

# An empirical analysis of Growth of Korean firms after the Asian Crisis: with a focus on technology

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## Abstract

After the Asian crisis in 1997, Korean firms have been fastly diversifying, depending on their technological capability and efforts. Before the crisis, Korean firms were more or less like bandwagon trails. Large leading firms called *chaebol* invested heavily in physical capital to broaden their territories, while their supplying firms faithfully followed the simple technological guidelines provided by *chaebols* and executed necessary investments. It was around at the asian crisis that the demand was not large enough to sustain such aggressive investments for production capacity expansion.

Since the crisis, Korean firms have drastically turned their attention from physical investments to R&D investments. Some large *chaebols* have surged as global technological leaders and some small and medium firms have stood firmly only with their devotion to technological innovations. As a result, surprisingly, the Korean economy is now better than ever in its macroeconomic indicators: 5% growth, positive trade balance, stable prices as such. However, such a healthy situation is not well felt by many people. For there are many firms that are not only longer profitable with their outdated technology or production know-how and do not know how to get through. As a consequence, jobs are endangered and remain as huge concerns to people.

This paper empirically analyzes the firm growth dynamics and diversification for which technological capability is believe to have a crucial role. And it finds that R&D efforts get more crucial to explain firm growth than capital investments, which implies strongly the structural change of the Korean economy.

For its methodology, this paper hints upon Crepon, Duguet, and Mairesse (1998, CDM) but modifies CDM, composed of four equations, into a simpler one composed of the following two equations, considering into account the research purpose and data sources:

$$\frac{R_i}{Q_i} = \kappa Q_i + \text{dummies} + v_i$$
$$\Delta \ln Q_i = a_L \Delta \ln L_i + \rho_K \frac{V_i}{Q_i} + \rho_C \frac{R_i}{Q_i} + \text{dummies} + \varepsilon_i$$

In the above equations,  $i$  denotes a firm,  $Q$  gross output,  $V$  physical investment,  $R$  R&D investments,  $L$  the number of employees, and  $v$  and  $\varepsilon$  errors.  $\Delta \ln$  denotes translog, that is, differentiation of a variable over any consecutive two

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periods (years in this paper).  $V/Q$  and  $R/Q$  are called capital intensity and R&D intensity respectively. *dummies* are sectoral ones and some types of firms.

This paper investigates the structural change of the Korean economy based on two kinds of listed manufacturing companies: KSE and KOSDAQ, Korean version of NYSE and NASDAQ respectively and major data sources are financial statements. Since these firms mostly have a certain degree of R&D investments, sample selection is not a crucial issue, which enables to omit an equation related to the selection issue in CDM. And financial statements do not include data of innovation output such as sales due to innovation or patents. So I shorten two equations of CDM bridged by innovation output into a one, the second above. I assume that there maybe a certain degree of correlation between  $\nu$  and  $\varepsilon$ . So 2SLS will be used to avoid simultaneity problem, by taking fitted value of R&D density based on the first equation.

The above two equations are rewritten with variable names as follows.

$$rdd_i = \kappa \ln size_i + IC_i' s + firmcategory_i' s + \nu_i$$

$$turngrr_i = a_L empgrr_i + \rho_K fasstvd_i + \rho_C rdd_i + IC_i' s + \varepsilon_i$$

$rdd$  (or  $fasstvd$ ) is the annual average of R&D (or capital) intensity over years.  $lnsize$  is the log of employment in the beginning of each period.  $turngrr$  (or  $empgrr$ ) is the annual average growth rate of turnover (or employment) over years. IC's are sector dummies (see note of Table below). *firmcategories* are *venture*, *ftgroup*, *fingroup* (see note of Table below).

The periods during which annual averages are calculated are three: (1) 1993–97 (2) 1998–2002 and (3) 2003–2006. The 2SLS regression results are in the following Table. In dummies, *ic1(food)* serves as a reference.

From the analysis we have the following notable discoveries. Beginning with panel 1, first, the relation between R&D intensity and the size of firm is mixed over periods. But after the asian crisis, it is negative. Second, among the dummies, *venture*, *ic4*, *ic7*, *ic10* show an outstanding positive relation to R&D density (*venture* means a small and medimum firm with technological capability, *ic4*, *ic7*, and *ic10* are respectively chemicals, electronics, and SW).

Now turning to panel 2, third, R&D density's contribution gets increasing to firm growth in turnover with a positive degree after the crisis (coefficient of  $rdd$ ). Fourth, on the other hand, Capital density's contribution gets diminishing though still positive (coefficient of  $fasstvd$ )

These discoveries contribute to capitulate the Korean economy in two aspects. First, the Korean economy gets more knowledge-intensified as seen in the outstanding role of R&D intensity to firm growth. Second, such a structural change is more prominent in venture firms. Considering that the development of the Korean economy was pulled and driven by large *chaebols*. The emergence of venture firms is surely an outstanding new feature and may prognoses further

structural change in a way to diversity the Korean economy.

<Table> Estimation Results by Period (2SLS)

	period 1 (93-97)	period 2 (98-02)	period 3(03-06)
<b>panel 1: dependent variable <i>rdd</i></b>			
Insize	0.22 ***	-1.94 *	-0.30
venture	-0.18	9.02 **	2.47 ***
ftgroup	0.41	2.35	0.22
fmggroup	-0.22	0.25	-1.27
ic2	-0.26	-4.39	0.00
ic3	0.07	-4.41	-0.66
ic4	1.11 ***	-1.46	1.93 **
ic5	0.36	-2.94	0.14
ic6	0.00	-4.71	-0.60
ic7	1.49 ***	0.33	2.65 ***
ic8	0.93 **	-3.56	0.54
ic9	0.71 *	-3.77	0.61
ic10	4.64 ***	1.16	6.04 ***
_cons	-1.12 *	16.65 **	2.83
observation no	253	535	916
R-sq	0.274	0.04	0.16
<b>panel 2: dependent variable <i>turngr</i></b>			
rdd_	-0.76	0.18 ***	0.50 **
fasstvd	0.23 ***	0.14	0.08 **
empgrr	0.42 ***	0.50 ***	0.45 ***
ic2	2.85	-1.59	-0.77
ic3	6.38 *	3.43	0.94
ic4	3.53	1.27	4.65
ic5	0.77	2.97	-1.35
ic6	2.94	0.59	11.80
ic7	8.55 ***	5.10	8.00
ic8	4.63 *	6.54	8.19
ic9	2.72	-0.05	9.92
ic10	25.05 **	11.81	-1.38
_cons	10.18 ***	6.40 **	1.51
관측수	253	535	916
R-sq	0.330	0.040	0.268

Note 1: rdd\_ fitted rdd from panel 1 as a predicted variable.

Note 2: sector dummines: IC1(food), 2(textile), 3(wood), 4(chemicals), 5(non-metal), 6(metal), 7(electronics), 8(cars), 9(construction), 10(SW).

Note 3: firm category: venture (small and medium technology oriented firm), ftgroup (first-tier *chaebol* firms), fmggroup (second-tier *chaebol* firms). *Chaebol* is a Korean-specific large family-based conglomerate

Note 4: In panel 2, rdd\_, fasstvd, empgrr are uncorrelated with each other (correlation is less than 0.2) and OLSs with one dependent variable and the others turn out very low R-sq(less than 0.1). This confirms no serious collinearity.