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Institutional diversity and technological systems of Asian capitalisms

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ABSTRACT.

This paper looks to contribute to the recent literature on institutional comparative analyses of Asian economies; it makes three distinct contributions. First, we investigate the institutional diversity of Asian economies by using multivariate methods, and show five different groups within Asian economies that can be distinguished from advanced economies. Second, we verify the correlation among institutional configuration, industrial structure, and economic development with a simple statistical method. Third, based on firm-level patent data, we determine whether institutional environments have a favorable effect on the innovation activities of firms. We emphasize that the current institutional diversity can persist, given the positive interaction between the institutional diversity of Asian economies and the innovation activities of Asian firms.

Keywords: Diversity of Asian economies, Institution, Innovation, East Asia, Multiple factor analysis, *Régulation*, Varieties of Capitalism.

A. INTRODUCTION

The past few decades have seen an increasing amount of debate concerning economic integration within East Asia[1], with the backdrop of rapidly growing economies in Asia. The economic integration in Asia has, it seems, progressed in terms of the evolution of the international division of labor amongst such countries as China, Japan, South Korea, and other ASEAN countries, along with increases in foreign direct investment (FDI) and international production networks among these countries and with other Asian economies. This *de facto* integration has been led by massive and rapid capital inflows from transnational corporations (TNCs).

However, Asian economies have not institutionalized regional integration; they have quite different historical and development paths on one hand, and on the other, the countries in this region have competed actively with each other to gain competitive advantages.

In discussing the relevance and feasibility of economic integration, we need to understand the differences among these economies and their interdependence or complementarity with each other. Hence, we must clarify the institutional diversity of Asian economies and investigate how that diversity has evolved and will continue to evolve.

The past two decades have seen an increasing number of comparative institutional studies of advanced capitalism. For example, studies taking the *Régulation* or Varieties of Capitalism approaches [Amable, 2003; Boyer, 2004; Hall and Soskice, 2001] argued that an economic system is not entirely characterized by a particular institutional domain; rather, it comprises a bundle of different institutions. These studies also indicated that, under certain conditions, institutions can be complementary [Aoki, 2001; Hall and Soskice, 2001]. Simultaneously, empirical analyses have documented a wide diversity of capitalism by using statistical methods and quantitative data [Amable, 2003; Hall and Gingerich, 2004; Hall and Soskice, 2001; Pryor, 2005].

Despite these studies' significant contributions to the diversity of capitalist theory, they have several limitations when applied to Asian economies. First, most assume that Asian economies are homogeneous. Amable [2003] analyzed 21 OECD countries, including Japan and South Korea. His analysis argued that the classification of capitalism could not always be binary, as earlier suggested by Hall and Soskice [2001], but is better expanded to five types. Japan and South Korea are categorized into a group described as representing "Asian capitalism" in comparison to advanced forms of capitalism[32]. Although it is possible to understand a specific "Asian capitalism" different from Western forms of capitalism, we find it problematic to restrict the breadth of Asian economies to be represented by these two countries.

As the center of the global economy has begun to shift from Western to Asian economies, Asian capitalism has come under the global spotlight [cf. Storz et al., 2013], and some researchers have begun to grapple with Asian economies within the literature on the institutional diversity of economies [Walter and Zhang, 2012; Harada and Tohyama, 2012; Tohyama and Harada, 2013; Witt and Redding, 2013; Zhang and Whitley, 2013]. These studies have demonstrated that Asian capitalism can be institutionally distinguished from that of advanced economies but that there is also institutional diversity within Asian capitalism.

For example, Harada and Tohyama [2012], using a methodology based on Amable [2003], identified five types of Asian capitalism by applying multivariate analysis methods, including multiple factor analysis (MFA) and cluster analysis, to institutional datasets covering five different domains. Though analyzing a different dataset, Witt and Redding [2013] also found five types of Asian economies based on five institutional domains. Unlike Harada and Tohyama [2012], they argue that (post-) socialist economies such as India and China should be classified into a specific cluster. The existence of this type arises from the adoption of the "role of the state" as an

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[1] According to the World Bank [1993], "East Asia" includes not only Northeast Asian countries such as China, Japan, and South Korea, but also Southeast Asian countries such as the members of ASEAN. For the sake of simplicity, our use of the term "Asia" refers to East Asia.

[2] Kitschelt *et al.* [1999] propose the same group as group-based Coordinated Market Economies (CMEs), by expanding the conception of CMEs of Hall and Soskice [2001], although their analysis was descriptive.

3 Masahiko Aoki proposes a new version of the flying geese pattern of economic development that takes account of the influence of political institutions and social norms. See http://www.rcast.org/sites/default/files/geese-basic-J.pdf.

[2] Kitschelt *et al.* [1999] propose the same group as group-based Coordinated Market Economies (CMEs), by expanding the conception of CMEs of Hall and Soskice [2001], although their analysis was descriptive.

institutional domain. Although we recognize the importance of Witt and Redding's argument in that they have incorporated an institutional domain, the state, that was missing in Hall and Soskice [2001] and Amable [2003], we find it problematic that rapidly growing China and India are categorized in the same group as Vietnam and Laos. Theoretically speaking, such a classification would encounter serious problems in explaining why the two more populous countries have outperformed the stagnated economies of Vietnam and Laos despite having similar institutional characteristics. In addition, from the viewpoint of empirical analysis, the post-socialist group might be determined by a sole institutional domain, the "role of the state." While analyses such as Witt and Redding are useful, they cannot reveal the relative importance of various institutional domains for categorizing Asian economies because the empirical approach depends solely on cluster analysis.

Second, we also investigate the relationship between institutional diversity and technological system of Asian capitalisms. Here, technological system is considered to have two dimensions: firm behavior (innovation) and industrial specialization. In the era of globalization, individual firms face much higher levels of competition than previously. They must fight for survival under such conditions, and so differentiation among them in terms of behavior and/or performance is expected to increase. Although precedent theories such as that of Hall and Soskice (2001] are based on the idea that institutional environments constrain patterns of how firms behave, they single-mindedly focus on the institutional configurations in which individual firms are embedded, rather than on firm behavior itself. In other words, they seem not to be concerned with how individual firms respond to their institutional environments. Given that Asian firms that operate in similar institutional environments often exhibit different behaviors, we need to reinvestigate the linkage between institutions and firms.

Furthermore, another problem is the influence of institutional configuration on the firm behavior and the composition of industries, which is resulted from collections of firm behaviors. It is Comparative Institutional Advantage (CIA) argued by Hall and Soskice [2001] that deals with such a problem. According to them, "the basic idea is that the institutional structure of a particular political economy provides firms with advantages for engaging in specific types of activities there" [Hall and Soskice 2001; p. 37]. It implies that the institutional environment of an economy constrains patterns of firm behavior and, consequently, forms a particular type of industrial specialization in that economy.

Third, precedent theories are not concerned with the global supply chain in East Asian economies. This chain reinforces closer links among the economies, a condition that can make it possible to generate dynamic complementarities: the development of an institution in one economy improves that institution and its evolution in another, related economy [cf. Aoki, 2010]. Hence, when considering the institutional diversity of Asian forms of capitalism, we should examine how firms in Asian economies associate with the global supply chain.

We make three distinct contributions to the literature. First, using multivariate methods, we investigate the institutional diversity of Asian forms of capitalism, and show that there are five different groups therein; these groups can be clearly distinguished from advanced groups. In addition, we show that diversity can persist, and that Asian forms of capitalism are not likely to converge into a single model.

Second, we briefly check the relationship among institutional configuration, economic development, and industrial structure. Although the Comparative Institutional Advantage (CIA) proposed by Hall and Soskice [2001] is acknowledged as an argument to relate institutional structure of an economy to a particular type of industrial specialization, we also have to consider the effect of economic development in order to examine the evolution of industrial structure in Asian economies because the economies with the different degree of economic development coexist in this area. More theoretically, we can imagine a traditional way to explain the diversity of Asian economies and the division of labor within each economy or between them, which is the so-called Petty-Clark's law [Clark 1957] and flying geese model [Akamatsu 1961, 1962; Kasahara 2004]. Considering the effect of institutional configuration and the complicated dynamism of Asian economies due to increasing FDI and international production linkages among them as

described above, such simple manners of thinking might have to be modified[3].

The comparative institutional advantage (CIA), proposed by Hall and Soskice [2001], is acknowledged to relate the institutional structure of an economy to a particular type of coordination at the firm level. In other words, this argument implies that the institutional structure conditions the strategies of firms; this argument leads empirical studies such as that of Hall and Gingerich [2004] to be preoccupied with determining the types of nationwide institutions. In those studies, the linkage between firm strategies and institutions is missing; in our analysis, we restore this missing linkage.

This paper is structured as follows. In the next section, we apply multiple factor analysis to East Asian economy data; we then examine, by cluster analysis, how many groups of economies can be found among the Asian economies. In the section C, we investigate the relationship between institutional diversity and patterns of industrial specialization. Section D deals with the issue of how, if at all, the institutional configurations derived in section 2 affect the innovation activities of East Asian firms; The final section provides concluding remarks.

B. INSTITUTIONAL DIVERSITY OF ASIAN ECONOMIES

Harada and Tohyama [2012] examined the institutional diversity of Asian economies and its determinants, through the use of multivariate methods. They show that Asian economies can be classified into five different types, based on the characteristics of their institutional configurations; these configurations consist of institutions found in different domains, such as the product market, labor market, financial market, education, social security, and international trade. In this section, we investigate the institutional diversity of Asian economies, based on the work of Harada and Tohyama [2012], so that we can eventually use the analytical results in subsequent firm-level data analysis.

B.1. PURPOSE AND METHOD

As in precedent studies, we assume that each economy is characterized by an institutional configuration that consists of institutions found in different domains, as discussed below. From that viewpoint, using multivariate methods, we investigate which factors determine the diversity of Asian economies, i.e., how many categories of Asian economy there are.

We apply two types of multivariate analysis: multiple factor analysis (MFA) and cluster analysis. The former is an extended version of principal component analysis (PCA), although it is not well known. MFA analyzes the variance of observations described by several sets of variables [Escofier & Pagès, 1998; Abdi & Valentin, 2007; Fusson, Le, & Pagès, 2011]. Here, observations and variables correspond to economies and institutions (or economic performance), respectively. Institutions are grouped into a few domains. First, we apply the MFA to sample economies; then, we carry out cluster analysis on the basis of the MFA results, in order to classify the economies into groups.

B.2. DATA

We examine 10 East Asian economies and 20 advanced capitalist countries[4]. We look at 54 variables from the following six institutional domains to identify the configuration of each economy: financial market (FM), product market (PM), labor market (LM), international trade (International), education (Edu), and social security (SS). In addition, we also include per-capita

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gross domestic product (GDP) as an indicator of economic development (EcoDev). A detailed list of variables is available in Harada and Tohyama [2012, pp. 260–261]. We use data from the 2004–07 period, because those data are full and complete, and the economies under examination were relatively stable during that period. Then, we obtain from the available data the average for each variable and use them within the analysis.
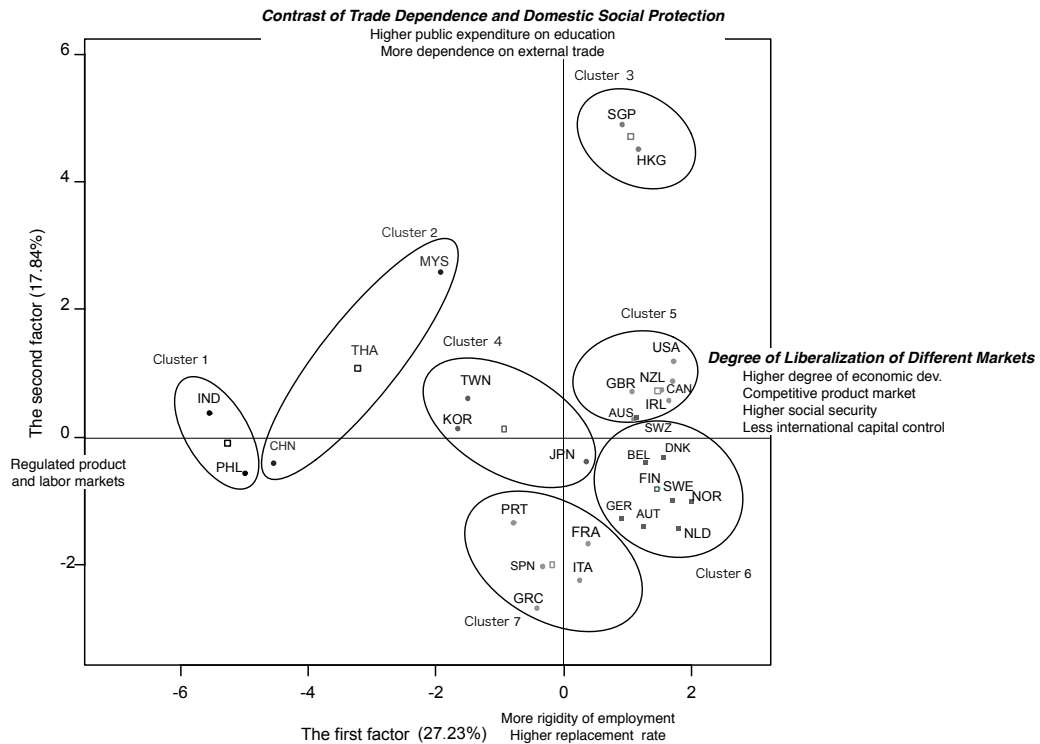
B.3. RESULTS

Figure 1 illustrates some of the results derived from the multiple factor analysis of the aforementioned Asian and advanced economies. In all, 45.07% of the variance among the economies can be explained by the first two factors. As indicated on the horizontal axis of Figure 1, the first factor had a contribution rate of 27.23%. Summarizing its components, we term it *the degree of liberalization of different markets*, which correlates with economic development. The vertical axis, representing the second factor (contribution rate of 17.84%), is termed *the contrast between trade dependence and domestic social protection.*

While the implication of the first factor is straightforward, the meaning of the second factor is somewhat paradoxical. Considering the connection between external trade and domestic policies, Ruggie [1982] developed the argument of "embedded liberalism," which implies an institutional nexus between post-war multilateral free-trade regimes and domestic social stability. Many other researchers have followed and developed this theory [Cameron, 1978; Rodrick, 1998].

Recent research has suggested that government spending and public social expenditures are positively linked to trade dependence in advanced countries but negatively linked in developing countries. For example, Wibbels [2006] argues that social expenditures in developing countries are likely to decrease during recessions because stakeholders such as trade unions lack sufficient power to maintain the pre-recession expenditure level in developing countries unlike advanced ones. Furthermore, spending on social security is reduced as trade dependence increases, although spending on human capital is more likely to be maintained. Wibbels' argument is compatible with the influence of some variables on our second factor: trade dependence correlates positively with public expenditures on education, a potential proxy for spending on human capital, and negatively with the replacement rate, which is connected to social security spending[5].

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[5] More precisely, the data analyzed shows two definite correlations for Asian economies: a positive one between trade dependence and public expenditures on education and a negative one between trade dependence and the replacement rate. Among advanced countries, these correlations are insignificant. Therefore, it could be argued that the second factor found in our analysis will lose its power to explain economies' institutional diversity as Asian capitalist economies develop and catch up to advanced ones.

Figure 1 Relative positions of Asian and Advanced economies in mid-2000s

Contrast of Trade Dependence and Domestic Social Protection
Higher public expenditure on education
More dependence on external trade

Source: Harada and Tohyama (2012) Figure 13.1

The results of cluster analysis using the MFA results are as follows (cf. Figure 1):

Cluster 1: Indonesia and the Philippines

Cluster 2: China, Malaysia, and Thailand

Cluster 3: Hong Kong and Singapore (These countries can be considered to have "*City capitalism.*")

Cluster 4: Japan, South Korea, and Taiwan

Cluster 5: Australia, Canada, United Kingdom, Ireland, New Zealand, and United States (These countries can be referred to as having "*Advanced liberal capitalism,*" named after the Liberal Market Economies (LMEs) presented by Hall and Soskice [2001].)

Cluster 6: Austria, Belgium, Switzerland, Denmark, Germany, Finland, Netherlands, Norway, and Sweden (These countries are referred to as having "*Welfare capitalism.*")

Cluster 7: Spain, France, Greece, Italy, and Portugal (These countries are referred to as having "*European mixed capitalism*"; this corresponds to the exceptional cluster, called "Mediterranean" in Hall and Soskice [2001].)

As can be seen, we can clearly distinguish groups of Asian economies from those of advanced economies. In addition, we conducted an analysis of institutional diversity among Asian economies and achieved results similar to those of the analysis of advanced economies, albeit with a few cluster differences (see Figure2). Considering the results of earlier analyses, the socio-economic context of each economy, and the preceding research outcomes, we can identify five groups of Asian economies, each of which is detailed below.

Figure 2 Relative positions among Asian economies in mid-2000s
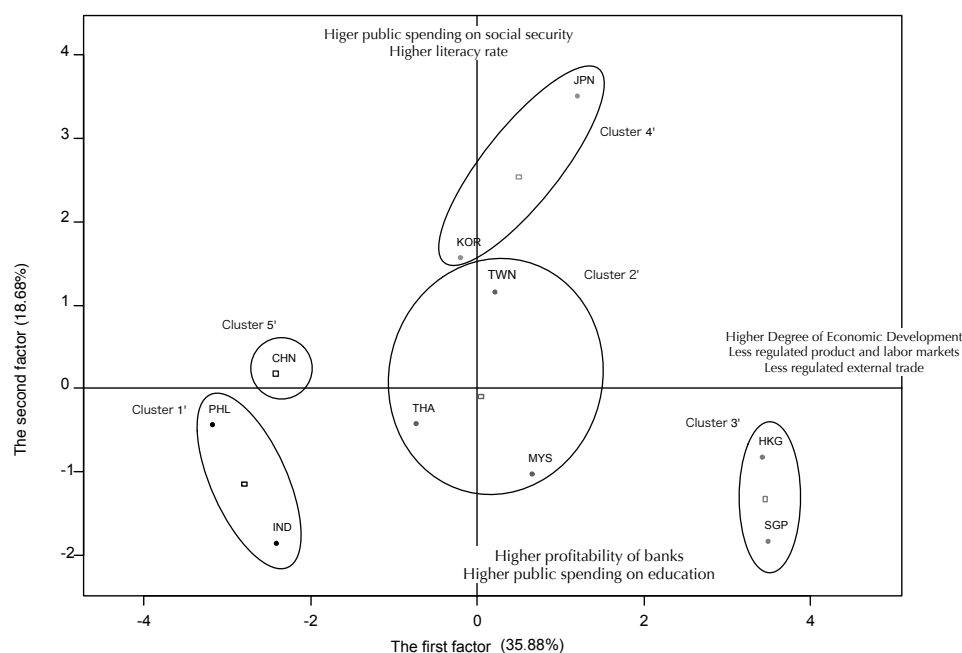
Source: Harada and Tohyama (2012) Figure 13.3

Group 1

Indonesia and Philippines: This group is characterized by a lower *degree of liberalization of various markets*. Moreover, both countries had experienced severe crises in terms of their political–economic regimes. For Indonesia, it was the Asian financial crisis in 1997, and for the Philippines, it was the external debt crisis in the early 1980s. Both countries were subject, for some time afterwards, to structural adjustment policies imposed by the International Monetary Fund (IMF). Such experiences might have stymied progress there, in terms of market liberalization, industrialization, and the introduction of FDI—unlike in Malaysia and Thailand, which are usually recognized as being ASEAN countries with relatively similar kinds of economies. Therefore, we could term these countries as having "*Insular semi-agrarian capitalism.*"

Group 2

Malaysia and Thailand: This group has characteristics similar to those of Group 1, in terms of *the degree of liberalization of markets*. Moreover, it has relatively higher public expenditure for education and a higher dependence on external trade, and less rigidity vis-à-vis employment and hours worked. Compared to the countries in Group 1, Malaysia and Thailand have not been heavily damaged by economic crises. We say that these countries feature "*Trade-led industrializing capitalism,*" because liberalization and industrialization have steadily advanced there, and these countries are integrated into the world-trade network via a global supply chain[5].

Group 3

Hong Kong and Singapore: The following characteristics are shared among the countries in this group: a significant *degree of liberalization of different markets*, higher *trade dependence*, lower *domestic social protection*, and the high profitability of the banking system. These countries can be termed as having "*City capitalism,*" a type analogous with the category seen in Berthelier *et al.* [2003].

Group 4

Japan, South Korea, and Taiwan: Higher economic development and barriers to entry in their product markets are observed as common characteristics in these countries. It might be difficult to recognize these countries as comprising a single group, since each country has its own

distinct features with regard to other variables. We can confirm much less cohesion, even in the time series in Figure 2. Moreover, it is observed that Japan is not highly integrated. Nevertheless, these three countries comprise a cluster from a statistical viewpoint, not only because they are clustered at the same, relative distance from other clusters, but also because they have had historical success in export-oriented industrialization, based on a number of innovations in the electrical goods industry. As such, the countries can be considered to have *"Innovation-led capitalism."* It should also be noted that this grouping aligns with the results of Berthelier *et al.* [2003].

Group 5

China: It shares many institutional characteristics with Malaysia and Thailand, as shown in the analysis with advanced economies. This would imply that its institutional configuration is heavily capitalist. However, it is distinct from those two countries in the analysis among Asian economies. Such characteristics might evoke China's peculiar political–economic regime, characterized by a "selective embrace of capitalism" [Chowdhury & Islam, 2007, p. 15]. Furthermore, as will be detailed below, analysis based on firm-level data also suggests that China is distinctive in how it pays attention to the relationship between institutions and innovation activities within firms. As Harada and Tohyama [2012] indicate, the share of domestic-marked-oriented firms in China is much larger than that found in other economies. Therefore, we consider China to have *"Continental mixed capitalism."* [see also Boyer, 2012]

B.4. PERSISTENCE OF DIVERSITY

Next, we investigate whether the diversity of institutional configurations persists—that is, whether Asian forms of capitalism are likely to converge into a single model. In order to answer this question, we extended the period of analysis both backward and forward. Figure 3 depicts the results of the MFA including the data from the mid-1990s to the period of 2007-11[6]; viewing the three different periods together shows the economies' transitions from the mid-1990s to the early 2010s. The first two MFA factors, corresponding to the figure's horizontal and vertical axes, are similar to those in Figures 1. It is evident that the diversity of economies found in the previous analysis persisted at least throughout the fifteen years under investigation; this suggests that Asian forms of capitalism are unlikely to converge to a single model (see Figure 3). However, some economies' relative positions show significant changes. For example, Cluster 5 in Figure 1 is divided into two groups, one of which includes Japan. As Japan has experienced different neoliberal institutional reforms since the 1990s, its position may have shifted to the right-hand side of the figure as market flexibility increased.

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[6] We collected institutional data from around 1995. However, the data in this period was much more limited because international organizations such as the World Bank had not yet begun providing high-quality quantitative institutional data. Therefore, it should be noted that the data used in the analysis is not completely consistent across all three different periods.
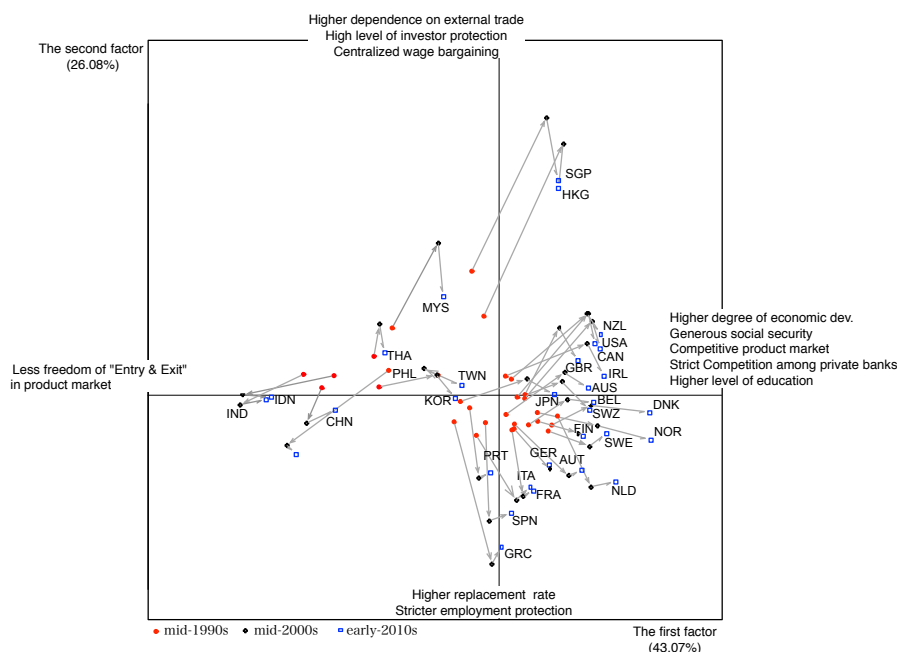
Figure 4: Transition of Economies from mid-1990s to early-2010s

Briefly stated, we show that there are five groups among Asian economies, in terms of institutional characteristics, and that the diversity has persisted for at least last fifteen years. Based on these analytical results, in the next section, we address the question of whether institutional configurations have a favorable effect on innovation activities, by examining firm-level data.

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c. CONSISTENCY AND DISCREPANCY BETWEEN INSTITUTIONAL CONFIGURATION AND INDUSTRIAL STRUCTURE

c.1. PURPOSE AND METHOD

How does the institutional configuration of a particular economy determine economic activities in that economy? Considering that it is firms that actually take actions in the economy, the problem is the influence of institutional configuration on the firm behavior and the composition of industries which is resulted from collections of firm behaviors. It is Comparative Institutional Advantage (CIA) argued by Hall and Soskice [2001] that deals with such a problem. According to them, "the basic idea is that the institutional structure of a particular political economy provides firms with advantages for engaging in specific types of activities there" [Hall and Soskice 2001; p. 37]. It implies that the institutional environment of an economy constrains patterns of firm behavior and, consequently, forms a particular type of industrial specialization in that economy.

The argument is faced with a following problem, being applied to the analysis of Asian economies. It is originally employed just for the analysis of advanced countries. As shown above, the institutional configurations of Asian economies are distinctly different from those of advanced countries. If the logic of CIA is applied to the Asian economies, one might suppose that the types of industrial specialization of Asian economies would be dissimilar from those of advanced countries as well. It is not, however, difficult to prove the conjecture by experimental analysis because of lack of data concerning innovation in Asian economies as Hall and Soskice had made use of.

What is more important is that there are economies with different degrees of economic development in Asia. It is often thought that economic development could considerably affect the evolution of industrial structure in Asian economies. There are two arguments which support such an induction. First, Petty-Clark's law would explain that the weight, such as share of employment or value-added, of industries shift away from primary (agriculture), secondary (manufacturing) sectors to tertiary (services) sector through the process of economic development [ex. Clark 1957]. Second, as for the evolution within manufacturing sector, the flying geese model proposed by Akamatsu [1961, 1962] would account for the catching-up process of some Asian economies which would be described by the overlapping dynamics of import, production, and export in industries[7].

Therefore, we can conjecture whether it is likely that the evolution of industrial structure in Asian economies is subject to the law and the model. Nevertheless, it doesn't imply that all the effects on the evolution of industrial structure in Asian economies are dependent on the economic development. For example, the activities of TNCs such as FDI, licensing, and subcontracting might enhance the growth of a particular industry. The activities of TNCs and the construction of international network of production would make connection among economies closer, so that the development of an institution and/or an industry in an economy would improve that of institution and the evolution of another economy [cf. Aoki 2010]. Therefore, the difference of industrial structure among Asian economies may be partly understood by that of institutional configurations.

The aim of the analysis below is to investigate the correlation between institutional configuration, economic development, and industrial structure. In other words, it verifies the extent to which the institutional configuration and the degree of economic development in an economy influence its situation of industrial structure respectively. To make it clear, we conduct two types of statistical analysis similar to that in the precedent section: MFA and Cluster analysis.

C.2. DATA

Ten Asian economies are dealt with as in the previous section. Databases of Asian Development Bank and United Nations are used as data sources. Industry is composed of two levels in this analysis: aggregate level (Primary, Manufacturing, and Tertiary) and disaggregated level (23 industries in manufacturing based on International Standard Industrial Classification (ISIC) Revision 3.0. Variables to represent the industrial structure are defined as follows: employment share (% of total employment in whole economy at aggregate level, % of manufacturing employment at disaggregated level), value added share (% of GDP at aggregate level, % of value added in manufacturing at disaggregated level), and labor productivity growth in an industry. Time period under investigation is from 2004 to 2007 in order to ensure compatibility with the analysis of institutional configuration.

C.3. RESULT OF ANALYSIS

MFA

The first two factors resulting from MFA explain 50.87% of the variance of economies (see Figure 5)[8]. The first factor (horizontal axis), whose contribution rate is 31.15%, suggests that the weights of primary (agriculture) sector and leather products industry regarding employment and value-added, the employment share of furniture industry, the value-added shares of industries of paper and tobacco products, and the productivity growth of food industry determine the variance of the economies on the positive side. The axis is also affected by the weights of tertiary sector with regard to both employment and value-added shares, and the

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7 For detailed survey, see Kasahara [2004], Kojima [2000]. According to them, the flying geese model per se has evolved along with the development of Asian economies such as deepening relationship among them through FDI.

8 While we identified four factors whose eigenvalues are more than one, we picked up the first two factors here. More detailed information of the results of the analyses presented below is to be requested to the authors.

employment shares of medical instrument, machinery, and fabricated metal industries on the negative side. The implication of the horizontal axis as a whole may be termed *the contrast of primary and tertiary sectors and/or traditional and advanced manufacturing*. On the other hand, the second factor explains 19.72% of the variance. It is significantly influenced by the productivity growth of the primary sector, value-added share of manufacturing sector and the employment share of chemical products industry on the positive side, and by the weights of employment and value-added of wearing apparel industry and the value-added share of printing industry on the negative side. What is interesting is that high weights of wearing apparel and printing industries is a characteristic of Hong Kong, so that the implication of the second axis is to classify it into a unique group.
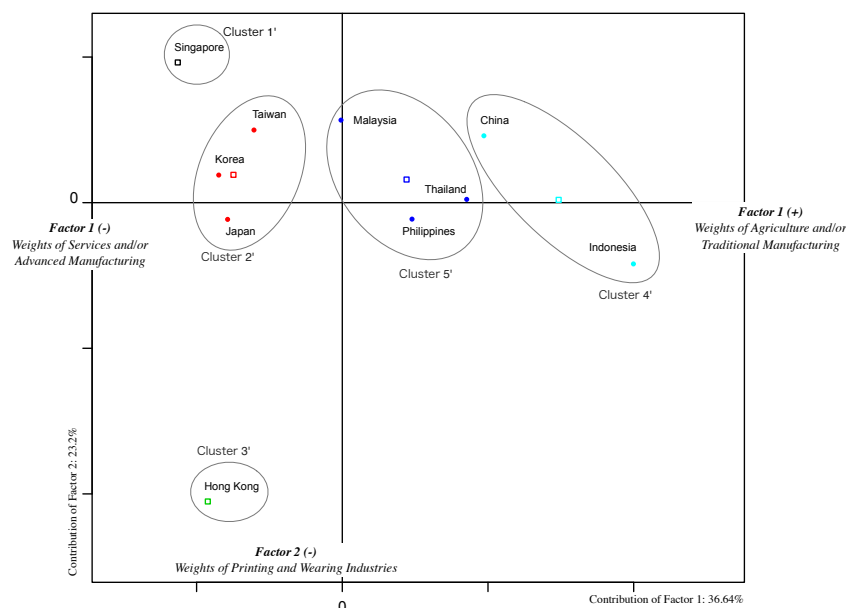

Figure 4 The Diversity of Industrial Structure in Asian Economies in 2000s

Cluster Analysis

Carrying out the Cluster analysis[9] using the result of the MFA, 5 clusters are recognized (Figure 4):

(Cluster 1') Singapore: This cluster is characterized by a significant low level of share of primary sector on one hand, high level of shares of advanced manufacturing industries.

(Cluster 2') Japan, Korea, and Taiwan: As common features of this cluster, we can point out the progress of tertiarization, high share of service sector with regard to employment and/or value-added, and relatively high share of advanced manufacturing industries such as fabricated metal products, and medical, precision and optical instruments.

(Cluster 3') Hong Kong: This cluster is characterized by the prominent progress of tertiarization, and high employment and value-added shares of wearing apparel, fur and high value-added share of printing and publishing.

(Cluster 4') China and Indonesia: These countries have common features of relatively high shares of employment and value-added in primary sector and "traditional" manufacturing industries such as leather products, paper products and tobacco products.

(Cluster 5') Malaysia, the Philippines and Thailand: This cluster seems not to be so much integrated. A characteristic common to all three countries is just a relatively high share of

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9 As in the analysis in the previous section, we applied the Ward method. Calculating values of the aggregation index at each level of hierarchy, we decide the number of clusters, cutting off the Cluster tree at a certain level that makes a particular number of classes, according to the distance between values of the aggregation index at each level. A longer distance from *s* classes to *s*-1 classes implies that the *s* classes are firmer [Lebart et al., 2002, 180]. Moreover, it is also important that cutoff at a certain level has a convincing implication in reality. The analyses below are carried out in a similar manner.

value-added in radio, television and communication equipment industry. On the other hand, we can find that two of them share some properties: high weight of primary sector and high employment share of leather products industry between the Philippines and Thailand; high value-added share of manufacturing and high employment share of furniture industry between Malaysia and Thailand.

c.4. IMPLICATION OF ANALYSIS

We could say that the clusters resulted from the above analysis, to some extent, indicate the similarity with clusters which have been obtained from the analysis of the diversity of institutional configuration. In fact, comparing the figures 1 and 3, one would perceive the correspondence of Cluster 3' with Group 4, and the similarity of Cluster 5 with Group 2. One can furthermore verify the statistical correlation between scores of each economy evaluated by the 1st factor from the analysis concerning the institutional configuration ($Factor1_{IC}$) and by that from the industrial structure analysis ($Factor1_{IS}$), that is -0.7366. It is also interesting to calculate the correlation between each of them and GDP per capita, proxy of economic development: the value of correlation between $Factor1_{IC}$ and GDP per capita is 0.92; that of $Factor1_{IS}$ and GDP per capita -0.6943.

According to Petty-Clark's law or flying geese model, one could expect that composition and weights of industries in an economy are consistent with its degree of economic development. However, contrary to the expectations, what these values of correlation would imply that the degree of economic development might not definitively determine the characteristic of industrial structure in Asian economies. The correlation of industrial structure with economic development is weaker than with institutional configuration. It can imply that there is a room that institutional factors have effect on the evolution of industrial structure.

However, it doesn't seem to be even enough to add institutional factors to understand the industrial structure of an economy. For example, Hong Kong and Singapore, both of which are characterized by high level of GDP per capita and classified into the same group by the analysis of institutional configuration, have individual characteristics in terms of their industrial structure: Singapore with not so much high share of tertiary sector in comparison with other advance Asian economies; Hong Kong with significant specialization for wearing apparel or printing and publishing regardless of lower weight of manufacturing. One could also recognize discrepancies among institutional configuration, economic development, and industrial structure in so-called ASEAN4, Indonesia, Malaysia, the Philippines, and Thailand. The height of the share of the primary sector in Thailand is similar with that of Indonesia and the Philippines although Thailand shares characteristics in terms of institutional configurations and high employment share of manufacturing with Malaysia.

One might imagine that one of the reasons of such discrepancies would be caused by dynamic interactions among Asian economies through the FDI and trade of intermediate goods mainly resulted from activities of TNCs..

d. INSTITUTIONAL DIVERSITY AND INNOVATION ACTIVITIES OF FIRMS IN ASIAN CAPITALISMS

How does the institutional configuration specific to each economy determine the economic activities within that economy? Given that it is firms that actually take action within an economy, the issue we must address is how institutional configurations influence firm behavior. It is CIA, as per Hall and Soskice [2001], that touches on this issue: according to them, "the basic idea is that the institutional structure of a particular political economy provides firms with advantages for engaging in specific types of activities there" (p. 37). This implies that the institutional environment of an economy constrains patterns of firm behavior and, consequently, constitutes a particular type of institutional configuration. However, Hall and Soskice single-

mindedly emphasize the institutional diversity in which individual firms are embedded. Little is known about how firms behave in institutional environments, and so the question of interaction between institutional environments and firm behavior is still open for discussion. In this section, we undertake a systematic analysis of the interaction between these factors by focusing on the innovation activities of Asian firms because innovations are the main drivers of firm growth.

Specifically, we investigate which institutional configurations have a favorable effect on the innovation activities of firms. If certain institutional configurations induce firms to engage in those activities, we can expect such firms to grow further in the presence of those configurations; such circumstances would, in turn, reinforce their existing institutional environment. Our analysis can explain whether or not the institutional diversity of Asian forms of capitalism can persist over time; it can also point to the institutional conditions required of Asian firms and economies if they wish to continue to grow, in terms of institutional characteristics and innovation activities at the firm level.

D.1. EVALUATING INNOVATION IN ASIAN ECONOMIES

Patent statistics as indicators of innovation

We will first consider innovation performance in Asian economies in terms of the rate of take-up of patents issued by the US Patent and Trademark Office (USPTO). Figure 4 shows the experiences of East Asia in patenting with the USPTO between 190 and 2006 by taking a simple sum of patents granted per year, without considering the size of each economy. Hence, we cannot compare Asian economies based on this analysis. However, this information provides an approximate picture of innovation performance within each economy.

As can be seen in Figure 5 (a), Taiwan and Korea are outstanding innovators in terms of their patenting activity. Activities in both economies have increased rapidly since the late 1980s. This is consistent with the result of the previous section, which argued that Taiwan and Korea could be categorized into an innovation-led economic typology. Innovation performance in Singapore and Hong Kong show similar trends, but the number of patents issued is lower than that in Taiwan or Korea due to the sizes of the economies (Figure 5 (b)).

Figure 4(a) Korea and Taiwan, Patenting activity in the USPTO
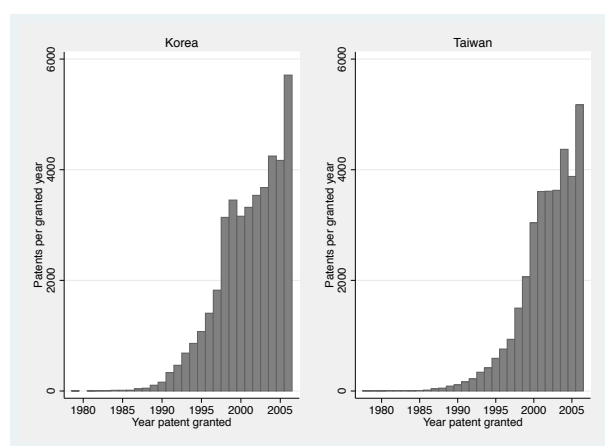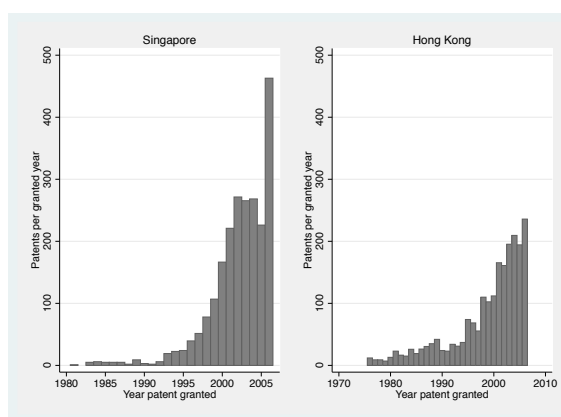
Figure 4(b) Singapore and Hong Kong, Patenting activity in the USPTO

The Chinese economy lags behind these economies but shows outstanding growth in innovation since the mid-1990s, the rate of which has accelerated since China joined the WTO in 2001. India shows a similar trend but to a lesser extent (see Figure 5 (c)).

Figure4(c) China and India, Patenting activity in the USPTO
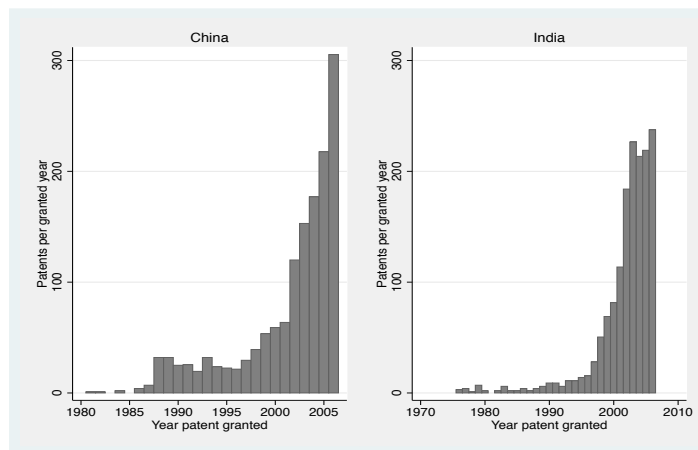
In contrast, patenting activities in the Philippines and Indonesia were stagnant over the entire sample period (Figure 5 (d)). As can be seen in Figure 5 (e), more patents were issued to entities in Malaysia and Thailand than to those in the Philippines or Indonesia. However, one could argue that innovative activities in Malaysia and Thailand remain lackluster, given these two economies' larger sizes.

Figure 4(e) Thailand and Malaysia, Patenting activity in the USPTO

Figure 4(d) the Philippines and Indonesia, Patenting activity in the USPTO
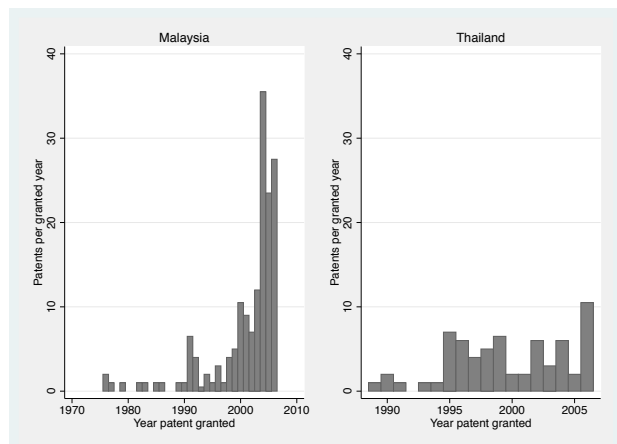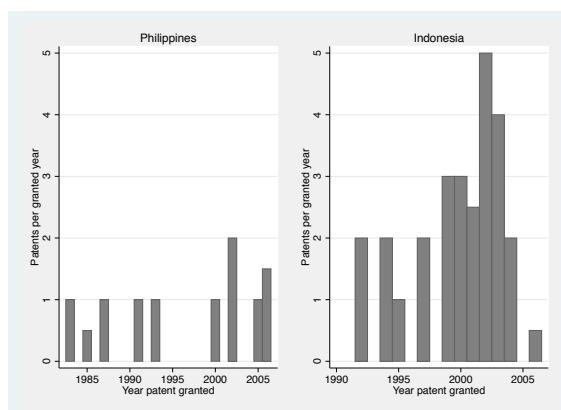
Based on these findings, Asian economies can be classified as follows: at one end of spectrum lie Korea and Taiwan, the most advanced; the Philippines and Indonesia are at the other end of the spectrum; and in between lie Singapore, Hong Kong, China, India, Malaysia, and Thailand. However, China and India appear to be in the process of shifting toward Korea and Taiwan and are near the level of Singapore and Hong Kong.

Innovative activities of Asian firms

Patent information is generally used as a proxy for innovation, but measuring innovation solely by patents is problematic. Patents are given to novel inventions, which purportedly lead to expanding the frontiers of technology or advancing production methods. However, in developing economies, these types of innovations are less likely to be observed. Instead, firms engage more in imitation and adaption of existing innovations rather than generating new inventions. For most developing economies, "new-to-the-country" innovation is more important than "new-to-the-world" innovation [Hu and Mathews, 2005], even if it may not be patentable [cf. Fagerberg and Srholec, 2008; Gorodnihnko, Svejnar, and Terrell, 2009].

Thus, for additional information on innovation we use firm-level data collected through the World Bank's Enterprise Surveys between 2002 and 2005, including 5,448 firms in China, India, Indonesia, Korea, Malaysia, the Philippines, and Thailand (see Appendix for details).

We measure innovation in terms of the following survey question and responses:
"Has your company undertaken any of the following initiatives in the last three years?"
1. Developed a major new product line
2. Upgraded an existing product line

The first answer is used as a proxy for radical innovation and the second for incremental innovation. Each type of innovation is represented by a dummy variable taking a value of 1 if a respondent answers "Yes" and 0 if he or she answers "No." Using these indicators, we consider whether or not institutional configurations are relevant to innovative activities in Asian firms. Table 1 cross-tabulates the four groups of Asian economies with their innovative activities. Examining innovative activities among Asian firms as a whole, 58.66% of firms are engaged in upgrading an existing product line while 37.57% of firms report that they developed a major new product line. This implies that a greater portion of Asian firms are assimilating existing technologies or knowledge that originated in advanced economies than are developing a new major technology that expands the technological frontier.

Table 1(a).   Radical innovation

| Economic group | Developed a major new product line? | | |
	Yes	No	Total
Indonesia, the Philippines	594	760	1,354
	(43.87%)	(56.13%)	(100%)
Thailand, Malaysia	951	1,331	2,282
	(41.67%)	(58.33%)	(100%)
Korea	99	116	215
	(46.05%)	(53.95%)	(100%)
China	402	1,193	1,595
	(25.2%)	(74.8%)	(100%)
	2,046	3,400	5,446
Total	(37.57%)	(62.43%)	(100%)

Pearson chi2(3) = 149.8793   Pr = 0.000

Table1(b).   Incremental innovation

| Economic group | Upgraded an existing product line? | | |
	Yes	No	Total
Indonesia, the Philippines	898	456	1,354
	(66.32%)	(33.68%)	(100%)
Thailand, Malaysia	1,421	861	2,282
	(62.27%)	(37.73%)	(100%)
Korea	134	81	215
	(62.33%)	(37.67%)	(100%)
China	743	854	1,597
	(46.52%)	(53.48%)	(100%)
	3,196	2,252	5,448
Total	(58.66%)	(41.34%)	(100%)

Pearson chi2(3) = 143.2189   Pr = 0.000

Second, when comparing between economic groups, the Chinese economy stands out: by either proxy, the share of firms engaging in innovative activities is much lower than that in other groups. This suggests that institutional environments in China might discourage firms from engaging in innovative activities. As for the group consisting of the Philippines and Indonesia, the share of firms engaging in developing a major new product line is close to that in Korea, the most innovative economy in terms of this indicator. In addition, the share of firms engaging in upgrading an existing product line in the Philippines and Indonesia is slightly higher than that in Korea; the group is more engaged in innovation than the patent data implies. In particular, high-tech exports in the Philippines stand out as an innovative sector [Woo, 2012].

Looking at the group consisting of Thailand and Malaysia, the share of firms engaging in developing a major new product line is lower than that in either the Philippines and Indonesia or

Korea. The share of firms upgrading an existing product line is comparable to that in Korea. This result suggests that institutional environments can lead firms to engage in innovative activities—or at least that they are less likely to prevent firms from engaging in such activities in the Philippines, Indonesia, Thailand, Malaysia, and Korea.

Lastly, the table presents the result of a chi-squared test of an association between Asian economies' institutional diversity and the distribution of the innovative activities of these countries' firms. The result indicates that there is a highly significant association between an economy's grouping and the innovative activity of its firms, confirming that the institutional diversity of Asian economies is likely relevant for Asian firms' innovative activities.

E. CONCLUDING REMARKS

In the preceding arguments, we show the diversity of Asian economies on the basis of institutional characteristics, as well as the effects of institutional configurations on firm growth by focusing on firms' innovation activities. The essential points of our arguments are as follows.

We found five groups among the Asian economies, and they are clearly distinct from those found in advanced economies. This diversity seems to persist, and Asian economies will not converge into a single model.

We also clarified the correlation between institutional configurations and economic development in terms of their effect on the evolution of industrial structure. The degree of economic development of an economy, to a large extent, explains the situation of its industrial structure, which implies that Petty-Clark's law and flying geese model are valid to some extent. Nevertheless there is a discrepancy to be made clear between economic development and industrial structure. It could be assumed that institutional configuration and international linkage of production have influence on the determination of industrial structure in an economy.

It was also found through an investigation of firm-level data that the institutional characteristics specific to each form of Asian capitalism have a positive effect on firms' decisions to engage in innovation activities. Those firms that engage in innovation are likely to grow further, which results in a reinforcement of the existing institutional diversity among Asian economies. Given our empirical results, we can assert that Asian economies are likely to evolve in a manner that is consistent with the concept of the diversity of Asian capitalism.

The institutional diversity of Asian capitalism also provides a foundation for a global supply chain built in East Asian economies. TNCs can take advantage of this institutional diversity by producing their goods within the most cost-effective location or economy. In an East Asian supply chain, *Continental mixed capitalism*—i.e., the Chinese economy—plays a pivotal role as the premier center of final assembly. *Innovation-led capitalism* supplies the center with capital goods or intermediate goods. Components or parts are produced in countries featuring *Trade-led capitalism*, and they are exported to the center. Final goods are assembled in the center and then exported to the American or European markets.

As noted, we acknowledge that our statistical analysis is restricted from offering robust conclusions, given the limited availability of data—institutional data and micro-level data in particular. Therefore, we need to support the arguments presented here by utilizing in future research the results of descriptive and historical analyses..

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Appendix A: Data source

Country	Survey Year
China	2003
Indonesia	2003
Malaysia	2002
Philippines	2003
South Korea	2005
Thailand	2004

Enterprise Surveys
(http://www.enterprisesurveys.org)
The World Bank