internal funds positive by adding the absolute value of the minimum to all values.

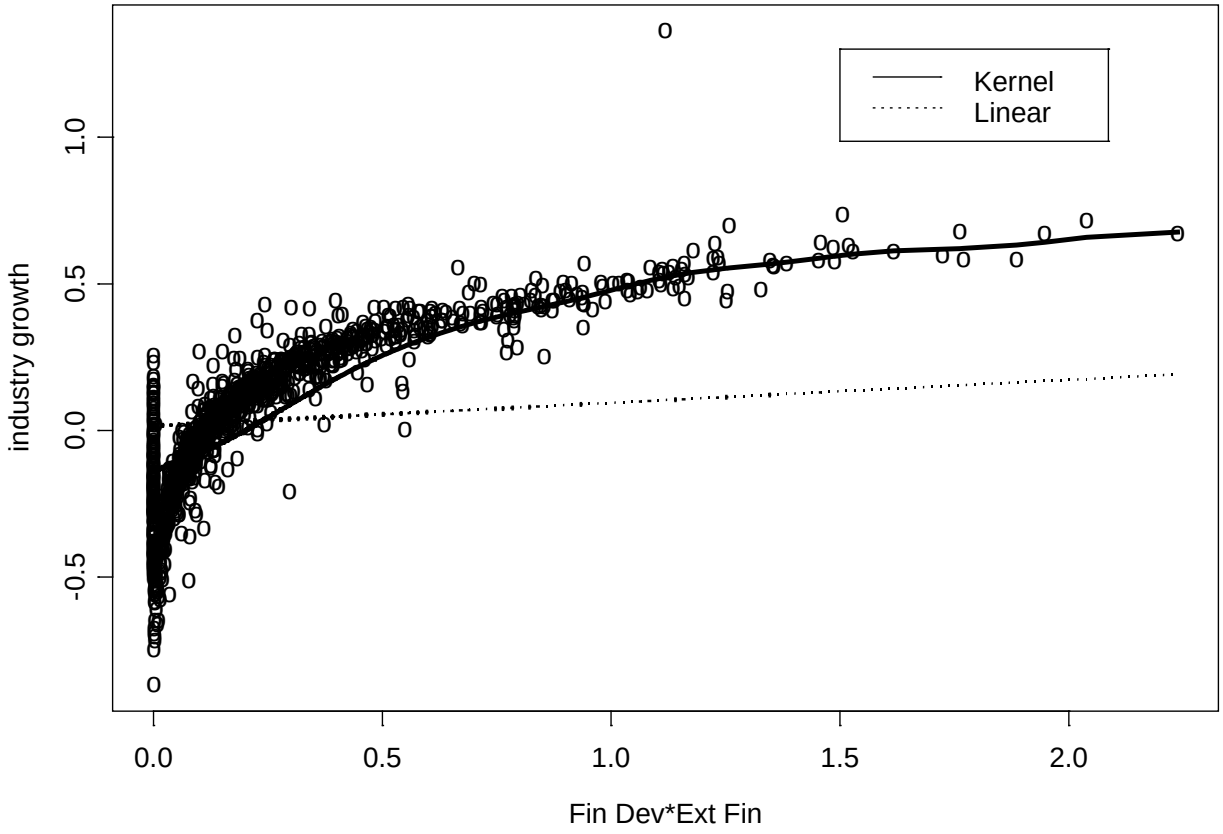

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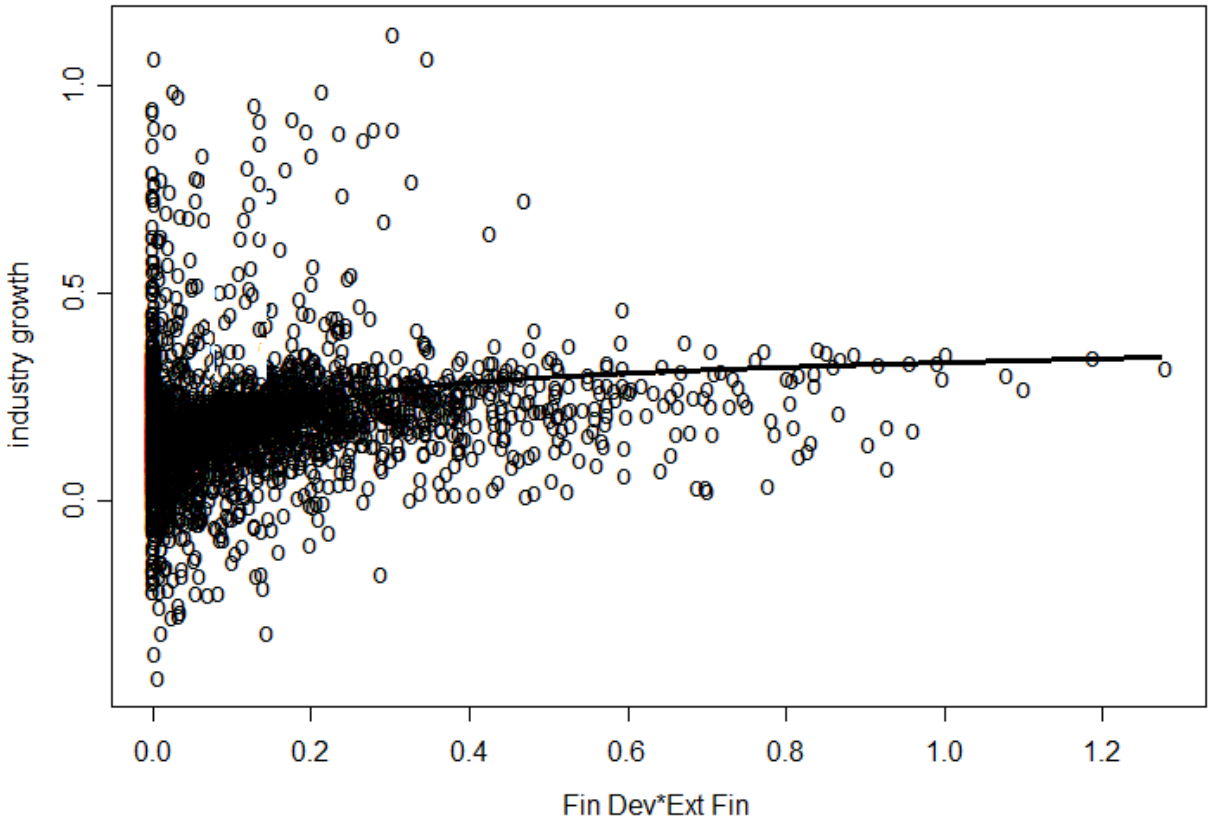
Figure 2 Panel data analysis growth rates 1980-1991 – non-parametric component

Notes: The y-axis is the average annual compounded growth rate in value added for every four years during 1980-1991 for each ISIC industry in each country after differencing with order m=3. The annual growth rate itself exhibits too much noise and therefore I look at the panel data in the averages of every four years. The results are similar if I used three or five years. External finance dependence is the fraction of capital expenditures not financed with internal funds by firms in the same industry during the 1980's. This ratio is set to 0 if it is negative. Financial development is private credit to GDP ratio. This ratio is positive for all countries. The negative external finance dependence is set to zero for ease of interpretation.



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