Background paper for Chapter on Indonesia

International Linkages, Market Structure, and Development in Indonesia*

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1. Introduction

The manufacturing industry was a main driver of remarkable economic growth that Indonesia registered during the late 1980s and 1990s before the economic crisis. The share of manufacturing industry in GDP increased from 17 percent in 1986 to 27 percent in 1997 (Takii, 2006). In the period, many important taxes and regulations on trade and investment were reduced or eliminated for manufacturing plants in Indonesia. In general, these measures are thought to have contributed to increased competition, which led to the remarkable growth before the 1997-1998 economic crisis. According to the results of Bird (1999), the simple average of four-firm concentration ratio for the Indonesian manufacturing declined from 64 percent in 1975 to 54 percent in 1993.

After the crisis competitive pressures appear to have increased as deregulation and trade liberalization continued despite a severe economic contraction. On the other hand, there has been much discussion of competition policy in Indonesia but the effects of such policy had been expected to be limited in view of deficiencies in the legal system. Instead, trade reform was thought to be invariably cleaner and quicker (Hill, 1997, p.68). However, no known studies how the level of competition has actually changed in the post-crisis period and the

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purpose of this paper is thus to examine how producer concentration has changed at the industry level and to investigate the determinants including international linkages of the concentration in the Indonesian manufacturing. Section 2 first explains the data examined in this paper and then examined market structure, the trend of MNCs and trade using the data for 1990-2005. Section 3 explores the determinant of concentration by using econometric method. Taking account for the dynamic nature of concentration, GMM technique is employed for the estimation. Finally, section 4 provides some concluding remarks.

2. Market Structure in Indonesian Manufacturing

2.1. Indonesian Manufacturing and Data

One of the difficulties in measuring the level of concentration comes from the limitation of data. Fortunately, a dataset is available on the Indonesian manufacturing, which is rigorous compared to datasets for other developing economies. Indonesia's BPS-Statistics (former Central Bureau of Statistics) conducts industrial surveys annually since 1975. The surveys cover manufacturing plants with 20 or more workers (L&M plants). For example, the survey for 2005 includes information related to 20.279 L&M plants. The aggregated results of the surveys are published as *Large and Medium Manufacturing Statistics*. The micro-level dataset enables us to calculate some measures of concentration for the Indonesian manufacturing.

However, it is worth to note several problems which occur when we calculate some measures of concentration using the dataset. First, the dataset is at a plant-level. In general, the level of concentration should be measured at a firm-level because producers' behavior is determined at a firm-level. The measurement bias would be large when a relatively number of firms operate multi-plants. For example, a large firm in food industry has plants all over the country.[1] Second, the dataset covers only plants with 20 or more workers. Therefore, the measures of concentration for the L&M manufacturing would be smaller than that of total manufacturing industry. Third, the survey covers manufacturing plants so the resulting

[1] This bias is partially accounted for in the regression analysis in this paper.

measure of concentration is producer concentration rather than seller concentration. Forth, all plant is classified by Indonesian standard industrial classification (ISIC) based on their main product. The bias caused by this would be large when a relatively large number of plants are manufacturing multi-products. Finally, there are a relatively large number of unusual data entries that seems to be caused by measurement, typing, or other possible errors. Although these problems exist, the dataset would be most helpful to investigate the trends of concentration in the Indonesian manufacturing.

2.2. Concentration in the Indonesian Manufacturing

Table 1 shows the concentration ratio of the largest 10 plants. The index at a 2-digit ISIC level was calculated as sales-weighted average of the shares of the large 10 plants in terms of sales in a sub-industry at a 3-digit ISIC level (CR10). CR10 was chosen instead of CR4 or CR5 which is broadly used, because the dataset is at a plant-level instead of a firm-level. The variable, sales, was defined as sum of production and decrease in inventory of finished goods. Plants with non-positive sales were dropped from the sample used in analyses in this paper. For data before 2000, ISIC codes at revision 3 were estimated from the information on ISIC at revision 2 and a concordance table between revision 2 and 3 (BPS-Statistics, 2000). For the calculation, wearing apparels made of fur [ISIC182], recording reproduction [223], Train [352], Aero plane [353] and recycling [37] (because the number of observations is too small), and petroleum products [23], office, accounting, data processing machineries [300] (because data do not seem to reflect actual activity in the industries) were dropped from sample for the analyses.

Table 1
Concentration Ratio (10 manufacturing plants, percent)

ISIC	Industry	1990	1995	90-95	2000	95-00	2005	00-05	90-05
15-	Food products	36.9	31.8	-	35.9	+	40.5	+	+
155	Beverages	68.1	60.4	-	66.7	+	45.1	-	-
16	Tobacco	87.6	89.1		84.3	-	80.3	-	-
17	Textiles	26.2	27.9		28.4		48.3	+	+
18	Wearing apparel	18.5	16.5		16.2		24.1	+	+
191	Leather products	51.4	49.6		56.4	+	69.7	+	+
192	Footwear	46.2	34.5	-	46.3	+	57.5	+	+
20	Wood products	21.2	25.5	+	22.2	-	26.0	+	+
21	Paper	68.0	63.1	-	75.9	+	64.8	-	-
22	Publishing	58.2	62.0	+	57.4	-	51.1	-	-
24	Chemicals	50.1	46.2	-	47.4		45.8		-
251	Rubber products	32.5	35.4	+	47.4	+	44.3	-	+
252	Plastics products	38.3	31.0	-	26.5	-	24.8		-
26	Non-metallic mineral prod.	78.8	70.0	-	78.0	+	78.9		
27	Basic metals	81.2	75.0	-	77.9		78.6		
28	Fabricated metals	44.3	41.5		46.1	+	36.7	-	-
29	General machinery	66.1	75.0	+	79.3	+	70.9	-	+
31	Electrical machinery	91.5	85.1	-	83.8		79.9	-	-
32	Radio, television & communi.	93.3	80.7	-	66.6	-	71.2	+	-
33	Precision machinery	94.0	97.2	+	97.8		98.0		
34	Motor vehicles	92.1	90.2		89.9		82.1	-	-
35	Other transport Equipment	90.2	91.8		92.1		85.9	-	-
361	Furniture	25.2	18.3	-	18.2		17.0		
369	Miscellaneous manufacturing	59.9	41.3	-	39.9		63.0	+	+
	Number of +			5		9		8	9
	Number of -			11		5		10	11

Notes) "+/-" indicates increase/decrease by more than 3 percent point.

According to the results, the trends of concentration measured by CR10 vary among industries and periods. Of the 24 industries listed in the table, the measure of concentration increased (more than 3 percent point) during 1990-1995 in 5 industries. On the other hand, it decreased in 11 industries. These trends were reversed in some industries during 1995-2000. As a result, the measure of concentration increased in 9 industries and decreased in 5 industries during the period. The number of industries in which the measure of concentration decreased was increased from 5 during 1995-2000 to 10 during 2000-2005. In longer term, the measure of concentration increased in 9 industries and decreased in 11 industries during 1990-2005. The industries with increased concentration include textiles, leather products, and footwear. In these industries, the measure of concentration increased mainly during 2000-2005. Table 2 shows Herfindahl-Hirschman Index (HHI, times 100) for each industry. The trends of the number of industries with increased/decreased HHI (more than 1 perbbcent point) are similar with that of CR10.

Table 2
Herfindahl-Hirschman Index (percent)

ISIC	Industry	1990	1995	90-95	2000	95-00	2005	00-05	90-05
15-	Food products	36.9	31.8	-	35.9	+	40.5	+	+
155	Beverages	68.1	60.4	-	66.7	+	45.1	-	-
16	Tobacco	87.6	89.1		84.3	-	80.3	-	-
17	Textiles	26.2	27.9		28.4		48.3	+	+
18	Wearing apparel	18.5	16.5		16.2		24.1	+	+
191	Leather products	51.4	49.6		56.4	+	69.7	+	+
192	Footwear	46.2	34.5	-	46.3	+	57.5	+	+
20	Wood products	21.2	25.5	+	22.2	-	26.0	+	+
21	Paper	68.0	63.1	-	75.9	+	64.8	-	-
22	Publishing	58.2	62.0	+	57.4	-	51.1	-	-
24	Chemicals	50.1	46.2	-	47.4		45.8		-
251	Rubber products	32.5	35.4	+	47.4	+	44.3	-	+
252	Plastics products	38.3	31.0	-	26.5	-	24.8		-
26	Non-metallic mineral prod.	78.8	70.0	-	78.0	+	78.9		
27	Basic metals	81.2	75.0	-	77.9		78.6		
28	Fabricated metals	44.3	41.5		46.1	+	36.7	-	-
29	General machinery	66.1	75.0	+	79.3	+	70.9	-	+
31	Electrical machinery	91.5	85.1	-	83.8		79.9	-	-
32	Radio, television & communi.	93.3	80.7	-	66.6	-	71.2	+	-
33	Precision machinery	94.0	97.2	+	97.8		98.0		
34	Motor vehicles	92.1	90.2		89.9		82.1	-	-
35	Other transport Equipment	90.2	91.8		92.1		85.9	-	-
361	Furniture	25.2	18.3	-	18.2		17.0		
369	Miscellaneous manufacturing	59.9	41.3	-	39.9		63.0	+	+
	Number of +			5		9		8	9
	Number of -			11		5		10	11

Notes) "+/-" indicates increase/decrease by more than 3 percent point.

2.3. MNCs and the Indonesian Manufacturing

Up until the mid 1980s, import substitution was pursued as a way to promote industrialization in Indonesia. However, trade reforms were initiated in the beginning of the 1980s when declining prices of oil and other raw materials resulted in a balance of payment crisis. More specifically, the exchange rate was depreciated, tariffs and non-tariff barriers were substantially reduced, various import bans were abolished, local content regulations relaxed, and the custom procedures made more efficient as well as financial liberalization (Sjöholm and Takii, 2006). The reforms continued throughout the 1980s and 1990s. The gradual relaxation or removal of restrictions on FDI and other MNC activities since the late 1980s was one of the reforms that accelerated in the early- to mid-1990s. For example, a deregulation in 1994 removed restrictions on foreign ownership shares and minimum capital

Table 3
Share of sales accounted for by foreign-owned plants (percent)

ISIC	Industry	1990	1995	90-95	2000	95-00	2005	00-05	90-05
15-	Food products	15.8	21.3	+	27.3	+	32.1	+	+
155	Beverages	45.9	55.1	+	44.0	-	33.4	-	-
16	Tobacco	2.7	4.5	+	6.9	+	3.4	-	+
17	Textiles	20.2	20.4	+	26.2	+	24.5	-	+
18	Wearing apparel	7.9	31.1	+	42.1	+	44.2	+	+
191	Leather products	6.2	20.3	+	19.5	-	49.4	+	+
192	Footwear	36.8	54.7	+	67.6	+	63.7	-	+
20	Wood products	12.1	13.8	+	18.0	+	17.4	-	+
21	Paper	26.9	32.6	+	28.4	-	21.3	-	-
22	Publishing	1.6	11.8	+	3.2	-	18.9	+	+
24	Chemicals	41.7	47.0	+	55.6	+	31.6	-	-
251	Rubber products	28.3	24.7	-	26.7	+	34.9	+	+
252	Plastics products	13.5	29.5	+	27.0	-	32.5	+	+
26	Non-metallic mineral prod.	28.0	31.4	+	38.6	+	36.4	-	+
27	Basic metals	35.0	35.6	+	34.7	-	28.1	-	-
28	Fabricated metals	31.4	51.5	+	59.3	+	39.8	-	+
29	General machinery	37.2	53.7	+	65.7	+	48.0	-	+
31	Electrical machinery	36.2	36.4	+	64.2	+	49.4	-	+
32	Radio, television & communi.	36.6	81.2	+	80.1	-	51.7	-	+
33	Precision machinery	22.5	50.5	+	63.1	+	85.0	+	+
34	Motor vehicles	65.7	72.5	+	80.6	+	86.0	+	+
35	Other transport Equipment	30.4	22.4	-	31.8	+	72.5	+	+
361	Furniture	9.9	12.6	+	19.9	+	15.5	-	+
369	Miscellaneous manufacturing	24.7	49.6	+	58.9	+	62.7	+	+
	All	24.5	32.0	+	38.2	+	35.2	-	+
	Number of +			22		17		10	20
	Number of -			2		7		14	4

requirements, and further relaxed divestment requirements (Pangestu 1996). These policy changes explain in part why MNC shares increased more rapidly since the late 1980.

Table 3 shows the share of sales accounted for by foreign-owned plants. Combining all industries analyzed, the share of sales accounted for by foreign-owned plants increased from 25 percent in 1990 to 32 percent in 1995. Even after experiencing the economic crisis in 1997-1998, the share increased to 38 percent in 2000 before slightly decreasing to 35 percent in 2005. The share of foreign-owned plants widely varies across industries. For example, in 2005, the share is only 3 percent in tobacco while the share is 86 percent in motor vehicles. In addition, the changes in the share also differ across industries and periods. During 1990-1995, in most of the 24 industries the foreign share of sales increased with exceptions of rubber products and other transport equipment. After that, however, the number of industries where the foreign share of sales decreased increased from 7 during 1995-2000 to 14 during 2000-2005. In sum, the share of sales accounted for by foreign MNCs rapidly increased in the first

half of 1990s but the pace slowed down in the second half. After the 2000, the shares are declined in many industries. However, the share is higher in 2005 compared to the shares in 1990 in most of the industries analyzed in the table with exceptions of beverages, paper, chemicals, and basic metals.

2.4. International Trade and the Indonesian Manufacturing

The series of liberalization since the 1980s resulted in the large increase in manufacturing export and import (Table 4). Total export, which was calculated as the sum of exports corresponding to industries classified based on ISIC analyzed here, increased from US$12 billion in 1990 to US$51 billion in 2005 accounting for three-fifth of the total export in Indonesia (bottom of the table). Although the growth rate was much slower than that of export, corresponding total imports also increased from US$18 billion in 1990 to US$36 billion in 2005. For comparison, the size of market for the L&M manufacturing and the size of international market for all of the manufactures in Indonesia were calculated by deflating WPI (1993=100).[2] Real manufacturing exports increased from Rupiah 27 trillion in 1990 to Rupiah 101 trillion, while real sales in the L&M manufacturing increased from Rupiah 47 trillion in 1990 to Rupiah 157 trillion in 2005. Comparing the annual average growth rates, the size of international markets grew faster during 1995-2000. During other periods, the markets grew at almost same rate. The two growth rates are similarly declining over time from 14 percent during 1990-1995 to 4 percent during 2000-2005. On the other hand, the ratio of real exports (the size of international markets for all of the manufactures in Indonesia) and the size of real sales (markets for the L&M manufacturing) increased from 56 percent in 1990 and 1995 to 63 percent in 2000 and 2005, indicating that the degree of export

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[2] Sales in each industry were deflated by deflated by wholesale price index (1993=100). WPI for each industry at a 2-digit Indonesian SIC level is chosen from WPI for nearest category in BPS-Indonesia, *Economic Indicators*. Trade figures are taken from BPS-Indonesia, *Foreign Trade Statistics*. HS codes were converted to Indonesian SIC revision 3 using a concordance table provided by BPS-Statistics after minor modification. Exports and imports were deflated by WPI for exports excluding oil/gas and WPI for imports (1993=100), which are taken from *Economic Indicators*.

Table 4
Shares of manufacturing exports and imports by industry

ISIC	Industry	1990	1995	90-95	2000	95-00	2005	00-05	90-05
15-	Food products	12.3	10.6	9.4	14.9	2.9	5.7	7.3	7.6
155	Beverages	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1
16	Tobacco	0.6	0.4	0.4	0.4	0.0	0.1	0.2	0.1
17	Textiles	11.8	10.2	9.0	6.6	3.6	3.5	4.7	1.8
18	Wearing apparel	12.7	10.9	10.7	8.9	0.1	0.0	0.1	0.2
191	Leather products	0.7	0.5	0.7	0.4	0.5	1.0	0.8	0.3
192	Footwear	4.8	7.4	4.3	2.8	0.3	0.4	0.4	0.2
20	Wood products	28.6	18.1	9.4	6.2	0.1	0.2	0.4	0.5
21	Paper	2.0	4.9	7.6	6.3	2.1	2.7	4.0	2.7
22	Publishing	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.2
24	Chemicals	6.2	7.5	9.4	10.2	21.4	20.5	25.9	23.5
251	Rubber products	0.6	1.0	1.1	1.9	0.5	0.5	0.9	1.0
252	Plastics products	0.6	1.0	1.4	1.6	0.7	0.7	1.0	1.0
26	Non-metallic mineral prod.	2.0	1.3	2.0	1.8	1.2	1.5	0.9	1.0
27	Basic metals	8.5	5.1	5.5	9.2	10.4	10.5	9.6	13.6
28	Fabricated metals	1.0	1.5	1.6	1.3	3.0	2.3	3.0	3.2
29	General machinery	0.4	1.3	1.9	2.8	27.8	24.1	17.1	19.9
31	Electrical machinery	0.7	2.5	4.6	5.0	4.2	5.4	3.1	4.3
32	Radio, television & communi.	1.1	6.5	11.5	9.2	3.6	4.6	2.1	4.4
33	Precision machinery	0.4	0.8	0.9	0.8	2.6	1.8	2.0	1.4
34	Motor vehicles	0.2	0.5	0.9	2.7	8.5	9.1	8.0	8.5
35	Other transport Equipment	0.7	1.2	0.8	0.9	3.5	2.5	4.9	1.9
361	Furniture	2.4	3.1	3.9	3.6	0.2	0.1	0.1	0.2
369	Miscellaneous manufacturing	1.6	3.9	2.7	2.3	2.6	2.6	3.3	2.6
Mfg. export/import (US$ bil.)		11.8	27.9	39.0	50.7	17.9	34.0	24.4	36.1
	In Rupiah, deflated by WPI (Rupiah trillion)	26.5	50.1	83.5	100.5	34.9	67.0	65.0	74.7
	Average annual growth (%)		13.6	10.8	3.8		13.9	-0.6	2.8
Sales in L&M manufacturing, Deflated by WPI (Rupiah tri.)		47.0	89.4	132.0	158.6	47.0	89.4	132.0	158.6
	Average annual growth (%)		13.7	8.1	3.7		13.7	8.1	3.7
	Trade*100/Sales	56.4	56.1	63.3	63.4	74.2	75.0	49.2	47.1

Notes) "+/-" indicates increase/decrease by more than 3 percent point.

orientation increased recently. On the import side, the ratio of real imports to real sales largely decreased from 74 percent in 1990 to 47 percent in 2005, indicating that the degree of import penetration decreased.

The rest of the table shows export/import shares of each industry in total manufacturing exports/imports. The traditional export-oriented industries (textiles, wearing apparels, and wood products) have been losing shares of exports. For example, the share of wood products decreased from 29 percent in 1990 to 6 percent in 2005. On the other hand, Radio, television & communication and chemicals gained shares largely during the period. More than one-forth of the total manufacturing imports was general machinery in 1990, but the share

declined to less than one-fifth in 2005. On the other hand, the share of food products, basic metal, and chemicals increased during the period.

3. Determinants of Market Structure

3.1. Conceptual Framework and Review

There are several previous studies empirically investigating market structure. Most of these studies consider scale economies (e.g., minimum efficient scale of plant size), barriers to entry (e.g., initial capital requirement) and the size of the market as key determinants of steady-state concentration level because these factors determines the optimal number of plants in a market in the long-run. According to Curry and George (1983), the results of previous studies suggest that the level of concentration is positively correlated with plant scale economy and initial capital requirement, and is negatively correlated with industry size as predicted by related theory.

In addition to these key determinants, there are several factors that are expected to affect the level of concentration especially in a developing country like Indonesia. First, some of the developing economies have liberalized trade regime as did in Indonesia. The import penetration can decrease market share accounted for by domestic producers and increase the degree of competition and thus it is expected to be more difficult for new firms to operate profitably.[3] On the other hand, the increase in the degree of import penetration can affect the rate of exit. In the case where a few large inefficient firms have had market power for some reasons (e.g., import protection, non-economic power), these firms are more likely to be force to exit from the market or lose market share, creating opportunity for smaller and more efficient firms to gain market share. In the case where many small firms have been inefficient, small firms lose market share and the degree of concentration is expected to be increased. In any case, the large increase in imports causes the disturbance of existing market structure at lease in short-run, and the effect of import penetration on concentration depends on the relationship between the distribution of plant efficiency and market shares at a firm-level in

[3] See Caves (1985) for a survey on the relationship between international trade and market structure.

an initial period. For example, the result of Bhattacharya (2002) which examined Malaysian manufacturing suggests significantly positive relationship between concentration and import penetration. On the other hand, Ratnayake (1999) found an evidence for the negative relationship between the two variables only during 1984–1987 when the liberalization program was intensified in New Zealand. Bhattacharya and Bloch (2000) examined the effect of import penetration on concentration using data for Australian manufacturing which faced substantial import penetration during the sample period. However, they could not find significant effect on concentration. The liberalization of trade has also increased exports in Indonesia. The export orientation is also thought to affect market structure. The access to international markets increases the size of markets for producers in Indonesian manufacturing. Therefore, export orientation is expected to have negative correlation with the level of concentration.

Another related international linkage factor is FDI. The effect of FDI on concentration is partially similar with that of import penetration. One of the main different aspects is that MNCs are likely to cause another oligopoly. Foreign MNCs are able to break down local oligopolies because they are thought to have firm-specific intangible assets (Caves, 2007; Ratnayake, 1999) but, at the same time, such assets enable them to have and keep market power by putting up entry barrier. On the other hand, the technology and skill transferred to their affiliates may spillover to other firms in host economies (Blomström and Sjöholm, 1999; Takii, 2005). The introduction of technology transferred from advanced economies can brought in more efficient operation and thus minimum efficient scale of plant operation can be lowered. In this case, the optimum number of plants in an industry will be increased. The empirical study of Ratnayake (1999) suggests that the share of sales accounted for by foreign MNCs is positively correlated with the level and change of concentration. Driffield (2001) also suggest that the change in share of sales accounted for by foreign MNCs is positively correlated with the change of concentration in U.K. manufacturing. On the other hand, Amess and Roberts (2005) found a supporting evidence of U-shape relationship between change in foreign share of output and concentration. The result suggests that until reaching a turning point the entry of MNCs decreases the degree of concentration but begin to increase when the foreign share exceeds over a certain level. Similarly with MNCs, the existence of government-owned firms is also thought to affect market structure in Indonesia. The

privatization of large government-owned firms is expected to affect negatively the level of concentration.

These effects of increased competition through international linkages vary among industries because the direction and scale of the effects depend on the distribution of plant efficiency/productivity in an industry, as mentioned above. Traditional industrial organization assumes that larger firms have higher productivity (or price-cost margin) exploiting scale economy compared to other smaller firms in industries with relatively large minimum efficient scale. Therefore, relatively large firms are more likely to survive in facing international competition because they have higher productivity. However, this expectation of positive relationship between plant scale and productivity is not always realized because not only plant scale but also other several factors can affect plant productivity. This indicates that a measure of scale economy such as minimum efficient scale cannot properly suggest the optimum number of plants in an industry. In addition, the reverse relationship is likely to have occurred in developing economies where there would have been greater room for large inefficient firms to survive under protectionism or for other non-economic and sometime political reasons. In equilibrium in more competitive markets, the smaller the productivity gap between relatively large and small firms is (cost disadvantage ratio) the lower the degree of concentration is expected to be.

Geographical dispersion of producers is thought to be one of the determinants of concentration at a national level. This factor is important in counties that have broadly separated territories like Indonesia. High domestic transportation cost is also an important characteristic of developing economies. The degree of geographical dispersion of producers varies among industries depending on scale economy and transportation cost of products. When producers are geographically concentrated, it is easier for consumers to switch between suppliers making the market more competitive (Syverson, 2004). Therefore, producers seeking for location where they can operate profitably are likely to disperse geographically in industries where transportation cost of products is relatively high. The level of concentration at a national level is expected to be positively correlated with the level of geographical dispersion of producers. In addition, there is another advantage of taking account for geographical dispersion in this paper. As mentioned in Section 2.1, measures of the concentration are only available at a plant-level in Indonesian manufacturing. The measures

of concentration at a plant-level may underestimate concentration at a firm-level when a relatively large number of firms have multi-plants. The inclusion of a variable on geographical dispersion partially controls for the downward bias in the plant-level concentration measures because firms operating multi-plants are likely to locate them in different location near to each market to save transportation cost.

3.2. Specification and Econometric Issues

Using the panel dataset explained in Section 2.1, the measures of concentration (y_{it}) in industry i in year t are regressed on the determinants discussed above (strictly exogenous variables $\mathbf{x}_{it}$ and exogenous variables $\mathbf{z}_{it}$). One of the advantages in using panel dataset is that we can examine intertemporal relationship (not cross sectional) among the variables accounting for the time-invariant industry-specific factors (η_i). The estimated equation can be written as follows:

$$y_{it} = \alpha_0 + \boldsymbol{\beta}_0 \mathbf{x}_{it} + \boldsymbol{\gamma}_0 \mathbf{z}_{it} + \eta_i + v_{it} . \quad (1)$$

Previous studies have estimated this kind of level equation which is thought to represent the relationship in equilibrium but also partial adjustment model (see Levy, 1985; Bhattacharya and Bloch, 2000; Driffield, 2001; Bhattacharya, 2002; Athreye and Kapur, 2006). A partial adjustment model assumes that the adjustment of disequilibrium is incomplete and is partial. Denoting the level of concentration in equilibrium as y*, a partial adjustment model can be written as follows:

$$y_{it} - y_{it-1} = \lambda(y^*_{it} - y_{it-1}) + u_{it} , \quad (2)$$

where the coefficient λ represents the rate of adjustment to deviations of the initial level of concentration from its equilibrium level. Substituting Equation (1) into (2) yields:

$$\begin{aligned} y_{it} &= \lambda(\alpha_0 + \boldsymbol{\beta}_0 \mathbf{x}_{it} + \boldsymbol{\gamma}_0 \mathbf{z}_{it}) + (1-\lambda) y_{it-1} + \mu_i + \varepsilon_{it} \\ &= \alpha + \boldsymbol{\beta} \mathbf{x}_{it} + \boldsymbol{\gamma} \mathbf{z}_{it} + (1-\lambda) y_{it-1} + \mu_i + \varepsilon_{it} \end{aligned} . \quad (3)$$

where $\alpha=\lambda\alpha_0$, $\boldsymbol{\beta}=\lambda\boldsymbol{\beta}_0$, $\gamma=\lambda\boldsymbol{\gamma}_0$, $\mu_i=\lambda\eta_i$ and $\varepsilon_{it}=\lambda v_{it}+u_{it}$.

The usual panel estimation technique (fixed effects model or random effects model) cannot yield consistent estimates in a dynamic panel data (DPD) model like Equation (3). Arrelano and Bond (1991) suggest GMM technique to estimate a DPD model. In the methodology, Equation (3) is first transformed into first-difference type to eliminate the

individual effects, η_i, from the model. In the first-difference model, however, Δy_{t-1} is correlated with $\Delta\varepsilon_t$ (Δ is first-difference operator) so the OLS estimates are biased. The GMM technique uses all or part of the set $\{y_{t-2}, y_{t-3}, \ldots, y_1\}$ as instrumental variables because $E[y_{t-i}\ \Delta\varepsilon_t]=0$ (i=2, 3,…). It is known that instruments used for the GMM estimators (thereafter denoted as DIF-GMM) are likely to be weak when the individual series have near unit root properties (Bond, 2002, p.154). To address this problem, Blundell and Bond (1998) suggest additional moment condition or that Δy_{t-1} can be valid instruments for the level equation (Equation 3). The simulation results of Blundell and Bond (1998) suggest that he extended GMM estimator (thereafter denoted as SYS-GMM) has much smaller bias and much greater precision (see Bond, 2002). These methodologies can also be applied to Equation (1) which potentially involves an endogenous variable problem. The lagged endogenous variables are used as instrumental variables.

More specifically, a following dynamic equation (Equation 3) will be estimated using above technique:

$$\begin{aligned} MOC_{it} = {} & \alpha_0 + \beta_1 \ln(MES_{it-1}) + \beta_2 \ln(ICR_{it-1}) + \beta_3 \ln(SOM_{it}) + \beta_4 \ln(EO_{it}) + \gamma_5 IP_{it} + \beta_6 GD_{it} \\ & + \beta_7 SOG_{it} + \gamma_5 SOF_{it} + \gamma_6 CDR_{it-1} + (1-\lambda) MOC_{it-1} + \eta_i + v_{it} \end{aligned} \quad (4)$$

where MOC_{it} refers to a measure of concentration in industry i (at a 3-digit Indonesian SIC level, revision 3) in year t (CR10 or HHI). MES is minimum efficient scale measured as the median of real sales of the largest firms accounting for a 50 percent share of industry sales.[4] ICR is a proxy for initial capital requirement, which is measured as the upper quartile of fixed capital stock in an industry. SOM is the size of markets measured as total real sales. EO is a proxy of export orientation measured as the ratio of exports to the sum of exports and total sales by large and medium manufacturing plants.[5] SOG is the share of sales accounted for by government-owned plants, which are defined as plants with 50 percent or more (central and local) government ownership share. GD is a proxy for geographical dispersion of producers,

[4] Real sales are calculated as sales deflated by wholesale price index. WPI for each industry at a 2-digit Indonesian SIC level is chosen from WPI for nearest category in BPS-Indonesia, *Economic Indicators*.

[5] Trade figures are taken from BPS-Indonesia, *Foreign Trade Statistics*. HS codes were converted to Indonesian SIC revision 3 using a concordance table provided by BPS-Statistics after minor modification.

which is measures as HHI calculated based on sales at a provincial level. The variables explained above are mainly determined by technology used in each industry or exogenous demand. Therefore, these variables are assumed exogenous variables. IP is a proxy for import penetration measured as the ratio of imports to the sum of total sales by large and medium manufacturing plants and imports. SOF is the share of sales accounted for by foreign-owned plants. CDR is a proxy for cost disadvantage ratio between relatively large and small plants, which is measured as the ratio of average TFP for the largest firms accounting for a 50 percent share of industry sales to average TFP for others. The TFP index for each plant was calculated based on Good, Nadiri, and Sickles (1999), which is suitable for a panel dataset. These three variables are though to be determined simultaneously with market structure. If an industry is not competitive due to oligopoly by inefficient firms, imports and the entry of MNCs would be increased because foreign exporters and foreign investors expect that they can successfully compete with the local existing firms. The productivity gap between relatively large and small firms is thought to be partially determined by market power.

3.3. Estimation Results

The Indonesian manufacturing experienced deep depression during and after the economic crisis. In this period, the price level increased drastically and demand deeply dropped, resulting to the 13 percent decrease in real GDP in 1998. To avoid catching up these unusual effects on the equilibrium level of concentration in the manufacturing and thus on regression results, data for 1990-1995 and for 2000-2005 were used to estimate Equation (4). For the differenced equation in the system GMM estimation, MOC_{t-2}, SOF_{t-2}, CDR_{t-2}, and further lags were used for instruments. Data for first two years were used as lag of the dependent variable and instrumental variable for it. Therefore, sample periods for the estimation are 1992-1995 and 2002-2005, respectively. For comparison, regression models with CR10 and HHI as dependent variables were respectively estimated (Table 5). The m2-tests of no second-order serial correlation and Sargan tests of overidentifying restrictions were passed for all of the four equations. According to the estimation results, the coefficients on lagged dependent variable were statistically significant at least at 10 percent level. This implies the persistency of concentration over time.

Table 5
Results of the system GMM estimation

Dependent variable	CR10		HHI	
Period	1992-1995	2002-2005	1992-1995	2002-2005
Ln(MES)	0.836	3.944***	-4.210***	2.811***
	(0.666)	(2.862)	(7.316)	(4.314)
ln(ICR)	1.984*	3.835**	2.654***	3.130**
	(1.706)	(2.408)	(2.918)	(2.268)
ln(SOM)	-1.821	-5.066**	-0.726	1.600
	(1.019)	(2.265)	(0.485)	(1.230)
Ln(EO)	-2.809***	-4.838***	-2.098**	-3.615***
	(3.108)	(3.215)	(2.131)	(5.132)
IP	0.018	0.064	-0.099***	0.096**
	(0.661)	(1.244)	(3.687)	(2.497)
GD	0.138***	0.192***	0.294***	0.262***
	(3.855)	(5.052)	(9.081)	(7.87)
SOG	0.117***	0.224***	0.303***	-0.010
	(2.910)	(2.861)	(7.640)	(0.185)
SOF	0.146***	0.151***	0.261***	-0.116***
	(3.267)	(2.704)	(16.480)	(2.717)
CDR	0.268	-0.817	2.376***	0.242
	(0.432)	(1.540)	(8.404)	(0.597)
MOC_{t-1} $(1-\lambda)$	0.649***	0.369***	0.075*	0.245***
	(12.930)	(6.466)	(1.727)	(12.152)
Year dummies	Included	Included	Included	Included
Tests (p-value)				
m1-test	0.001***	0.000***	0.061*	0.004***
m2-test	0.915	0.567	0.614	0.660
Sargan test	0.304	0.985	0.549	0.269
Joint significance test				
- All variables	0.000***	0.000***	0.000***	0.000***
- Year dummies	0.879	0.002***	0.043	0.649
Nob (=ind. X year)	228(=57x4)	228(=57x4)	228(=57x4)	228(=57x4)

Notes) Figures in parentheses are t-ratios. ***, **, and * indicate coefficient is significant at 1 percent, 5 percent, and 10 percent level, respectively.

Minimum efficient scale (ln(MES)) was an important determinant of concentration during 2002-2005. The significantly positive coefficients suggest that minimum efficient scale is positively correlated with concentration as suggested by theory. The variable was not statistically significant or negative in the estimated model for 1992-1995. On the other hand, however, the coefficients on initial capital requirement were significantly positive in the model for the period.

Regarding to the effects of market size, the size-of-market variables (ln (SOM)) were negative for the four models as suggested by theory. The coefficients were statistically significant only in the model of CR10 for 2002-2005, and not significant in other models. However, the coefficients on export orientation variable, which is related to market size, were significantly negative for all estimated models. This indicates that the growth of export

markets decreases the level of concentration. These results suggest that the growth of market including international markets has contributed to the decline in the level of concentration in the Indonesian manufacturing.

The coefficients on import penetration were statistically significant in the models of HHI, but the sign of coefficients were different between 1992-1995 and 2002-2005. The negative coefficient in the model for the pre-crisis indicates that import penetration is negatively correlated with the level of concentration. The positive coefficient in the model for the post-crisis period indicates that the increase of imports make the markets smaller for domestic producers and then positively affect the level of concentration.

The coefficients on the share of government-owned plants were significantly positive in three models of the estimated four models, indicating that the privatization process can contribute to the decline in the level of concentration. The positive coefficients on the share of foreign-owned plants in the model of CR10 for 1992-1995 and 2002-2005 and the model of HHI for 1992-1995 suggest that the increase of MNCs tended to have positive correlation with the level of concentration in the Indonesian manufacturing. The coefficients on geographical dispersion variable were significantly positive for all estimated models and the coefficient on CDR was significantly positive only in the model of HHI for 1992-1995.

4. Concluding Remarks

This paper has investigated the trend of concentration in the Indonesian manufacturing. The level of concentration, which was measured by concentration ratio for 10 manufacturing plants and Herfindahl-Hirschman Index, was increased in a relatively large number of industries in the post-crisis period compared to the pre-crisis period. The results of analysis also suggest that international linkages are important determinants of the level of concentration in Indonesia. In particular, the results provide supporting evidence that the increase in export decreases the level of concentration in the manufacturing sector. This indicates that, given small domestic markets, exporting enlarged markets for producers in the Indonesian manufacturing and contributed to decline in the concentration levels. On the other hand, the results of import penetration and the entry and presence of MNCs were not clear. The sign and significance of coefficients were different among models. The coefficient on

import penetration was significantly negative in the regression of HHI for the pre-crisis period, but the corresponding coefficient was positive in the regression for post-crisis period.

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