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Cyclical Industrial Dynamics:

The case of the global semiconductor industry

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Abstract

In this paper, we focus on firms' cyclical behavior in the global semiconductor industry. We demonstrate that these cyclical dynamics at the industry level differ from both the business cycles at the macro-economic level and the lengthy industrial technology life cycle. We discuss a range of possible causes of those cyclical industrial dynamics, including the general business cycles as well as industry-specific factors. Our study reports three stylized facts in relation to the cyclical industrial dynamics in the global semiconductor industry: first, the industry is more concentrated during the industry cycle downturns; second, the capital investment of the industry as a whole follows a 'pro-cyclical' pattern; and third, firms that pursued a 'counter-cyclical' capital investment strategy during the industry cycle downturn have reaped rewards during the subsequent cycle period. These facts suggest that cyclical industrial dynamics, especially the industry cycle downturns, play an important role in firm rivalry, strategic positioning and industrial growth.

Key words: industry cycles; counter-cyclical investment; industrial downturn; semiconductor industry

Cyclical behaviors in the economic system is one of the great themes in economic forecasting and innovation study, going back to scholars such as Joseph Schumpeter in the middle years of the 20th century [43,44]. In industries where sales, R&D and capital investment, capacity and price often exhibit strong cyclicality, those cyclical industrial dynamics, or *industry cycles* as they are more conventionally known, have profound implications to the evolution of market structure and firms' behavior. Some of the implications have been captured in a fragmentary literature. For example, Mascarenhas and Aaker [34] demonstrate that companies adjusted their strategic activities such as capital expenditure and asset allocation according to the stage of the industry cycle, as shown in the oil-well drilling industry, and that 'optimal' strategies varied across the stages of the cycles. In the highly cyclical flat panel display industry, where there have been six upturns and downturns since the industry began in 1990, Mathews [35] reveals that there is a striking pattern in firms' entry behavior: not a single successful entry was engineered during an industry upturn. In this sense, entry strategies were deeply influenced by firms' reading of cycle upturns and downturns. In the marketing literature, it has been widely noted that some firms or some market sectors as a whole have been able to exploit fluctuations in the economy, especially the downturns of business cycles, to enhance the standing of their brand [47] or to seize market share from others [29]. Other scholars have suggested prescriptive strategies in coping with economic recessions based on case study or anecdotal evidence [2,41,42]. What is missing is a clear overview of the pervasiveness and influence of industry cycles.

In this paper we provide an overview of cyclical industrial dynamics and some of the implications for industry structure and firm performance. We argue that cyclical industrial should be distinguished from the general business cycles and from the conventional industry/technology life cycles. We illustrate our discussion on cyclical industrial dynamics with the case of the global semiconductor industry where cyclicality of the industry has been pronounced. We discuss a range of factors that possibly drive the cyclical industrial dynamics in the industry, which make the cyclical patterns distinct. In particular we examine the influence of industry cycles on firm concentration in the semiconductor industry, and the way that firms that adjust their investment strategies according to the timing of industry cycles (pursuing a counter-cyclical strategy rather than the normal pro-cyclical strategy) have reaped rewards. We summarize these findings in terms of three stylized facts derived from the industry demonstrating that the cyclical industrial dynamics play an important role in firm rivalry, strategizing and industrial growth.

Business cycles, industrial life cycles and industry cycles

Previous studies relating firms' behavior such as innovative or marketing initiatives to their cyclical economic environment have primarily focused on business cycles in the aggregate economy [21] [47]. Business cycles in this sense are defined as "a type of fluctuation found in the aggregate economic activity of nations […] a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle" [7, p.3]. A widely accepted chronology of the US business cycle is developed by the National Bureau of Economic Research (NBER) based on this definition.[1] Other cyclical dynamics in the aggregate economy and their

[1] For a full list of reference dates for the U.S. business cycle since 1854 identified by NBER,

implications have also been closely studied, including the Kitchin cycle, the Juglar cycle and the Kondratieff long wave (for a seminal work on these cycles see [43]; for recent discussions see [4, 10, 13]).

However, business cycles in those previous studies are derived from indicators of the economy using highly aggregated data, and therefore heterogeneity across industries may be ignored and missed. Further, phases of business cycles are indicated by the coincident timing of a number of economic indicators. For example, a recession is only recognized when the real gross domestic product (GDP), the employment, the total income and the sales are all falling.

Cyclical industrial dynamics of interest here may present rather different patterns from the general business cycles. For example, Berman & Pfleeger [5] found that while the fluctuations of a large number of industries correlate with those in the aggregate economy, there were also many industries that are not sensitive to business cycles -- such as the pharmaceutical, educational service, insurance carriers and public service industries; some other industries such as the health service industry even enjoy higher growth during recessions. In fact, it was claimed by Bain & Company, a firm of strategy consultants, and cited in the *Economist*, that "in any one recession [during the 1980s and the 1990s] only 60% of all industrial sectors were actually in a downturn."[2]

Thus the timing, duration and amplitude of industry cycles can vary widely. The study by Petersen and Strongin [40] of about 300 manufacturing industries in the US showed that durable goods industries are approximately three times more cyclical than

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see www.nber.org/cycles.html/

[2] See 'How was it for you?' The Economist, 2001, Vol. 362: 4-6

nondurable-goods industries. The service sector generally exhibits fewer cyclical fluctuations, and less intense fluctuations, than manufacturing activities, for reasons that have to do with difficulties involved in stocking services, in there being less capital required for service activities and the higher price and wage rigidities found in the service sector [9].

On the other hand, a large body of literature deals with the industry/technology life cycle which describes the movement of an industry and development of the technology in the long run. An industry /technology life cycle is usually featured with a technological trajectory that goes through a sequence of stages [1,22,28]. During the evolution, competition shifts from technology to price [38]; and innovation shifts from product innovation to process innovation [27]. Industry/technology life cycles in a range of industries have been formally described and their implications to firms examined [14,45].

While there is an underlying relationship between industry cycles and industry/technology life cycles, the two concepts are different. An industry/technology life cycle describes the long-term evolution of industry while industry cycles are derived from some more ‘visual’ industrial variables. More specifically, we see industry cycles as cyclical patterns in industrial variables including sales, price, capital investment, and capacity which display as recurrent deviations from the long-term trend [50]. Compared with an industry /technology life cycle, industry cycles are more concerned with the medium-term cyclical dynamics which normally span quarters rather than years.

In the next section, we take the global semiconductor industry as an example and discuss a range of drivers that possibly contribute to the phenomenon of cyclical industrial dynamics. We also present the cyclical pattern we have identified for the industry, as a first step towards an investigation of the implications of the cyclical industrial dynamics which follows the next section.

The global semiconductor industry and its industry cycle

Since its infancy the global semiconductor industry has featured continuous growth accompanied by pronounced cyclical swings.[3] A number of significant factors are likely to contribute to the strong cyclicality of the industry, including the business cycles, the mismatch and delay between different market dynamics and the technology cycles.

The semiconductor industry plays a key role in the electronics value chain and therefore the whole economy.[4] It is generally agreed that the macro-business cycle is one of the main drivers of the semiconductor industry cycles. From one point of view, the industry cycles are mainly a product of the 'external shocks'. For example, among the six cycles observed by McClean [37] in the industry between 1970 and 2000, three are named 'oil shock cycle' because he believes that the cycles are due to world recessions in 1975, 1982 and 1991 which were initially triggered by an oil crisis. The extension of the fifth downturn in 1998 is also attributed to the Asian Financial Crisis.

[3] According to the data available from the Semiconductor Industry Association (www.sia-online.org), the industry has grown by an annual average rate of 17 percent for the last thirty years; meanwhile the industry has been very volatile, with the shipment annual growth ranging from positive 130% to negative 27%.

[4] In 2008, the global semiconductor industry in total generated US$249 billion of revenue (www.sia-online.org). On average the semiconductor content of electronic systems accounts for between 15 percent and 25 percent but more importantly the industry serves as a technology enabler for many downstream industries [25].

This view is shared by Martin [33], another consultant in the industry, who extends the observation to include events such as the booming of Taiwanese foundries, the rise of the Chinese economy, the collapse of the Internet bubble, Y2K and terrorism as the triggers of the recent ups or downs of the semiconductor cycle.

Mismatch and delay between different market dynamics seems to be another factor in triggering and amplifying the semiconductor industry cycle, attributable to two main mechanisms: the so-called Bullwhip/Forrester effect [18,46] and game-like competition [19]. As semiconductors are intermediate goods with a wide range of applications, small fluctuations in demand of the final consumer markets tend to result in large swings in production, inventory and investment in the upstream semiconductor industry. Still worse, building a semiconductor fabrication plant involves a large amount of investment and time, [5] causing significant time delays and information distortion in the decision-making process of firms in ‘feedback loops’ [48]. The industry also suffers from game-like competitions. For example, Liu [31] reports how the head-to-head competition for market share between the two largest semiconductor foundry companies from Taiwan, namely Taiwan Semiconductor Manufacturing Company (TSMC) and United Microelectronics Corporation (UMC), causes cyclicality in price, production and capacity. Dearden and colleagues [11,12] provide three main reasons why competitive behaviour of companies can lead to capacity cycles, which is applicable to the semiconductor industry. First, as capacity in the industry is ‘lumpy’, that is, indivisible and involving large fixed costs, firms may choose adding excess capacity for reasons of *strategic preemption* in order to

[5] It is estimated that the cost of a new semiconductor fabrication plant ranges from one to four billion USD and the equipment procurement only usually takes 6–12 months [53].

achieve first-mover advantage [see also 51]. However, each firm makes decisions simultaneously and similarly in such an investment game. When lacking in *coordination*, both firms add capacity and over-capacity or under-capacity tends to occur. Finally, cycles are likely to be 'amplified' because of the *delay* of commitment by firms in recessions, a phenomenon dubbed 'the economics of wait and see' [20].

Finally, technology changes also seem to play a significant role in causing the semiconductor industry cycle. The industry has been well-known for its rapid technology progress following Moore's law thanks to both product innovations and process innovations [15,36]. The generally high but uneven pace of technology progress has resulted in shorter product life cycle,[6] rapid decline in price, continuous emergence of new applications and markets, and large market uncertainty, all having effects on the cyclical industrial dynamics of the industry. On the one hand, there is evidence suggesting that during certain periods of time the industry cycle does move in conformity with the technology cycle featured with major generations of technology, a phenomenon consistent with the notion that sales in an industry will peak after a 'dominant design' has emerged [3,52]. For example, the introduction of a generation of IC technology/product usually creates mass demand in the downstream computer market, which in turn pushes the sales of processors [50]. On the one hand, continuous process innovations in the industry has improved the productivity persistently, and may cause cyclical patterns in industrial variables such as price and sales departing from the technology cycle in other times. In the manufacturing area, for example, the yield factor, measured as the percentage of defect-free chips on a

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[6] Jorgenson [26] estimate there was a three year technology/product cycle in the semiconductor industry before the middle 1990s but that was shifted to a two year cycle more recently.

wafer, can rise significantly after the launch of the plant thanks to introductions and implementations of process innovations and the learning effect [23].

Therefore, the cyclical industrial dynamics in the global semiconductor industry seem to be a joint outcome of changes in the macro-economy as well as industry-specific factors, resulting in the cyclical pattern distinct from both the business cycle and the industry/technology life cycle. Based on a rigorous procedure offered elsewhere [50], we have been able to identify a cyclical pattern in the global semiconductor industry, as shown in Figure 1. The semiconductor industry cyclical pattern we identified largely confirmed the patterns identified by industry consulting firms, such as *IC Insights* (as shown in Figure 2), although our study was based on more accurate quarterly data for the series compared with the annual data used by *IC Insights*. Both studies identify five cycles for the years 1976 to 2002 in the industry where the periods under study overlap. In particular, two recent industry cycle downturns in the industry were commonly identified, namely the 1996-1998 downturn and the 2001 downturn.

Insert Figure 1, Figure 2 about here

In our analysis below involving the firm-level data that are of annual frequency, we also align the industry cycle with the calendar years according to whether the majority of time in the year is spent within an upturn or a downturn. The years of upturns and downturns are suggested in Table 1.

Insert Table 1 about here

The implications of the cyclical industrial dynamics to market structure and firm strategy

The industry cycle identified, when checked against the evolution of market structure and strategic behaviours of firms, brings out many interesting phenomena. In this section, we present three ‘stylized facts’ concerning the change of market structure, the overall investment pattern of the whole industry, and the consequences of capital investment of individual firms in different timings in the context of the industry cycle..

Stylized fact (1): The global semiconductor industry is more concentrated during the industry cycle downturns.

Determinants of evolution of market structure, usually indicated with firm size distribution (FSD) over time, remain an important topic in the area of industrial dynamics [16,32]. Our analysis intends to shed light to the area by studying possible influence of the cyclical industrial dynamics on the market structure. Our sample frame consists of 75 major semiconductor manufacturers in the world; and their capital expenditure and sales data captured annually during the period from 1993 to 2004 were obtained from *IC Insights*, one of the primary data sources of the industry. A list of the firms is shown in Appendix A.

We use turnover as a measure of firm size and use the indicator of skewness and the

Herfindahl-Hirschman Index (HHI) to measure the extent of the market concentration over time. The former is a statistical measure of the degree of asymmetry of a distribution around its mean; and the latter is the sum of the squares of the market shares of all firms, both having been employed by previous studies as indicators of market structure (e.g. [39]). As suggested by Figure 3 and Figure 4, the industry is more concentrated, or skewed, during the downturns than during the upturns of the industry cycle. For example, the skewness of the industry jumps from 1.9 in the year 1995 and continues increasing until it reaches 4.7 in 1998 but falls back in the years 1999 and 2000. The structure of industry skews further to the right in 2001, reaching a level of 4.9. Similarly, the HHI increases from the trough in 1995 (0.045) to the peak in 1998 (0.057) and drops in 1999 and 2000. The HHI rises again in 2001 and reaches a new peak in 2002. The pattern of the industry concentration closely follows the pattern of the industry cycle.

Insert Figure 3, Figure 4 about here

Stylized fact (2): The capital investment of the industry as a whole follows a pro-cyclical pattern

As shown in Figure 5, the trend of capital investment in the global semiconductor industry as a whole clearly co-moves with that of the industry cycle.[7] Such a co-

[7] The capacity cycle is captured from the series of the total wafer start capacity of the integrated circuit manufacturing industry, which is taken as an approximation of the global semiconductor capacity addition. The data source is the SICAS Capacity and Utilization Report available from the Semiconductor Industry Association. The series is in the biannual frequency for the period from 1994 to 1996, and in the quarterly for the remaining period. For reason of consistence, the current study utilizes the method established by Lisman and Sandee [30] to

movement can be further quantified. Stock & Watson [49] define the counter-cyclical activities in terms of a large negative correlation between one cycle and the reference cycle;[8] whereas pro-cyclical activities would have a positive correlation. Acyclical behaviour does not have any significant correlation with the reference cycle series.

Insert Figure 5 about here

Following this approach, we calculate the correlations of the two series based on both current values and lagged values. The correlation statistics, as reported in Table 2, confirm the visual inspection of the co-movement of the two series with a time lag. The correlation is largest when the time lag is between two and four quarters. According to the Semiconductor Industry Association, the average equipment procurement lead time is about 6–12 months (two to four quarters) [53]. Thus we see that there is clear evidence regarding the pro-cyclical investment behavior of firms in the industry taken as a whole.

Insert Table 2 about here

Stylized fact (3): Firms that made counter-cyclical capital investment during the industry cycle downturn reap rewards in the subsequent cycle period

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convert the biannual data to quarterly data for the period from 1994 to 1996. This procedure, though relatively simple, generates good adaptation of the figures in the low frequency to those in the high frequency and has been adopted by many later studies [17,24].

[8] The reference cycle is usually a business cycle measured by real GDP.

Our third stylized fact concerns timings of capital investment against the backdrop of the cyclical industrial dynamics and their consequences for firm performance. Among our sample frame of 75 semiconductor manufacturers found worldwide, 59 firms have the complete capital expenditure data through 1996-1998 industry cycle downturn and the sales revenue data afterwards till 2004.[9] We divide those firms into two groups, depending on whether they increase or cut capital investment during the 1996-1998 industry cycle downturn. In this context, 32 firms increase their capital investment during the industry cycle downturn while 27 firms cut their investment at the same time. We compare the sales revenues of firms from the two groups before 1998 and do not find any significant difference in our statistics –in other words, the firms are randomly distributed across the two groups. The five largest companies of each category in terms of the sales in 1996, that is, the first year of the downturn, are listed in Table 3, along with their market shares. As shown in the table, both groups include some significant players of the industry, and their market shares in total do not differ largely as of 1996.

Insert Table 3 about here

However, the two groups of firms exhibit clear differences in sales growth in the

[9] A list of the firms is shown in Appendix A. The firm-level capital expenditure and sales data captured annually during the period from 1993 to 2004 are obtained from *IC Insights*, a market research firm specializing in the semiconductor industry. While the sample frame consists of 75 major semiconductor manufactures in the world, not all these companies have complete series through the period. For the purpose of this analysis, only 59 of the companies have the capital expenditure data through 1996, 1997 and 1998 and the sales revenue data over the period 1999-2004.

subsequent period (up to 2004), as shown in Figure 4. By both measures of ‘average annual growth’ or ‘compounded average growth’, the group of ‘counter-cyclical’ firms well outperforms the group of ‘pro-cyclical firms’; and the significance of the difference is confirmed by two-tailed t-tests.[10]

Insert Figure 6 about here

Discussion

These three stylized facts derived from the global semiconductor industry demonstrate that the cyclical industrial dynamics, especially the industry cycle downturns, play an important role in firm rivalry and industrial growth. The first stylized fact suggests that during the industry cycle downturns the industry was restructured with resources being re-allocated to stronger players. The second stylized fact confirms that firms in an industry as a whole follow the immediate market conditions without a longer perspective on cyclical industrial dynamics. Such short-sighted behaviour in fact could be one of the underlying reasons causing industry cycles as there will be delays between market dynamics such as between capital investments and sales on the market. Finally, the third stylized fact clearly supports the Schumpeterian strategy where investment during industry cycle downturns will just be able to capture the opportunities emerging from the next upturn. In sum, the cyclical industrial dynamics provide a ‘cleansing’ mechanism for productivity enhancement and serve as a source of competitive advantage for firms who dare to engage to their cyclical environment

[10] Given that the sample size is relatively small and that firms are assumed to be independent, the independent two-sample t-test seems appropriate [8]. The results of the t-tests are reported in Appendix B.

and align their strategies accordingly [43,44].

The role of cyclical industrial dynamics to industry restructuring and firm performance can be further illustrated with Intel's experience. Intel has consistently acted as a 'counter-cyclical investor' over the past two industry cycle downturns covered by our data, with its average capex increasing by 9 per cent over the 1996-98 downturn and by 10 per cent over the 2001 downturn. It appears that the firm has been well rewarded for pursuing this extraordinary strategy. As shown in Figure 7, its market share reached 18 per cent in 1998 up from 9.5 per cent in 1995, and rose again by 3 per cent in the 2001 downturn, both successes taking place during the industry cycle downturns.

Insert Figure 7 about here

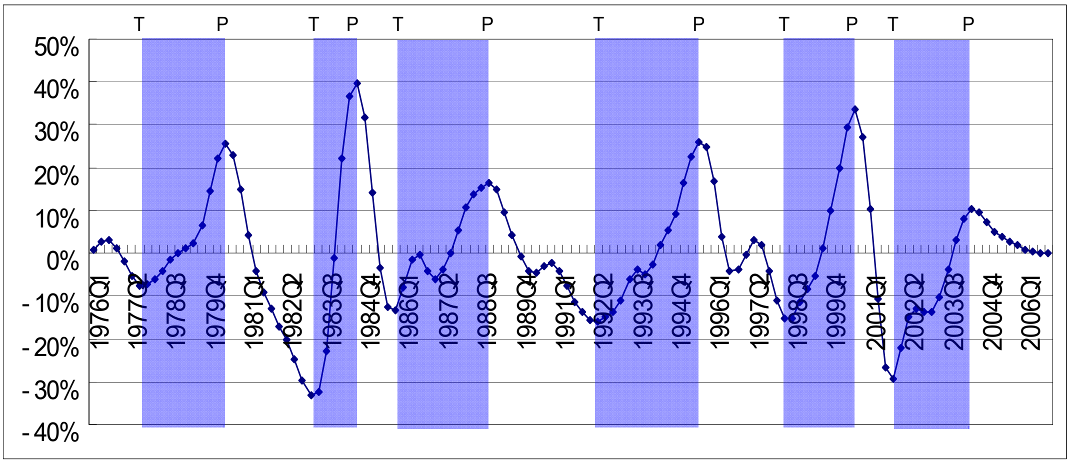
Concluding remarks

Players and observers in all industries bemoan downturns, and see them purely as times of distress, when firms are forced into closure, when workers are laid off, when revenues, profits, prices and investment fall – it's all bad news. Yet in reality capitalism would fail as a system without downturns. They are the necessary episodes for recovery, for 'rebooting', for renewal, for an opportunity for a change in industry leadership, when new firms can enter the industry and when old and tired firms can exit, or be taken over. We believe that it is timely to look at downturns from a strategy perspective and from a wider economic perspective as well. The remark by John Bowman, Executive Editor of the trade journal *Electronic Business,* echoes the dynamics of these situations:

> “Volatility creates opportunities for everyone. Downturns produce buy opportunities for investors and acquisition-minded companies. Upturns produce excitement among investors and entrepreneurs, which enhances opportunities for capitalization. And the churning cycles themselves promote chances to gain -- or lose -- market share, a condition that generally benefits the best and brightest companies. That's a good thing -- right?”
>
> Bowman [6]

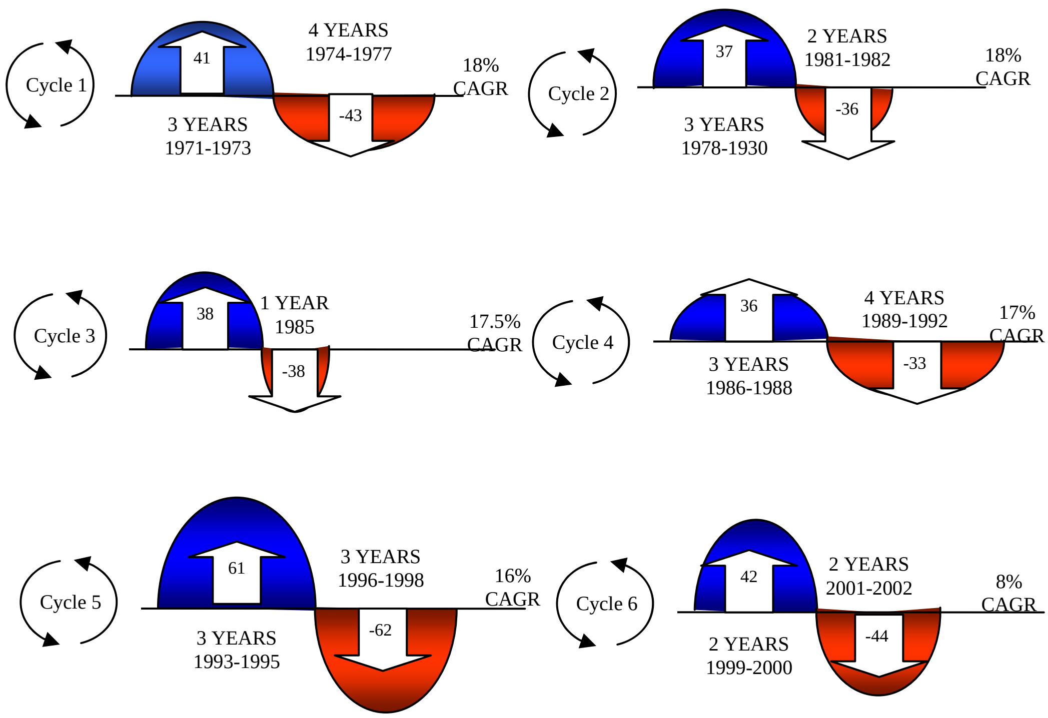
Firms such as Intel have made a major discovery in their ability to profit from industry cyclical downturns. These business successes now call for complementary innovations in the fields of business policy and strategy to generalize the findings and account for their success in terms of the field’s theoretical frameworks.

Figure 1 The Semiconductor Industry Cycle Identified by Tan & Mathews



Note: The cycle we present here is based on the global semiconductor billing data available from the Semiconductor Industry Association. The cyclical pattern of the industry is generated by a rigorous procedure offered elsewhere [50], with a core being the use of the Hodrick-Prescott filter to de-trend the data series and to remove components with very high and very low frequencies.

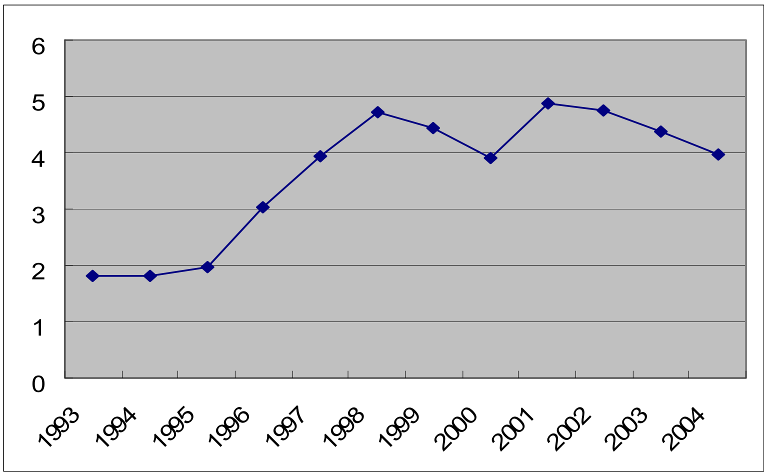
Figure 2 The Semiconductor Industry Cycle Suggested by *IC Insights*



CAGR is annual market growth rate during that cycle.
Number shown in arrows is total deviation from IC market CAGR during that cycle.

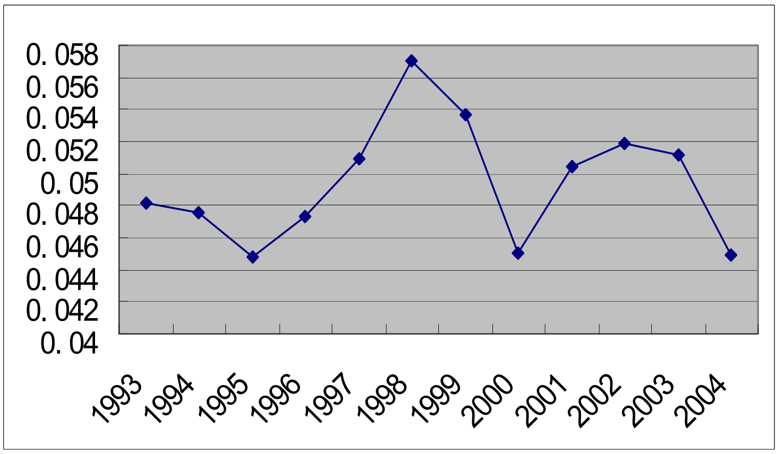
Source: *IC Insights*

Figure 3 Skewness of the Firm Size Distribution



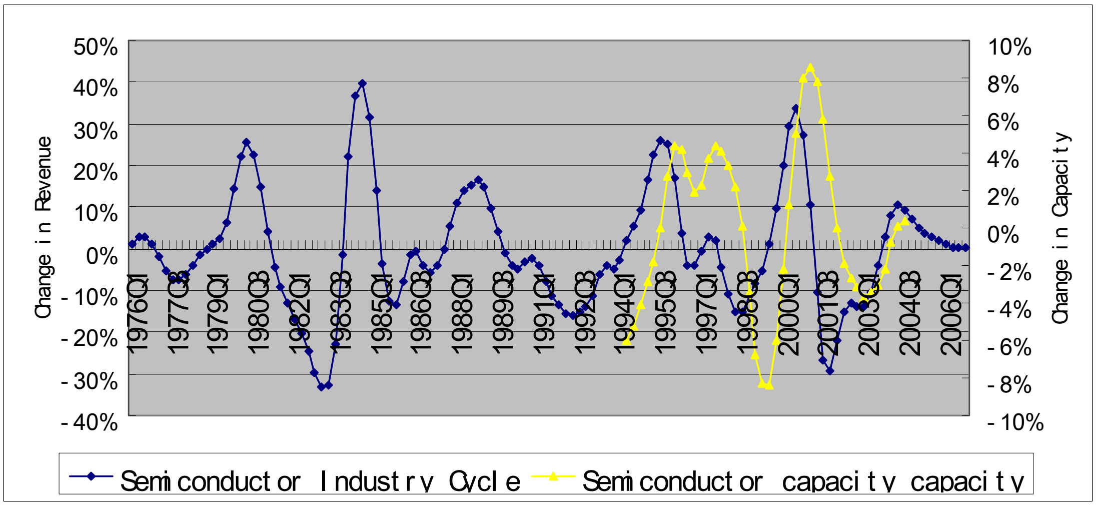
Source: Author's calculation based on the data obtained from *IC Insights*

Figure 4 Herfindahl-Hirschman Index of the Global Semiconductor Industry, 1993-2004



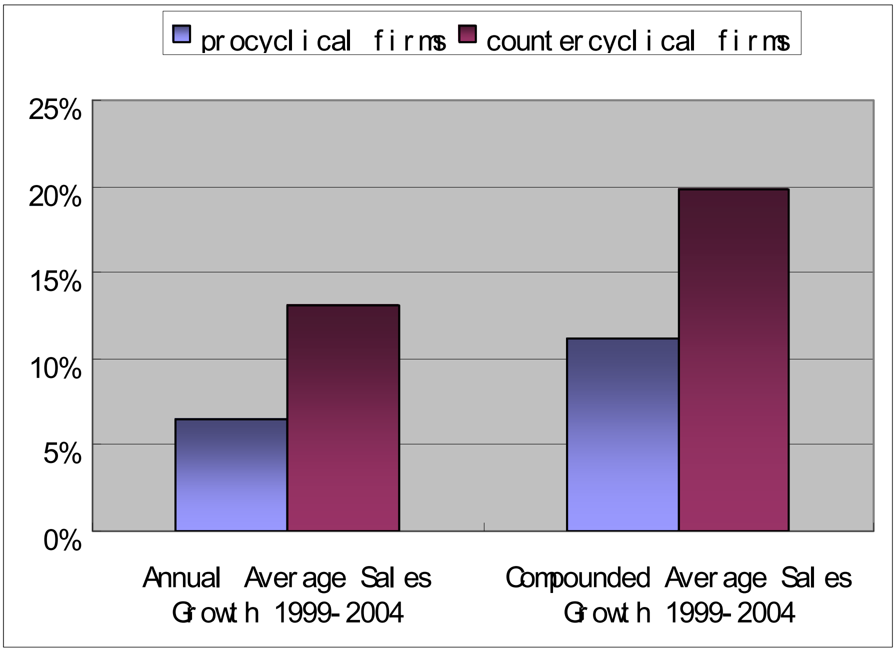
Source: Author's calculation based on the data obtained from *IC Insights*

Figure 5 Semiconductors Industry Cycle and Semiconductor Capacity Cycle



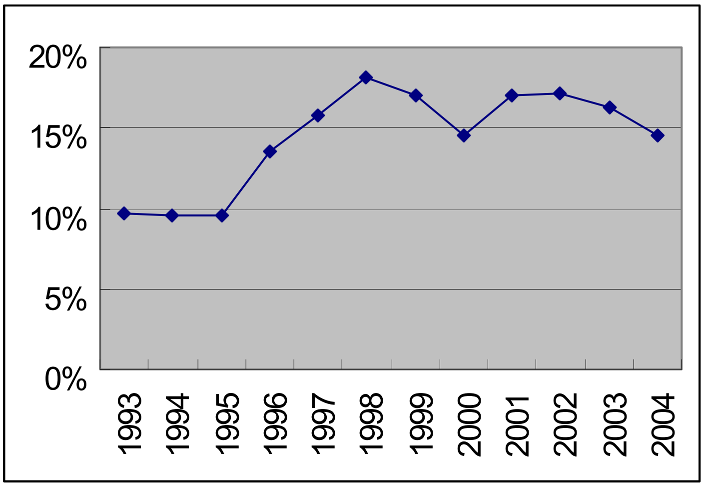
Source: Authors' calculation based on data from SIA

Figure 6 Subsequent sales growth of pro-cyclical capex and counter-cyclical capex in the semiconductor industry



Source: Authors' calculation based on data obtained from *IC Insights*

Figure 7 Market Share of Intel, 1993-2004



Source: Authors' calculation based on data obtained from *IC Insights*

Table 1 Semiconductor Industry Cycle with Calendar Year

Upturn	Downturn
1978, 1979	1980, 1981, 1982
1983, 1984	1985
1986, 1987, 1988	1989, 1990, 1991
1992, 1993, 1994, 1995	1996, 1997, 998
1999, 2000	2001
2002, 2003	

Source: Authors' calculation

Table 2 Correlation of the cyclical component of the capacity data series and the industry cycle series

Capacity	lag=0	lag=1	lag=2	lag=3	lag=4	lag=5	lag=6	lag=7	lag=8
Correlation	.114	.448**	.675**	.758**	.717**	.595**	.439**	.278	.133

Notes: ** Correlation is significant at the 0.01 level (2-tailed)

Table 3 The largest companies engaging in pro- versus counter- cyclical capex in the 1996-98 industry cycle downturn

	Firms engaging in pro-cyclical capex		Firms engaging in counter-cyclical capex	
Rank	Name	Market share as of 1996 (%)	Name	Market share as of 1996 (%)
1	NEC Electronics	9.3	Intel	13.3
2	Toshiba Semiconductor	7.7	Texas Instruments	5.5
3	Freescale Semiconductor	5.9	IBM Microelectronics	3.9
4	Samsung Semiconductor	4.7	Sony Semiconductor	1.8
5	Mitsubishi Semiconductor	4.2	Agere Systems	1.7

Source: Authors' calculation based on data from *IC Insights*

Appendix A: The List of the Semiconductor Companies in the Sample

Advanced Micro Devices
Agere Systems
Anadigics
Analog Devices
Applied Micro Circuits
Atmel
Austria Micro Systems
Chartered Semiconductor Manufacturing
Cypress Semiconductor
DongbuAnam Semiconductor
ELMOS Semiconductor
Fairchild Semiconductor
Freescale Semiconductor
Fujitsu Electronic Devices
Gennum
Hynix Semiconductor
IBM Microelectronics
Infineon Technologies
Integrated Device Technology
Intel
International Rectifier
Intersil
IXYS
Linear Technology
LSI Logic
Macronix International
Matsushita/Panasonic
Maxim Integrated Products
Micrel
Microchip Technology
Micron Technology
Micronas
Mitsubishi Semiconductor
Mosel Vitelic
National Semiconductor
NEC Electronics
New Japan Radio
Oki
Philips Semiconductors
RF Micro Devices
Rohm
Samsung Semiconductor
Sanyo Semiconductor
Seiko Epson
Sharp

Siliconix
Sipex
Sony Semiconductor
Spansion
STMicroelectronics
Supertex
Taiwan Semiconductor Manufacturing
Texas Instruments
Toshiba Semiconductor
Tower Semiconductor
TriQuint Semiconductor
United Microelectronics
Winbond Electronics
Yamaha Electronic Devices

Appendix B: Results of the t-tests

B.1 Compounded average sales growth consequent on pro-cyclical or anti-cyclical investment during 1996-98 downturn

Group Statistics					t-test for Equality of Means		
Group	Number of Firms	Mean of Compounded Sales Growth	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pro-cyclical	27	.0650	.07836	.01508	-2.68	57	.010
Counter-cyclical	32	.1311	.10626	.01878			

B.2 Average sales growth consequent on pro-cyclical or anti-cyclical investment during 1996-98 downturn

Group Statistics					t-test for Equality of Means		
Group	Number of Firms	Mean of Annual Sales Growth	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pro-cyclical	27	.1123	.08916	.01716	-2.59	57	.012
Counter-cyclical	32	.1978	.15003	.02652			

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