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## Research note

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# Supply chain management and business cycles

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### Abstract

**Purpose** – The purpose of this research note is to investigate the implications of supply chain management of e-business for the macroeconomic phenomenon of business cycles.

**Design/methodology/approach** – The paper provides a list of propositions, which form the broad basis of an empirical research agenda, to explore and investigate the mechanisms through which supply chain innovations can influence business cycle.

**Findings** – Economic research literature has pointed out that there are linkages between inventory investment and business cycle fluctuation. Given that the e-business supply chain management drastically alters inventory investment across a range of industries, it is likely to affect the behaviour of economic fluctuation.

**Originality/value** – This research has the potential to contribute to a better-informed formulation of economic policies at national and global level.

**Keywords** Business cycles, Supply chain management, Electronic commerce, Economic policy

**Paper type** Conceptual paper

## 1 Introduction

Economics researchers and practising economists are generally in agreement that inventory investment has been closely associated with business cycles:

Inventory fluctuations are important in business cycles; indeed, to a great extent, business cycles are inventory cycles (Blinder, 1981, p. 500).

Similar views have been expressed by Blinder's professional colleagues, like Dimelis (2001), Flood and Lowe (1995), Lovell (1961), and Metzler (1941). Even though inventory investment accounts for a small percentage of gross national product (GNP) and its fluctuation is insignificant in a smooth performing economy, its correlation with changes in GNP during economic fluctuation is huge. For example, during the 1981-1982 economic contraction, real GNP in the USA declined by \$105 billion while inventory investment (which averaged a mere 0.7 per cent of GNP) declined by \$95 billion (Ramey, 1989). In other words, the fall in inventory investment accounted for 90 per cent in the fall of the

GNP. This high ratio is observed in cyclical economic fluctuations of other periods (Blinder, 1981; Ramey, 1989).

For information systems researchers, the above insight provides an interesting and rewarding avenue to investigate a serious claim we often come across in e-business literature, namely e-business holds the potential to transform not only the business landscape, but it has also profound implications for the economic landscape. We believe that the profound meaning of e-business for economy is not hot air[1]. We would argue why, and the reasoning is pretty straightforward:

- Supply chain management (SCM) is transforming the theory and practice of inventory management. How this is happening has become a core component of e-business textbooks and is amply described in business newspapers.
- Inventory management has direct impact on business cycle, a fact well established by economics researchers.
- Combining the above two points, we come to the following conclusion: SCM is going to affect the behaviour of business cycle.

This paper presents a list of propositions that are argued on the basis of previous research findings of inventory management and business cycles.

The rest of the paper is organised as follows. The next section, section 2, briefly describes pattern of inventory management and the factors that account for the formation of such pattern. Section 3 goes into the cost structure of inventory investment, which provides a basis for us to understand how SCM can radically change the cost structure. By going through the response of business firms in managing their inventory in economic fluctuations in the old economy and the new economy, section 4 submits a list of propositions.

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These propositions or hypotheses have yet to be tested empirically. Section 5 goes into possible implications of these propositions for economic planners at national and international levels. Section 6 concludes the paper with a brief discussion on yet another contribution of SCM to economic productivity.

## 2 Pattern of inventory investment and its sources

This section discusses the various ways inventory management system can be affected the business cycle. As a prelude to it, we briefly go through the notion of business cycle. For the purpose of this paper, we may identify two different meanings associated with the term business cycle, broadly classified as the business perspective and the economics perspective. Business management views business cycle as closely associated with the four basic functions of business management: development, production, marketing and administration (Karlof, 1993). A subset of this perspective, namely, from production operating point of view, business cycle is seen as the duration from the purchase of materials to the sales of products to customers. This perspective is implicit in the following statement of the CEO of IBM:

E-business is all about cycle time[2] speed, globalization, enhanced productivity, reaching new customers and sharing knowledge across institutions for competitive advantage (Source, 1999).

From an economics point of view, business cycles refer to the periods of expansions and recessions in the level of economic activities (Burns and Mitchell, 1950). Compared to the business management perspective, the economics perspective is broader in terms of scope and longer in terms of time. Thus, an economic business cycle consists of the sum total of periodic but irregular up-and-down movement in production and sales of many individual firms (McTaggart, 1999). As it is implied earlier on in this paper, we look at business cycle from an economics perspective, which is also the most common perspective adopted in our ordinary discourse.

The relationship between inventory investment and business cycles is complex. The former is affected by fiscal and monetary policies, perceptions of outlook of the global economy, and other related issues. It is therefore not surprising that there is no final word on the structural relationship between inventory investments. Broadly speaking however, there are three possible sources of the high correlation between inventory investment and economic fluctuation (Ramey, 1989):

- 1 inventory investment might react passively to changes in output, i.e. inventories act as an important propagation mechanism or accelerator of economic fluctuation;
- 2 inventory investment responds strongly to monetary policies and credit conditions in general, i.e. it is an important monetary transmission mechanism; and
- 3 changes in demand for inventories might be an important source of inventory investment changes.

Based a study of durable goods industry, Ramey (1989) finds that 40 per cent of the decline in inventory during a recession comes from an accelerator effect, i.e. source (1) and 60 per cent from unobserved shifts in the demand for inventories. The conclusion is that monetary policy plays a very marginal role. This is not to imply that monetary policy is totally irrelevant; interest rate affects the cost of capital directly and a lower interest rate in economic downturn will be read by the

business world as the government's willingness to help turn the economy around.

## 3 Cost structure of inventory investment

Next, we look at the categories of inventory in different industries, drawn mainly from the two standard textbooks Garrison and Noreen (2003) and Anthony *et al.* (1992), and also Ramey (1989).

Most of us are familiar with the three types of inventory in the manufacturing industry, namely the raw materials to be turned into final products, completed products but not yet sold to customers known as the finished goods, and those in between called work in process. From the production point of view, well-stocked supply of raw materials is a condition for smooth production. It acts as a buffer so that production can proceed smoothly even if suppliers are late with deliveries. This point is very important for manufacturing enterprises where the setup costs induce them to make extended runs of each item they produce (Lovell, 1981). For the sales point of view, well-stocked inventory of finished goods acts as a reservoir for the manufacturing firm to deliver goods to their customers even when production is disrupted. Lovell (1981, p. 451) argues that:

... manufacturers may hold inventories of finished goods because they want smooth production in the face of fluctuating sales. Manufacturers may find inventories of work in progress useful in scheduling production.

Such reasoning supports the position of using inventories to smoothen production. Commonsense would suggest that it is applicable when production occupies central stage either because of the nature of the industry, or because key management people believe in it. It has found theoretical support in a very influential piece of work by Holt *et al.* (1960).

Apart from manufacturing firms, we have trading companies. According to Garrison and Noreen (2003), a merchandising company has only one class of inventory – goods purchased from suppliers that are awaiting resale to customers. This may be accurate to the first degree. A more complex picture is presented by Blinder (1981, p. 450): “Firms hold inventories for transactions, speculative, or precautionary reasons.” As example of precautionary motive, a departmental store would rather suffer the cost of holding inventories than run out of stock and lose customers (Blinder, 1981).

Finally we have the service industry. Although adopting the vocabulary of the manufacturing industry, the service industry has no buffer, the cost of many of service firms are fixed in the short run, they have difficulty in controlling quality.

In general terms, the costs involved in inventory procurement can be broken down into (adapted from Garrison and Noreen, 2003):

- 1 cost of the inventory itself;
- 2 transport costs, including insurance;
- 3 holding costs consisting of warehousing cost, insurance, depreciation, and bank interests; and
- 4 administrative costs consisting of ordering, checking of delivery and quality, payment, and reporting.

SCM in e-business environment reduces cost items (3) and (4) dramatically.

#### 4 Inventory investment in old economy and new economy

For the scope of this paper, the key differences the old economy and the new economy can basically be summarised in the differences in the inventory – relative large size of inventory in the old economy compared to the minimum possible using business network in the new economy. We shall examine the implications of this point for business cycles.

##### Pro-cyclical tendency in the old economy

In the old economy, manufacturing firms holds substantial amounts of raw materials, finished goods and work in process. There are good reasons to understand why inventory investment falls so sharply whenever there is economic downturn. In the face of a gloomier prospect, firms would want to cut whatever cost possible. Reducing inventory is a good option because there is still a reservoir of inventory around, built up previously to smoothen production. This is made all the more desirable because holding costs (consisting of warehousing cost, insurance, depreciation, and bank interests) can only increase as time goes by. This can well explain why in the durable goods manufacturing sector studied by Ramey (1989), 40 per cent of reduction in inventory investment is a response to the economic downturn. Such reaction can only worsen the economic downturn. The reverse holds true during an economic upturn. The raw materials has to be replenished in time to take advantage of good time ahead, and such collective move across a given industry can contribute to a sharper upturn. In other words, it is pro-cyclical in both phases of the economic fluctuation. Hence we state the following:

- P1.1.* In the old economy where firms hold substantial inventory, inventory investment tends to aggravate an economic downturn.
- P1.2.* However, it tends to speeds up the recovery when the general consensus points to an economic upturn.

##### Reduced inventory contributes to economic stability

In the network economy, SCM supports a production schedule driven by demand, or made to order (Turban *et al.*, 2004; Kalakota and Robinson, 2001). In terms of cost incurred, we have now cost of very low level of raw materials, the usual work in process inventory, and very low level of finished products. As a result of SCM, there is no more administrative costs related to ordering, checking of delivery and quality, payment, and reporting. The whole cost associated with inventory management is reduced to the bare minimum. In the event of a likely economic downturn, a production firm has no inventory of raw materials and finished products to trim. When the demand is low, there will be corresponding lower order of raw materials. As Abramovitz (1950) observes in his seminal work, leaner stocks would contribute to economic stability. In other words, SCM in the new economy would not be so pro-cyclical as in the old economy. This is a point echoed by Cairncross (2000) who writes that when demand grew a bit more slowly in the past, inventories would often fall, amplifying a mild deceleration into a recession. On balance, the result is summed up by *The Economist* (2001) as follows:

Across the economy as a whole, “just-in-time” inventory management has reduced the ratio of inventory to sales. But it cannot guard against excessive stocks when shocks occur. It can only ensure that for any given shock, the error is smaller than it would otherwise have been. So far, the build-up stocks is modest given how sharply demand has fallen.

A recent research supports this line of thinking. Stock and Watson (2003) point out that:

Most of the G7 economies have experienced a reduction in the volatility of output growth, and a concomitant moderation of business cycle fluctuations, in the past two decades ... Some of the proposed explanations, such as changes in monetary policy and adoption of new inventory management, are domestic in origin, ...

Hence we submit the following:

- P2.1.* Adoption of SCM by business firms across the economy would contribute to economic stability.

We would do some “fine tuning” in applying *P2.1* to some economic players. For example, there are certain industries that have followed the built-to-order method even in the old economy. Aircraft manufacturers, makers of factories, ship builders, etc. run their production schedule on the basis of the orders they receive. Because of the long production cycle, they can afford to tune their inventory on a demand driven basis. The adoption of SCM in the new economy would still contribute to economic stability, though in a less remarkable fashion than those industries that did not use built to order method in the old economy. Therefore we submit the following:

- P2.2.* Suppose *S* is the class of manufacturing firms that adopted the built to order technique in the old economy, and *T* is the class of manufacturing firms that did not adopt the built to order technique in the old economy. *SN* refers to *S* that has SCM in the new economy, and *TN* refers to *T* that has adopted SCM in the new economy. *TN* will contribute more than *SN* to economic stability in the new economy.

##### Faster transmission of economic upturn and downturn

Besides reducing stock level, SCM speeds up production cycle time, and tightens integration of business activities and it cuts cross the borders of individual companies. Between them, these features reduce lag time between business cycle of individual company and that of the industry. Production variation in the main players will be transferred to the industry and their suppliers very quickly. Use of IT in inventory control and supply chain collaboration creates transparency of orders and operations problems, thereby increasing the visibility of demand throughout the supply chain (Lee *et al.*, 1997). This can have its downside in that without the buffer or reservoir role of stock, any downturn is transmitted more quickly through the whole system. The chairman of the US Federal Reserve Bank, Alan Greenspan, told the Senate hearing in March 2001 that:

The faster adjustment process does raise some warning flags. Firms appear to act in a far closer alignment than in previous decades. The result is not only a faster adjustment but one that is potentially more synchronized, compressing changes into an even shorter time frame[3].

Another aspect of SCM is that integration of business activities is global in character, linked together by a data communication network. To use a trite phrase, changes happen at internet time and are transmitted at the speed of light. Alan Greenspan’s remark can be modified to apply to read:

The faster adjustment process does raise some warning flags for global economy. Firms across the world appear to act in a far closer alignment than in previous decades. The result is not only a faster adjustment but one that is potentially more synchronized, compressing changes into an even shorter time frame affecting all members of the global economy (the added words are in italics).



We submit therefore the following:

- P3. SCM has integrated the activities of business firms across the global more tightly and economic fluctuations in one major player are rapidly transmitted to the rest.

## 5 Implications for policy makers

There are a few implications of the above three sets of propositions for policy makers at the national and international level. Half a century ago, Abramovitz (1950) was suggesting that government could influence business firms to maintain a leaner level of inventory by levying a tax on the average level of inventories. The intention was to use it as a way to contribute to economic stability. Now that role is being taken over by SCM in the e-business environment. However it does not mean that the spirit of that argument is totally out-dated. In the new business environment, governments can promote economy stability by encouraging businesses to adopt SCM.

Following the line of thinking in P2.1 and P2.2, government would put more emphasis to urge firms that have not adopted built to order method to use SCM. In fact, governments have been encouraging and supporting companies operating in their territories to adopt SCM following very much the ideology of developmental state, an idea articulated by Johnson (1995) and Castells (1992, 2001). For example, as a measure to cope with the challenges of globalisation, the Taiwanese Government has been actively involved in setting up a SCM infrastructure meant for small and medium enterprises by launching the Industrial Automation and Electronic Business program in 1999 (Chen, 2003). It is very interesting to note that the explicit aim is to strengthen the competitiveness of Taiwanese small and medium firms as suppliers of IT components. Any benefit in the form of contributing to milder economic fluctuation would be accruing from the project as a kind of unintended consequence. It also suggests that the potentially benign contributions of SCM to business cycles has perhaps escaped the attention of economic planners.

A related point of the above is that educational course designers in economics faculty could be informed of the value SCM in their curriculum.

Finally given its global character and its role in affecting business cycles, SCM deserves the close attention of international bodies like the International Monetary Fund (IMF) which have a deep interest in reducing global economic volatility. For the same reason, governments across the globe have to co-operate in this truly global project to contribute to a more stable world economic order. It would mean that SCM would enjoy the same kind of consideration as macroeconomic issues like monetary policy.

## 6 Concluding remarks

As stated in the foregoing sections, SCM plays a role in influencing the economic behaviour by the way inventory is managed. This in itself is certainly a very significant point, significant enough to make SCM one of the most important e-business topics for economists. There is yet another point that deserves the attention of economists, namely the contribution of SCM to economic productivity by way of direct cost reduction (please see section 3 of this paper) and by way of promoting more efficient production in the more

general sense. This second point is often overlooked in e-business literature but it is noticed in management control texts. For example, Garrison and Noreen (2003, p. 13) tell us that:

... the presence of inventories encourages inefficient and sloppy work, results in too many defects, and dramatically increases the amount of time required to complete a product.

Inventory holdings can be used to cover up mistakes – wrong items ordered, defective manufactured parts thrown back into the storage space instead of being quickly fixed (Lovell, 1994). Indeed, “every effort may be made to keep what is involved out of sight rather than uncovering error by liquidating stocks” (Lovell, 1994, p. 36).

In an economic growth cycle, we run the risk of stoking the flame of inflation if there is no productivity gain. Productivity gains can come in the form of technological innovation (e.g. falling price of computer hardware) or other kinds of innovation. SCM has a two-pronged contribution to productivity gains.

As a way to conclude the paper, we may say that the contributions of SCM to economic activity in themselves are sufficient ground for us to argue that e-business does contribute to economy and society.

## Notes

- 1 Our belief is basically different from that of those investors who expected the extraordinary huge financial profits to be made by e-business companies. Their speculative and irrational exuberance has contributed to the recent dot.com bubble, and the saga is well reported in the business press.
- 2 Cycle time here indicates product development cycle, production cycle, inventory cycle or credit collection cycle, etc.
- 3 Reported in *The Australian* (2001, p. 37).

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