

The Correlation between Library Circulation and Bookstore Circulation in Japan: A Time Series Analysis

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ABSTRACT

The objective of this paper is to investigate the interrelationship between the two main book distribution channels in Japan, bookstores and libraries. For this purpose, we compare and analyse the circulation of books via bookstores and via libraries in the 60 years since the end of World War II. We also focus on domestic economic trends as an external factor influencing book circulation. Three time-series variables were analysed: total annual net paid circulation via bookstores (from 1953 to 2009), total annual circulation via public libraries (from 1958 to 2008), and the real economic growth rate, calculated on the basis of real GDP, for each calendar year (from 1956 to 2009). The circulation of books via libraries has increased almost monotonically since the 1960s, while that via bookstores has decreased since reaching a peak in 1996. Simple correlation coefficients and partial correlation coefficients were calculated to demonstrate synchronous relationships between each pair of the three time-series variables. Tests of non-correlations for each correlation coefficient were also conducted. Finally, the Granger causality test was conducted to demonstrate anterior-posterior relationships among variables. From the results of the correlation analyses and the Granger causality test, we can conclude with reasonable certainty that book circulation has been affected by economic trends, whereas the correlation between the circulation of books via bookstores and the circulation of books via libraries is in fact spurious. To eliminate the population effect, per-capita circulation was also calculated. The per-capita circulation data also supported the above conclusion.

Keywords: Book Circulation; Correlation Analysis; Domestic Economic Trends; Circulation of Books Via Libraries; Public Library.

INTRODUCTION

The Japanese publishing industry has been shrinking continuously over the past decade. Figure 1 shows transitions in the total annual sales of books and magazines from 1953 to 2008. The figure shows that the market continued to increase until the mid-'90s. The book publishing market expanded almost monotonically until reaching a peak in 1996 (1.09 trillion yen). After that year sales generally declined, with a few minor upticks. The magazine publishing market also expanded almost monotonically until reaching a peak in 1997 (1.56 trillion yen). After that sales decreased monotonically. Total book and magazine sales decreased after reaching a peak in 1996 (2.66 trillion yen); in 2008, total sales stood at 2.02 trillion yen (Shuppan Kagaku Kenkyujo, 1960-2010).

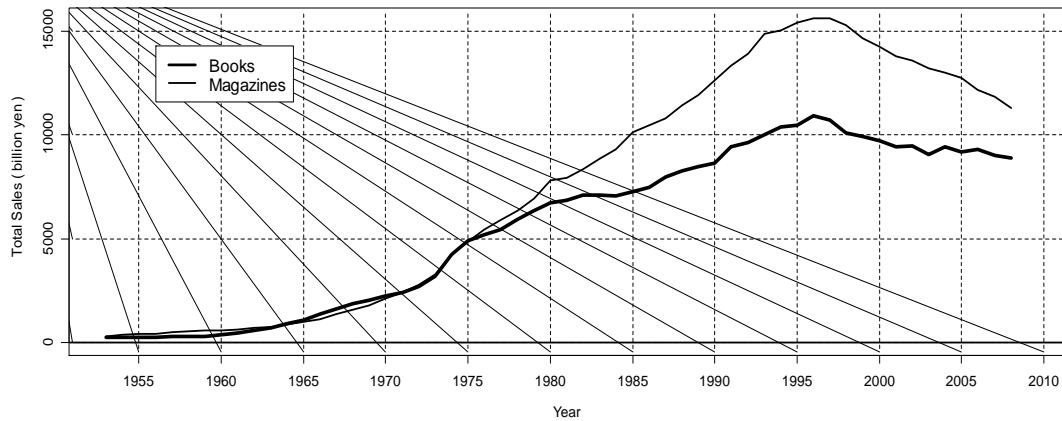


Figure 1: Transitions in the Total Annual Sales of Books and Magazines

Many Japanese authors have warned of a crisis in the industry since the 1990s. For instance, this problem was taken up by Oda Mitsuo in “The crisis in the publishing industry and social structure” (Oda, 2007) and “In what way will publishers and bookstores perish?” (Oda, 2008), and by Maeda Rui in “When paper books perish” (Maeda, 2009).

Some authors have pointed to public libraries as the cause of the depression in the publishing industry. Hayashi Nozomu condemned public libraries for turning into book rental stores that loan out best-selling books for free and thus cut into publishing industry profits (Hayashi, 2000). Nire Shuhei wrote an inflammatory essay titled “Libraries flourish and writers perish” (Nire, 2007). Even the Ministry of Economy, Trade and Industry (METI) has pointed to increased access to books in libraries as one of the factors behind the business depression in the publishing industry (METI, 2002).

The objective of this paper is to investigate the interrelationship between the two main book distribution channels in Japan, bookstores and public libraries, in order to clarify whether public libraries have had a negative impact on the publishing industry or not. For this purpose, we statistically compare and analyse the circulation of books via bookstores and via libraries over time. We focus on the 60 years since the end of World War II, as the Japanese publishing industry was reconstructed from scratch in the postwar period.

HYPOTHESES AND DATA

Data on the circulation of books via bookstores and via public libraries were used as basic data for analysis. We decided to focus on economic trends as an external factor influencing circulation, as it is safe to assume that economic trends have had an impact on publishing industry sales. Our hypotheses about changes in book circulation are as follows:

- H1. Circulation via bookstores and circulation via public libraries are correlated.
- H2. Circulation of books has been affected by domestic economic trends.

For circulation via bookstores, we collected data on the total net paid circulation for each year from 1953 to 2009, which the Research Institute for Publications, part of the All Japan Magazine and Book Publishers' and Editors' Association, has estimated continuously (Shuppan Kagaku Kenkyujo, 1960-2010). The institute estimates the total circulation on the basis of the difference between the value of shipments of books and magazines from wholesalers and the value of stock returned by retail booksellers to wholesalers. These statistics are reliable and their method of calculation reasonable, because in Japan almost all print media in the market are circulated via wholesale distribution channels.

For circulation via libraries, we collected data on the total lending of public libraries for each year from 1958 to 2008, which the Japan Library Association (JLA) has surveyed continuously (JLA, 1959-2009). JLA surveys the circulation by questionnaire each fiscal year (from April to March), but we treated the data for each fiscal year as if it represented data for that calendar year, in order to analyse all data consistently on the basis of calendar year.

For domestic economic trends, we calculated the real economic growth rate on the basis of real gross domestic product (GDP) for each calendar year from 1956 to 2009, which is estimated and announced as “national economic accounting” by the Statistics Bureau of the Ministry of Internal Affairs and Communications (Statistics Bureau, 2010).

Figure 2 shows the transitions in annual circulation via bookstores and public libraries. The figure shows that circulation via libraries increased monotonically from the 1960s until peaking in 2008 (692 million copies), although circulation via bookstores generally declined after peaking in 1988 (944 million copies).

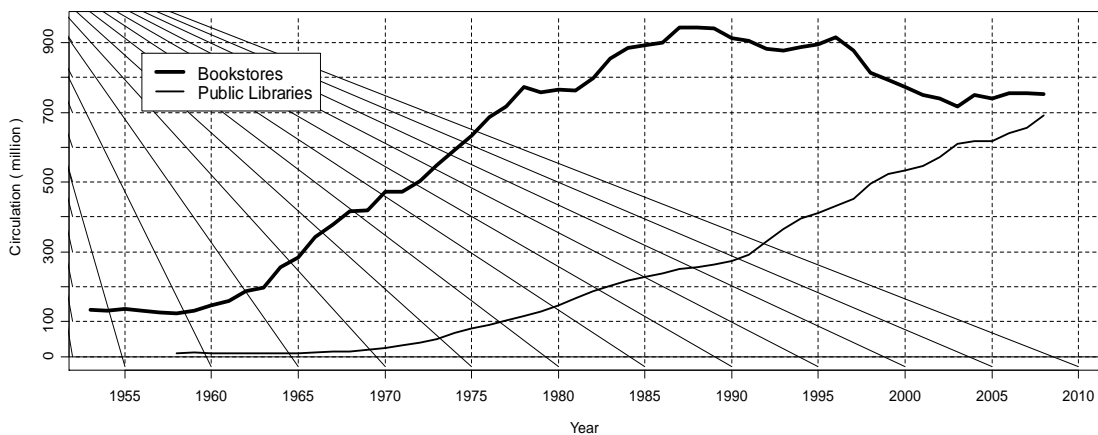


Figure 2: Transitions in Total Annual Book Circulation via Bookstores and Public Libraries

Figure 3 shows the transitions in real GDP growth rate in Japan for the calendar years 1956 to 2009. In general, Japanese economic history after World War II can be divided into three periods: the high-growth period (from 1955 to 1973), the stable-growth period (from 1974 to 1991), and the low-growth period (since 1992). The average economic growth rates in each period are 9.3%, 4.1%, and 0.7%, respectively.

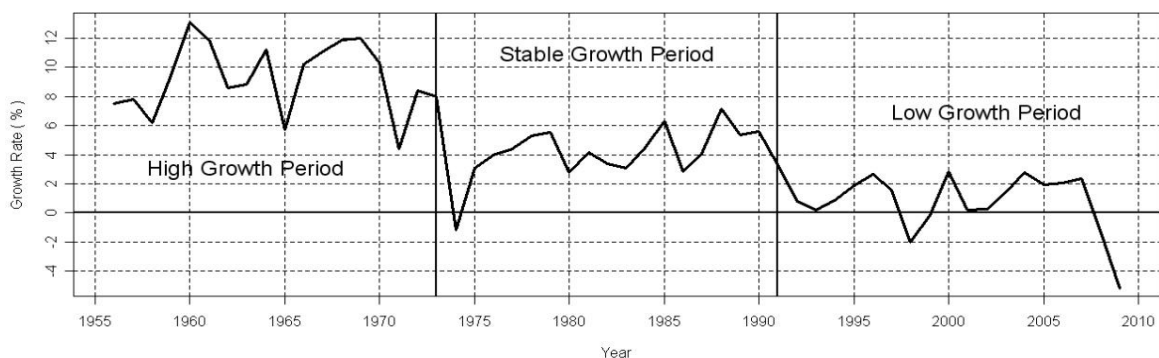


Figure 3: Japan's Real Economic Growth Rate

We analysed these three sets of time-series data to verify our hypotheses. When analysing time-series data, it is necessary to check whether it is a “stationary process” or not. It is impossible to attain reliable conclusions using non-stationary data. If time-series data are non-

stationary, they must be transformed into stationary data before using a statistical model (Hamilton, 1994).

Stationarity of time-series data can be tested using a “unit root test.” The three sets of time-series data were tested using the Phillips-Perron test. The data on domestic economic trends were found to be significantly stationary with the significant level being less than 0.1% ($p < .001$). However, with regard to the data on circulation via bookstores and via libraries, the existence of a unit root as the null hypothesis could not be rejected.

From the original series $(x_1, x_2, x_3, \dots, x_n)$, a first difference series $(x_2 - x_1, x_3 - x_2, x_4 - x_3, \dots, x_n - x_{n-1})$ was then generated as a typical pre-whitening process. These two first difference series were again tested using the Phillips-Perron test, and were found to be significantly stationary with the significant level being less than 0.1% ($p < .001$). We therefore selected the original series of domestic economic trends and the first difference series of circulation via bookstores and via libraries for use in our analyses.

CORRELATION ANALYSIS

Pearson product-moment correlation coefficients were calculated between each pair of the three time-series variables. These are referred to as simple correlation coefficients (SCCs), in contrast with partial correlation coefficients (PCCs). As the SCCs are calculated by pairing data from the same year, they can indicate synchronous correlations between time-series data.

PCCs were also calculated between each pair of the three time-series variables, holding the other time-series variable fixed. PCCs show the strength of association between two variables when the effect of all other variables is removed. PCCs can also indicate synchronous correlations between time-series data.

Table 1 shows the results of these correlation analyses. Tests of non-correlations were also conducted where the null hypothesis is that the correlation coefficient (SCC or PCC) is equal to zero. Asterisks (**, ***) denote the level of p-values of the tests.

Table 4: SCCs and PCCs between Three Time-Series Variables

	SCCs	PCCs
Bookstores & Libraries	-.497 ***	-.234 (n.s.)
Bookstores & Economy	.467 **	.136 (n.s.)
Libraries & Economy	-.796 ***	-.735 ***

** $p < .01$, *** $p < .001$, n.s. not significant ($p > .1$)

GRANGER CAUSALITY TEST

Neither SCCs nor PCCs reveal anything about the anterior-posterior relationship between time-series variables. The Granger causality test was thus conducted to demonstrate anterior-posterior relationships between variables. The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. It does not necessarily indicate that an actual cause-and-effect relationship exists, but it indicates the probable presence of some causal connection (Hamilton, 1994).

There are several ways in which to implement the Granger causality test. Our simple approach used the autoregressive specification of a bivariate vector autoregression (VAR). For each pair of time-series variables, the lag order p of the bivariate VAR(p) model was estimated before testing Granger causality. The best-fitting order p can be selected based on the smallest AIC (Akaike's information criteria). As a result of the estimation, VAR(2) was the best for the pair of circulation via bookstores and circulation via libraries, VAR(4) was the best for the pair of

circulation via bookstores and economic trends, and VAR(1) was the best for the pair of circulation via libraries and economic trends.

Table 2 shows the result of the Granger causality test. The tilde and asterisks (~, *) denote the level of p-values. As mentioned above, economic trends are an external factor in our research model, so two anterior-posterior relationships in which economic trends came before circulation via bookstores ("Bookstore → Economy" and "Library → Economy") were excluded from the test.

Table 2: Granger Causality between the Three Time-Series Variables

Anterior-posterior relationship	VAR models	p-value
Bookstores → Libraries	VAR(2)	.0479 *
Libraries → Bookstores	VAR(2)	.594 (n.s.)
Economy → Bookstores	VAR(4)	.0714 ~
Economy → Libraries	VAR(1)	.0156 *

~ $p < .1$, * $p < .05$, n.s. not significant ($p > .1$)

DISCUSSION

Correlation analysis demonstrated a medium negative correlation between circulation via bookstores and circulation via libraries (SCC=-.50), a medium positive correlation between circulation via bookstores and economic trends (SCC=.47), and a strong negative correlation between circulation via libraries and economic trends (SCC=-.80). The Granger causality tests demonstrated a clear anterior-posterior relationship from circulation via bookstores to circulation via libraries and from economic trends to circulation via libraries ($p < .05$) are found. A probable anterior-posterior relationship from economic trends to circulation via bookstores ($p < .1$) was also found.

We can consequently conclude with reasonable certainty that our two hypotheses (H1, H2) are both supported by the data. Figure 4 gives a graphic representation of the relationship between the three time-series variables. The arrows denote an anterior-posterior relationship (solid line: $p < .05$; dashed line: $p < .1$). The numbers without parentheses denote SCCs, and the numbers with parentheses denote PCCs.

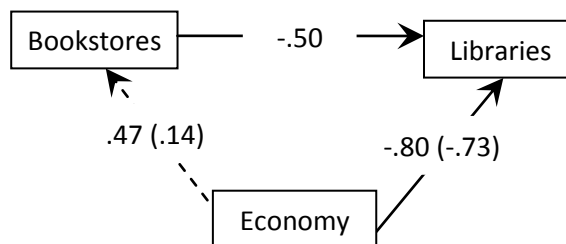


Figure 4: Relationship between the Three Variables

The relationship between circulation via bookstores and circulation via libraries seems competitive judging only from the medium negative correlation coefficient (-.50). The result seems to confirm the assertion that public libraries have a negative impact on the publishing industry in Japan. However, there are two pieces of contrary evidence that prove the assertion to be fallacious.

Firstly, concerning the synchronous relationship, the correlation between circulation via bookstores and circulation via libraries is in fact spurious. These circulations are correlated indirectly due to the domestic economic trends. This is supported by the fact that the absolute value of PCC (.23) between circulation via bookstores and circulation via libraries is much smaller than the absolute value of SCC (.50), and the non-correlations test of PCC cannot reject the null hypothesis that the PCC is zero with the significant level being less than 5% (see Table 1).

Secondly, concerning the anterior-posterior relationship, circulation via bookstores changes before circulation via libraries. Because a second order VAR model is selected for the Granger causality test, it is reasonable to declare that a change in circulation via bookstores for the last two years would have an effect on the change in circulation via libraries. The Granger causality test denies that circulation via libraries changes before circulation via bookstores, with the significant level being less than 10% (see Table 2). There is no evidence that circulation via libraries influences circulation via bookstores.

The relationship between circulation via libraries and economic trends is very clear. Concerning the synchronous relationship, when the economy declines circulation via libraries increases, judging from the strong negative correlation coefficient (-.80). This can be explained by the fact that people tend to borrow a book at public libraries without buying one, even though an increase in circulation via libraries does not cause a decrease in circulation via bookstores. Concerning the anterior-posterior relationship, economic conditions change before circulation via libraries does. Because a first order VAR model is selected for the Granger causality test, it seems reasonable to declare that a change in economic conditions for the previous year, as well as for the same year, would have an effect on the change of circulation via libraries.

The relationship between circulation via bookstores and economic trends is less clearer than the one between circulation via libraries and economic trends. Concerning the synchronous relationship, it seems that the stronger the economy, the more bookstore circulation increases, judging from the medium positive correlation coefficient (.47). However, it may be a spurious correlation, judging from the small number of PCC (.14). The non-correlations test of PCC cannot reject the null hypothesis with the significant level being less than 5% (see Table 1). Concerning the anterior-posterior relationship, the Granger causality test demonstrates that economic conditions change before circulation via bookstores, but the significant level is not so good ($p < .1$, see Table 2).

Our research model with three variables is not sufficient to decipher the hidden factors behind the change in circulation via bookstores, because circulation via libraries does not explain circulation via bookstores, as mentioned above. METI enumerated a variety of other possible causes for the depression in the publishing industry (METI, 2002). These include (1) a falling-off of consumer demand, (2) a decrease in the number of potential readers due to a shrinking and aging population, (3) a social tendency not to read or to read less, (4) a reduction of expenditure on books due to an increase in expenditure on mobile phones and the Internet, and (5) the emergence of the "like new" used book market (excluding increased access to books via libraries). There is much room for further investigation.

TRANSITIONS IN PER-CAPITA CIRCULATION

Up to this point, transitions in total annual circulation of books have been discussed. However, it is necessary to deal carefully with the effect of changes in population. We take it as obvious that the larger the population, the greater circulation will be. To eliminate the effect of population change, we also calculated per-capita circulation of books via bookstores and via public libraries, using the annual population statistics published by the Statistics Bureau of the Ministry of Internal Affairs and Communications (Statistics Bureau, 2010).

Figure 5 shows the transitions both in per-capita annual circulation via bookstores and per-capita annual circulation via public libraries. The figure shows that circulation via public libraries increased monotonically from the 1960s until 2008 (5.42 copies), although circulation via bookstores generally declined after peaking in 1987 (7.7 copies). The patterns of transition are very similar to total annual circulation (see Figure 2).

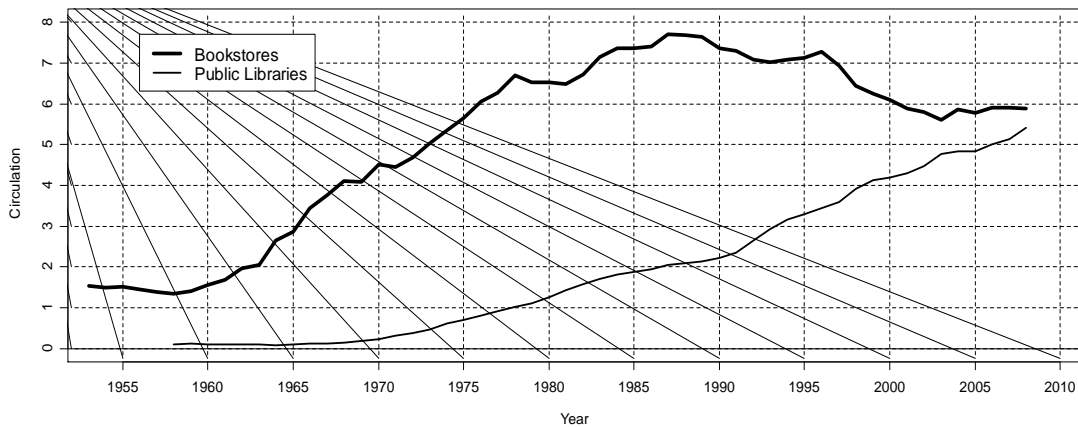


Figure 5: Transitions in Per-Capita Annual Book Circulation

Correlation analysis and the Granger causality tests were conducted for per-capita book circulation and domestic economic trends, following the same process as for total annual circulation. Figure 6 gives a graphic representation of the result. The arrows denote anterior-posterior relationships (solid line: $p < .05$; dashed line: $p < .1$). The numbers without parentheses denote SCCs, and the numbers with parentheses denote PCCs.

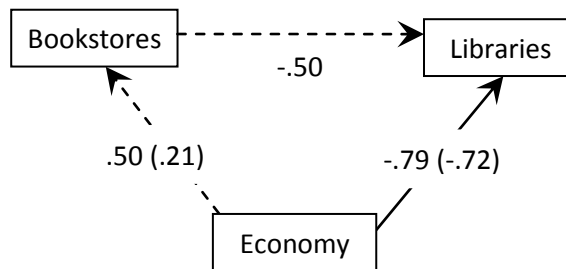


Figure 6: Relationship between the Three Variables Per Capita

Once again, the results support both of our two hypotheses (H1, H2). The discussion of the analysis and the tests lead to the same conclusion for total annual circulation, although the anterior-posterior relationship between circulation via bookstores and circulation via libraries is less clear where the significant level is not so good ($p < .1$).

CONCLUSION

To investigate the interrelationships between the two main book distribution channels in Japan, we analysed the circulation of books via bookstores, the circulation of books via public libraries, and the real economic growth rate, calculated on the basis of real GDP, for the 60 years since the end of World War II. From the results of the correlation analyses and the Granger causality tests, we can conclude with reasonable certainty that book circulation has been affected by economic trends, whereas the correlation between circulation via bookstores and circulation via libraries is spurious.

To eliminate the population effect, per-capita circulation was calculated. The per-capita circulation data supported the same conclusion as above.

The Japanese publishing industry has been shrinking continuously since the 1990s, and some authors have attributed this business depression to the free circulation of books via public

libraries. However, our time-series analyses show that statistically circulation via libraries has neither synchronous effects nor delayed effects on circulation via bookstores.

It is clear that more research is needed to analyse transitions in book circulation in this country. In particular, our research model must be expanded in order to throw light on the hidden causes of transitions in circulation of books via bookstores. We have already carried out a statistical analysis of circulation that covered magazines as well as books (Umino, 2010), and we are currently engaged in more extensive and thoroughgoing analysis of print media circulation in the postwar period.

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