PRODUCTIVITY CHANGES OF ASIAN ECONOMIES BY TAKING INTO ACCOUNT SOFTWARE PIRACY

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For the past two decades, the fast-developing Asia has emerged as one of the most important economic regions. However, its economic growth is accompanied with severe software piracy. This paper analyzes productivity changes of 11 Asian economies and 4 non-Asian industrialized economies by taking into account software piracy using the Malmquist productivity index and its two components, efficiency change and technical change over the period 1994–2002. The results indicate that when software piracy is included, productivity growth in Asian developing economies regresses, while productivity growth in the four non-Asian industrialized economies improves. Interpretation and implications are provided. (*JEL* L86, O34)

I. INTRODUCTION

Ethics may create economic advantages for countries (Donaldson 2001). One common claim for the impact of good ethics on economic performance is tied to the social promotion of economic incentives. The protection of intellectual property rights (IPRs) is required to provide motivation for innovation (Ginarte and Park 1997). The respect for property rights in general, and for IPRs in particular, is crucial for the establishment of a well-functioning market system and economic development (Chen and Puttitanun 2005). If people fail to respect intellectual property and engage in intellectual property violations such as software piracy, then the incentive to create new and better forms of intellectual property would diminish. Because of computer software's manifest and increasing importance in global economy and the centrality of IPRs to the development of the software industry (Sell 2003, Chapter 5; Shadlen, Schrank, and Kurtz 2005), software piracy is a particular ethical issue that deserves discussion.

The protection of IPRs in developing countries has been a debated issue in recent years. This debate is often placed in a north-south framework, where the predominant view is that southern (developing) countries tend to lose from protecting IPRs. While less IPR protection may cause imitations of foreign technologies, which reduce the market power of foreign firms and benefit domestic consumers, a developing country still needs to strengthen IPR protection to encourage innovations and international technology diffusion (Park and Ginarte 1996). In developing countries, IPR protection will foster dynamic competition (Rapp and Rozek 1990). New improved products or new uses for established products will be introduced. Local industries will get

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ABBREVIATIONS

APEC: Asia-Pacific Economic Cooperation
ASEAN: Association of Southeast Asian Nations
BSA: Business Software Alliance
CRS: Constant Returns to Scale
DEA: Data Envelopment Analysis
GDP: Gross Domestic Product
IPRs: Intellectual Property Rights
NIEs: Newly Industrialized Economies
R&D: Research and Development

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the foreign help they need to survive and to exploit their comparative advantage in world markets. The lower software piracy rates of the north have a positive effect on economic growth by encouraging innovation. On the other hand, the higher software piracy rates of the south also have a positive effect on economic growth by stimulating the dissemination of new software applications. However, in the long run, there are some arguments of why developing countries need to enhance the protection of IPRs and reduce software piracy rates. Diwan and Rodrik (1991) argue that without the southern protection of IPRs, northern countries would not develop technologies largely needed by the south. Yang and Maskus (2001) point out that northern firms may react to the lack of IPR protection in the south by making their technologies more difficult to imitate. Park and Lippoldt (2005) indicate that IPR protection and effective enforcement can be instrumental in enabling firms in developing nations to access and exploit technologies through international technology diffusion. Thus, even if infringement may lead to short benefits, weak IPR protection produces little innovation, and then, there is no interest in defending IPR. This could bring a vicious circle (Park and Ginarte 1996). Protecting IPRs should be a public policy for developing countries seeking sustained economic growth (Rapp and Rozek 1990).

For the past two decades, Asia has emerged as one of the most important economic regions. The "Asian Tigers," China, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand, are particularly attractive. Their economic growth rates are more than twice those of Canada and the United States in 2003 (World Bank 2003). These Asian economies, however, have higher software piracy rates. Table 1 presents estimated rates of software piracy in 11 Asian

TABLE 1
Estimated Rates of Software Piracy for 18 APEC Economies, 1994–2002

	%								
Economy	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
East Asian									
China	97	96	96	96	95	91	94	92	92
Japan	66	65	41	32	31	31	37	37	35
NIEs									
Hong Kong	62	62	64	67	59	56	57	53	56
Singapore	61	53	59	56	52	51	50	51	48
South Korea	75	76	70	67	64	50	56	48	50
Taiwan	72	70	66	63	59	54	53	53	43
ASEAN-5									
Indonesia	97	98	97	93	92	85	89	88	89
Malaysia	82	77	80	70	73	71	66	70	68
Philippines	94	91	92	83	77	70	61	63	68
Thailand	87	82	80	84	82	81	79	77	77
Vietnam	100	99	99	98	97	98	97	94	95
Non-Asian industrialized									
Australia	37	35	32	32	33	32	33	27	32
Canada	46	44	42	39	40	41	38	38	39
New Zealand	43	40	35	34	32	31	28	26	24
United States	31	26	27	27	25	25	24	25	23
Developing									
Chile	70	68	62	56	53	51	49	51	51
Mexico	78	74	67	62	59	56	56	55	55
Peru	86	84	74	66	64	63	61	60	60

Source: Business Software Alliance (2003).

economies and 7 non-Asian economies from 1994 to 2002. The 18 economies are all Asia-Pacific Economic Cooperation (APEC) members. The Asian economies include China, Japan, the Newly Industrialized Economies (NIEs; Hong Kong, Singapore, South Korea, and Taiwan), and the ASEAN-5 (Indonesia, Malaysia, Philippines, Thailand, and Vietnam), the five selected members of the Association of Southeast Asian Nations (ASEAN). The non-Asian economies include four industrialized countries (Australia, Canada, New Zealand, and the United States) and three developing countries (Chile, Mexico, and Peru). In most Asian economies, although there exists dramatic improvement in the protection of software, rates of change and overall levels of protection vary widely and do not exhibit convergence.

Data envelopment analysis (DEA; Charnes, Cooper, and Rhodes 1978) has been used to evaluate the relative macroeconomic performance of economies (e.g., Lovell, Pastor, and Turner 1995; Ramanathan 2005). In general, DEA is performed at a given point of time. The Malmquist productivity index, one of its extensions, is a commonly used approach for measuring productivity change over a period of time. Färe et al. (1994b) use the Malmquist index to analyze productivity growth for 17 Organization for Economic Cooperation and Development countries by considering labor and capital as inputs and gross domestic product (GDP) as an output. Chang and Luh (2000) use the same approach to perform productivity analysis for ten Asian economies. The Malmquist index allows for further decomposition of productivity change into efficiency change and technical change, which may help explain the differences of growth patterns among different economies.

Since intellectual property protection plays an important role in economic development, it should be taken into account when evaluating an economy's performance. However, performance evaluation with the consideration of ethical factors such as software piracy is rarely seen in the literature. In this study, we will discuss how the productivity growth is influenced by including the ethical factor of software piracy. The analysis will be conducted for the above-mentioned 11 Asian economies and 4 non-Asian industrialized economies.

II. METHOD

The measurement of productivity change is based on the distance function defined by (e.g., Färe et al. 1994b; Ma et al. 2002)

$$(1)\quad D^t(\boldsymbol{X}^t, \boldsymbol{Y}^t) = \min\{\theta : (\boldsymbol{X}^t, \boldsymbol{Y}^t/\theta) \in S^t\},$$

where θ determines the maximal feasible proportional expansion of output vector $\boldsymbol{Y}^t$ for a given input vector $\boldsymbol{X}^t$ under production technology S^t at time period t. $D^t(\boldsymbol{X}^t, \boldsymbol{Y}^t) \leq 1$ if and only if the input and output combination $(\boldsymbol{X}^t, \boldsymbol{Y}^t)$ belongs to the technology set S^t. If $D^t(\boldsymbol{X}^t, \boldsymbol{Y}^t) = 1$, then the production is on the frontier of technology, and the production is technically efficient.

The Malmquist index of productivity change between time period t and time period $t + 1$ by using technology at time period t as the reference is given by (Caves, Christensen, and Diewer 1982; Ma et al. 2002)

$$(2)\quad M^t = D^t(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1})/D^t(\boldsymbol{X}^t, \boldsymbol{Y}^t).$$

Similarly, the Malmquist index by using technology at time period $t + 1$ as the reference is given by

$$(3)\quad M^{t+1} = D^{t+1}(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1})/D^{t+1}(\boldsymbol{X}^t, \boldsymbol{Y}^t).$$

Taking the geometric mean of M^t and M^{t+1} in Equations (2) and (3), with the assumption of constant returns to scale (CRS) technology, Färe et al. (1994b) propose the following index:

$$(4)\quad \text{MALM} = [(D_{\text{c}}^t(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1})/D_{\text{c}}^t(\boldsymbol{X}^t, \boldsymbol{Y}^t)) \times (D_{\text{c}}^{t+1}(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1}) / D_{\text{c}}^{t+1}(\boldsymbol{X}^t, \boldsymbol{Y}^t))]^{1/2},$$

where subscript c denotes the CRS benchmark technology. MALM can be calculated using the linear programming approach outlined in Färe, Grosskopf, and Lovell (1994a). MALM in Equation (4) can be decomposed into the efficiency change (EFFCH) and the technical change (TECHCH) (Färe et al. 1994b; Ma et al. 2002) as follows:

$$(5)\quad \text{Efficiency change(EFFCH)} = D_{\text{c}}^{t+1}(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1})/D_{\text{c}}^t(\boldsymbol{X}^t, \boldsymbol{Y}^t),$$

(6) Technical change(TECHCH)

$$= [(D_c^t(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1})/D_c^{t+1}(\boldsymbol{X}^{t+1}, \boldsymbol{Y}^{t+1})) \times (D_c^t(\boldsymbol{X}^t, \boldsymbol{Y}^t)/D_c^{t+1}(\boldsymbol{X}^t, \boldsymbol{Y}^t))]^{1/2}.$$

EFFCH (catching up) measures the change in the relative position of a unit to the production frontier between time periods t and $t + 1$ under CRS technology. It can also be explained by how much closer an economy gets to the world frontier. TECHCH (innovation) measures the shift in the frontier observed from the unit's input mix over the period. It is regarded as how much the world frontier shifts at each economy's observed input mix. The product of these two components yields a productivity change. That is, MALM = EFFCH × TECHCH. Values of MALM or any of its components greater than unity reflect improvement in productivity, whereas values less than unity denote regress or deterioration.

III. DATA

Our sample contains 18 APEC economies: Australia, Canada, Chile, China, Hong Kong, Indonesia, Japan, Malaysia, Mexico, New Zealand, Peru, Philippines, Singapore, South Korea, Taiwan, Thailand, the United States, and Vietnam. The data are collected for the three input variables, capital per capita, labor force per capita, and software piracy loss per capita, and one output variable, GDP per capita, over the period 1994–2002. The reason why software piracy loss is an input variable is that it is regarded as a cost, and hence, its lowest value is preferred. The sources of data include the Asian Development Bank (2004), the World Bank (2003), and the Business Software Alliance (BSA 2003). The monetary values are in 1995 prices. The labor force per capita is calculated by dividing total labor force (whose unit is person) by total population.

For software piracy, we follow a number of studies in which the data provided by BSA are used (e.g., Knapp 2000; Marron and Steel 2000; Shadlen, Schrank, and Kurtz 2005; Teran 2001). BSA gives annual data, from 1994 onward, of estimated software piracy levels for more than 80 economies. Software piracy loss is estimated by three steps (Shadlen, Schrank, and Kurtz 2005). First, an economy's existing and newly purchased hardware infrastructure is used to estimate its software demand. Second, the data on legitimate software sales are obtained from local distributors and retailers. Third, piracy loss is the difference between estimated demand and legitimate sales. Piracy rates can then be obtained by dividing piracy loss by the estimated software demand and multiplying by 100. Specifically, software piracy loss = legitimate sales/(1 − piracy rate) − legitimate sales. Software piracy loss per capita, which is the estimated loss due to software piracy within the economy divided by its total population, is used in this study to measure software piracy.

Table 2 provides summary statistics for the input and output variables. The fact that industrialized countries, having lower piracy rates, experienced more piracy loss is due to the size of their software markets. In such enormous markets, even small piracy rates can lead to much loss. On the other hand, developing economies have higher piracy rates but less piracy loss since their software markets are smaller.

IV. RESULTS AND DISCUSSIONS

Productivity growth is analyzed for China, Japan, the NIEs, the ASEAN-5, and the other four APEC economies over the period 1994–2002 with the Deap 2.1 software (Coelli 1996). The NIEs and the ASEAN-5 are grouped based on economical and geographical proximity. China and Japan are independent individuals. Australia, Canada, New Zealand, and the United States, four non-Asian industrialized economies, are included in contrast to Asian economies. Analysis is first performed with two inputs, capital per capita and labor force per capita, and one output, GDP per capita. Analysis is further performed by taking software piracy loss per capita as an additional input.

A. Mean Productivity Change

The mean Malmquist productivity changes as well as the two components, the mean efficiency changes and the mean technical changes, without/with consideration of software piracy are calculated for each economy and summarized in Table 3. It is clear from Table 3 that, when software piracy is taken

TABLE 2
Summary Statistics of Economic Inputs and Output, 1994–2002

	Output[a] (Per Capita)		Input[a] (Per Capita)					
	GDP		Capital		Labor		Software Piracy Loss	
Economy	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
East Asian								
China	729.49	138.25	285.37	55.04	0.5987	0.0014	0.89	0.51
Japan	43,771.35	1,175.07	12,018.15	505.55	0.5354	0.0020	10.05	3.28
NIEs								
Hong Kong	23,791.05	1,174.40	7,458.88	684.33	0.5237	0.0051	16.59	4.56
Singapore	26,187.44	2,640.05	8,161.60	1,185.95	0.5007	0.0056	12.44	2.84
South Korea	12,635.38	1,378.01	4,109.15	474.67	0.5018	0.0111	8.70	4.14
Taiwan	12,356.44	595.80	2,586.77	356.24	0.4355	0.0044	6.09	0.87
ASEAN-5								
Indonesia	1,040.94	59.76	254.63	80.30	0.4752	0.0117	0.58	0.30
Malaysia	4,561.42	277.03	1,509.54	375.19	0.4085	0.0085	4.03	0.69
Philippines	1,137.59	47.40	255.62	20.54	0.4175	0.0064	0.55	0.22
Thailand	2,834.53	146.63	805.54	316.92	0.6000	0.0073	1.31	0.51
Vietnam	337.82	48.85	100.07	21.58	0.5126	0.0041	0.29	0.19
Non-Asian industrialized								
Australia	22,407.79	1,577.91	5,565.50	754.21	0.5078	0.0023	7.85	1.92
Canada	21,419.64	1,587.90	4,352.36	511.92	0.5346	0.0025	10.69	2.28
New Zealand	17,344.55	930.09	3,824.26	240.19	0.4970	0.0039	5.12	2.14
United States	29,866.28	1,773.27	6,056.86	779.52	0.5108	0.0032	9.80	2.31
Developing								
Chile	5,039.70	410.61	1,145.28	169.48	0.4036	0.0077	3.01	0.57
Mexico	3,521.61	228.94	967.39	169.45	0.4035	0.0111	1.66	0.34
Peru	2,293.73	79.94	500.46	61.36	0.3699	0.0121	1.12	0.41

Sources: Asian Development Bank (2004), Business Software Alliance (2003), and World Bank (2003).
[a]The monetary values are in 1995 prices.

into account, the mean MALM productivity changes for the 11 Asian economies decrease except for Japan and South Korea, while those for the four non-Asian industrialized economies mostly increase. In most Asian economies, the main source leading to deterioration in productivity is the slide in efficiency change (the reduction in EFFCH), indicating weak catching-up capabilities to the frontier. On the other hand, the productivity improvements in the industrialized economies are due to technical progress (the increase in TECHCH).

B. Patterns of Productivity Growth

To provide perspective on the changing patterns over time, the cumulative Malmquist index as well as its components, the cumulative efficiency change and the cumulative technical change, are calculated as the sequential multiplicative results of the annual indices. The average cumulative changes of productivity (cumulative MALM) for the 11 Asian economies without/with consideration of software piracy are shown in Figure 1 using 1994 as the base year. Overall, the movement of the cumulative MALM including software piracy over the period 1994–2002 follows that ignoring software piracy, but the former is below the latter for every year. The gap between these two trends condenses in 1997 and 1998, whereas it gradually widens again after 1998. This phenomenon is in contrast to the productivity growth patterns for the four non-Asian industrialized economies shown in Figure 2, in which their average cumulative MALM including software piracy is above that

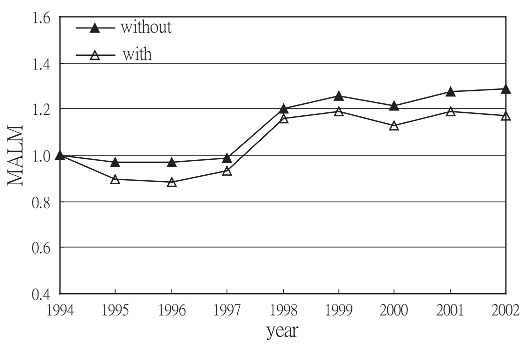
TABLE 3
Decomposition of the Mean Malmquist Productivity Changes without/with Consideration of Software Piracy

	Mean Annual Change					
	Malmquist (MALM)		Efficiency Change (EFFCH)		Technical Change (TECHCH)	
Economy	Without	With	Without	With	Without	With
East Asian						
China	0.995	0.975	0.980	0.951	1.015	1.025
Japan	1.011	1.012	1.000	1.000	1.011	1.012
NIEs						
Hong Kong	1.007	0.999	1.002	0.992	1.005	1.007
Singapore	1.036	1.031	1.028	1.020	1.008	1.011
South Korea	1.039	1.044	1.043	1.043	0.996	1.001
Taiwan	1.029	1.022	1.021	1.003	1.008	1.019
ASEAN-5						
Indonesia	1.072	1.056	1.059	1.035	1.012	1.020
Malaysia	1.047	1.047	1.034	1.018	1.013	1.029
Philippines	1.007	1.003	0.992	0.998	1.015	1.005
Thailand	1.086	1.045	1.074	1.030	1.011	1.015
Vietnam	0.969	0.912	0.956	0.917	1.014	0.995
Non-Asian industrialized						
Australia	0.993	1.007	1.002	0.977	0.991	1.031
Canada	0.992	0.992	0.998	0.998	0.994	0.994
New Zealand	0.998	1.071	1.002	1.003	0.996	1.068
United States	0.997	1.018	1.000	1.000	0.997	1.018
Developing						
Chile	1.014	1.012	1.002	1.002	1.012	1.010
Mexico	0.999	1.014	0.985	0.980	1.014	1.035
Peru	1.025	1.025	1.014	1.027	1.011	0.998

Notes: These numbers are the geometric means of annual changes in each economy over the period 1994–2002.

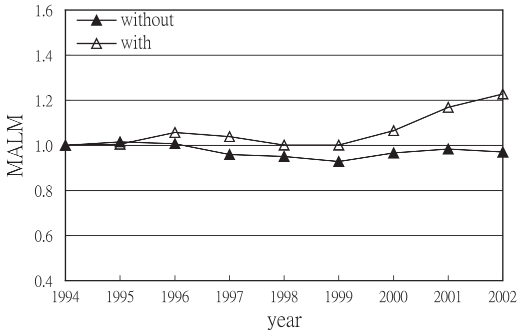
ignoring software piracy except in 1995. The gap of these two trends gradually widens after 1998. The two opposite results provide some interesting information. The fast-developing Asian economies are not doing as well as we thought they were when the ethical issue of software piracy is taken into account. Comparatively, the four non-Asian industrialized economies, whose economic growth is not so quick as the Asian Tigers in recent decades, display greater productivity growth when taking software piracy into consideration.

FIGURE 1
Average Cumulative MALM without/with Consideration of Software Piracy for 11 Asian Economies



The 11 Asian economies were further divided into China, Japan, the NIEs, and the ASEAN-5 to understand their patterns of productivity growth. Figure 3 displays the cumulative MALM and its components for China. The cumulative MALM including software piracy is below that ignoring software piracy, and the deterioration in productivity growth is, as seen before, due to the substantial decline in the cumulative EFFCH. However, it is noteworthy that cumulative TECHCH with the consideration of software

FIGURE 2
Average Cumulative MALM without/with Consideration of Software Piracy for the Non-Asian Industrialized Economies



piracy is above that without. One possible reason is that, in developing countries, new technologies and technology transfer may be achieved through foreign direct investment and intellectual property reform could be a facilitator. Nonetheless, without efficiency in the enforcement of IPR protection, intellectual property reform alone will not suffice to close the technology gap between developed and developing countries (Park and Lippoldt 2003). Weak protection of IPRs may encourage imitation only, but imitation activities discourage incentives to do future research and limit the diffusion of future new technologies (Park and Ginarte 1996).

There exists a particular phenomenon for Japan. From Figure 4, the pattern without considering software piracy is pretty smooth with indices exceeding unity just a bit. However, when software piracy is included, the cumulative MALM shows a fluctuation, increasing before 1998, dropping in 1999 and 2000, but slowly rising again after 2000. Overall, the cumulative change of productivity is better after considering software piracy. One reason why it goes down in 1999 and 2000 is that there exists a sudden rise of Japan's software piracy rate from 1999 to 2000 (from 31% to 37%; Table 1), but at the same time, the software piracy rates of other economies in our sample do not rise so much relatively. We also find that productivity growth in Japan is due to the TECHCH progress since the cumulative MALM and the cumulative TECHCH coincide.

As for the NIEs (Figure 5), the average cumulative MALM without/with consideration of software piracy is almost identical in movement after 1998. The lower values of the average cumulative MALM when considering software piracy before 1998 result from the decrease in the average cumulative EFFCH. After 1998, the trend of coincidence is due to the slight increase in the average cumulative TECHCH but slight decrease in EFFCH, indicating that the former is offset by the latter. Attention should be given to efficiency enhancement.

From Figure 6 for the ASEAN-5, the average cumulative MALM with consideration of software piracy is below that without. The difference comes from the much worse cumulative EFFCH even though the cumulative TECHCH is slightly better.

From Figure 7, the average cumulative MALM including software piracy for the four

FIGURE 3
Cumulative MALM and Its Components without/with Consideration of Software Piracy for China

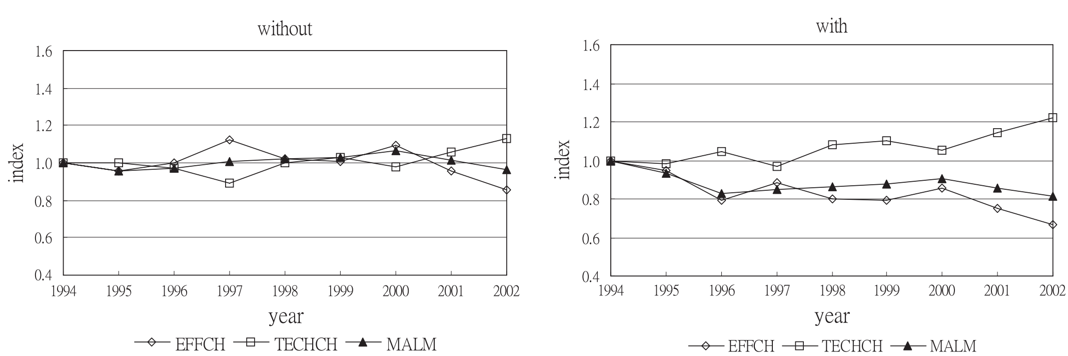
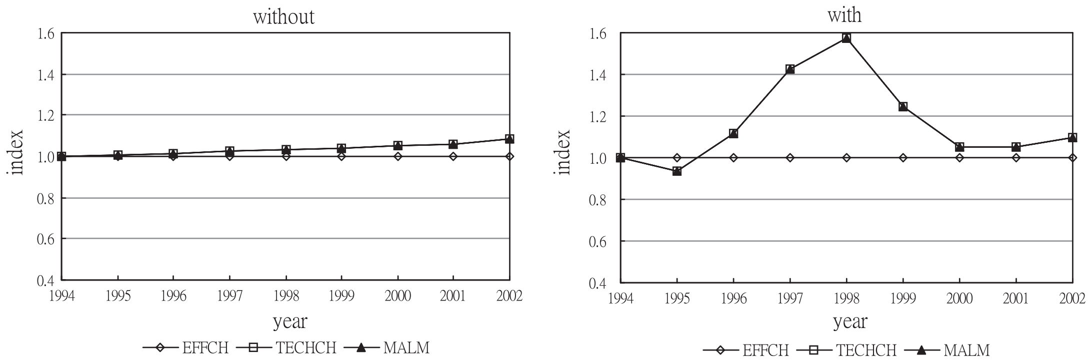


FIGURE 4
Cumulative MALM and Its Components without/with Consideration of Software Piracy for Japan



non-Asian industrialized economies is higher than that ignoring software piracy except in 1995. The gap becomes wide after 1998. The TECHCH contributes to the growth of productivity. Innovation performs well for the last 2 yr.

Discussions

In industrialized economies, although software piracy loss is greater, its ratio to GDP is lower. In contrast, in developing economies, the software piracy loss is less, but its ratio to GDP is higher. The lower ratio of software piracy loss to GDP reflects stronger IPR protection and can lead to better productivity growth. Weak IPR protection can reduce the productivity.

In many developing economies such as China and the ASEAN-5, demand for software is being met by piracy. Governments have invested billions of dollars in building technology infrastructures, but such huge investments go unprotected without enhanced education and enforcement campaigns for ending the piracy problem. Developing countries have generally taken a different approach to property claims (Deardorff 1990). The fact that property is so linked to liberty and self-actualization is an argument employed by developing countries for destroying rather than bolstering monopoly powers in property. Nevertheless, developed countries argue that strong protection of intellectual property is essential to provide incentives for future innovations and to ensure the competitive

FIGURE 5
Average Cumulative MALM and Its Components without/with Consideration of Software Piracy for the NIEs

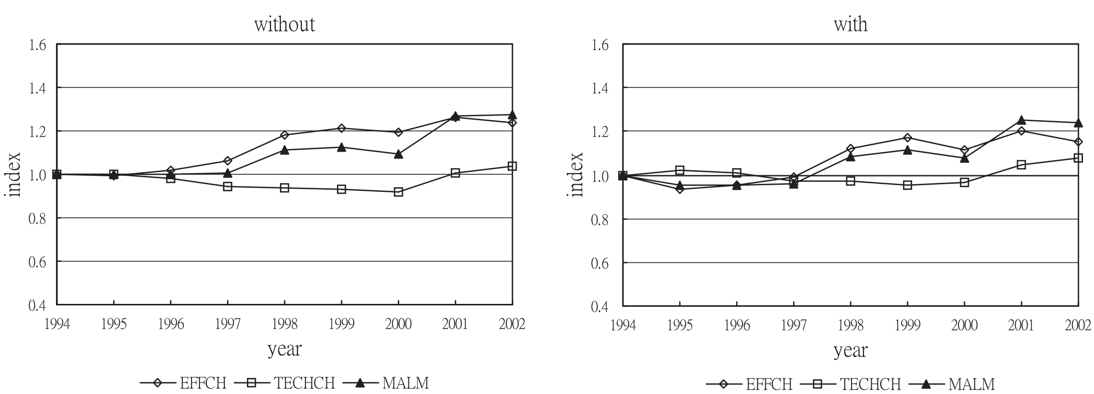
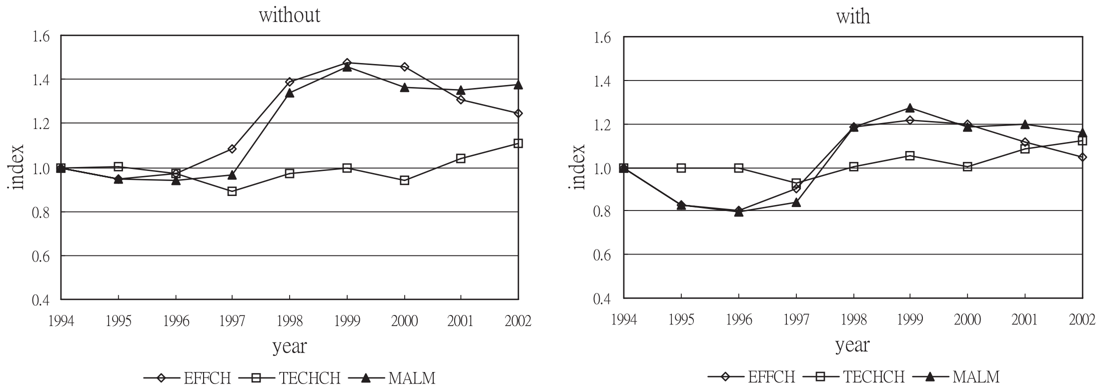


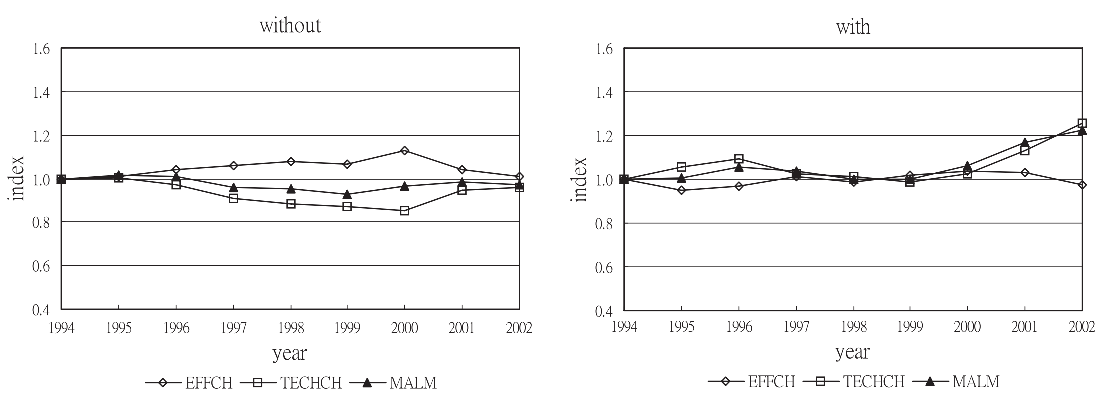
FIGURE 6
Average Cumulative MALM and Its Components without/with Consideration of Software Piracy for the ASEAN-5



profitability of companies that spend on research and development (R&D). In order to promote economic growth for Asian economies, efforts should be made to first increase catching-up capabilities by better resource allocation such as building strong economic institutions to secure intellectual property by means of regulations, government controls, legislation, and sound education. A growing empirical literature has demonstrated that countries with strong economic institutions protecting traditional property and contracts can have important impacts on economic performance (e.g., Hall and Jones 1996; Knack and Keefer 1995). Marron and Steel (2000) think that countries with weak economic institutions protecting IPRs have significantly higher piracy rates, and lower levels of education may make people so unfamiliar with IPRs that they are likely to become violators. The presence of weak institutions may reflect disregard for IPRs.

By scrutinizing the varying growth pattern and its components among economies further, we find that after taking software piracy into account, the industrialized economies experience higher productivity growth and the TECHCH is the main contributor. Resource allocation for IPR protection in these countries has been well implemented, and

FIGURE 7
Average Cumulative MALM and Its Components without/with Consideration of Software Piracy for the Four Non-Asian Industrialized Economies



therefore, the space to improve efficiency is quite limited. However, economic improvement can be achieved by enhancing innovation and technical change. The issue of IPR is related to R&D activities (Kumar 1996). Ginarte and Park (1997) find that countries investing heavily in R&D tend to have strong protection for intellectual property because R&D is based upon incentives to innovate. Putting emphasis on IPR protection can inspire innovation and in turn lead to productivity improvement. Stronger intellectual property protection, resulting in lower piracy rates, has the potential to improve economic growth by making more investment activities possible, particularly in R&D (Park and Ginarte 1997).

A policymaker's choice of level of IPR protection should depend on weighing the benefits and costs (Ginarte and Park 1997; Rapp and Rozek 1990). The benefits of IPR protection are that it would stimulate innovation, increase the quality and variety of goods, and enhance productivity growth. IPR protection can also provide another potential benefit that a nation develops better trade relations with other economies (Ginarte and Park 1997). On the other hand, the costs of IPR protection include the restraint of dissemination of new technologies and the supply of new goods (or processes) at higher prices. Furthermore, excessive IPR protection could reduce threats from potential rivals (who could imitate existing products) and lead to less motivation to upgrade existing intellectual property or to develop new inventions (Park and Lippoldt 2005). Indeed, finding a balance between incentives for innovation on one hand and wide access to new technologies on the other deserves to be deliberated.

V. CONCLUSIONS

Productivity analysis by taking account of software piracy opens up a new way to simultaneously pursue economic growth and ethical wealth. This paper attempts to address the issue by conducting comparative productivity analysis for 11 Asian economies and 4 non-Asian industrialized economies over the period 1994–2002. The 18 APEC economies are included so as to construct a benchmark frontier. When the software piracy index (software piracy loss per capita in this study) is incorporated into the calculation of the Malmquist productivity change index, productivity growth in developing economies decreases (due to reduction in efficiency), while productivity growth in industrialized economies increases (due to technical progress).

The empirical results obtained imply again that resources should be focused on the enforcement of IPR protection in developing economies and on technological innovation in developed economies so that productivity can be improved.

Other ethical issues such as corruption may be considered. It is widely agreed that corruption is an unethical problem that affects all elements of society, especially the poor, and significantly hampers business activity and economic development (Voyer and Beamish 2004). Past research suggests that bribery and other forms of corruption reduce investment and economic growth. For example, Mauro (1998) indicates that corruption lowers economic growth and breeds poverty over time. At the same time, poverty itself might cause corruption. Transparency International, a lobbying coalition against corruption in international business, contends that corruption is not merely a problem in Third World nations but is a threat to clean government in Europe as well (Holman 1994). Productivity analysis by including corruption as well as other ethical factors deserves future research.

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