Online Appendix
Measuring the Time-Varying Market Efficiency in the Prewar Japanese Stock Market

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Abstract: This note provides the replication result of Bassino and Lagoarde-Segot (2015) using a GLS-based time-varying AR model. In particular, we employ the 1930s Japanese stock market monthly data as same as Bassino and Lagoarde-Segot (2015) and estimate a time-varying degree of market efficiency. We find that the 1930s Japanese stock market was almost inefficient as well as Bassino and Lagoarde-Segot (2015). This fact means that we have to employ the sample period and the empirical method more carefully to obtain accurate empirical results.

Keywords: Efficient Market Hypothesis; Adaptive Market Hypothesis; GLS-Based Time-Varying Model Approach; Degree of Market Efficiency; Equity Performance Index.

JEL Classification Numbers: C22; G12; G14; N20.

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A.1 A Summary of Bassino and Lagoarde-Segot (2015)

Bassino and Lagoarde-Segot (2015) investigate the market efficiency on the Tokyo Stock Exchange (TSE) in 1931–1940. They construct daily price indexes for stocks and bonds that are obtained from the *Nihon Keizai Nenpo* (*Annual Report on the Japanese Economy*) and estimate a GARCH-in-mean model.[1] They find that the 1930s Japanese stock market was inefficient in the weak-form sense of Fama (1970).

A.2 A Replication Study

In the main text, we conclude that the 1930s Japanese stock market was almost efficient in contrast to Bassino and Lagoarde-Segot (2015). Then we use the same period datasets as Bassino and Lagoarde-Segot (2015) to confirm the replicability. Note that the frequency of the dataset is different between their study (daily data) and the current study (monthly data). However, no problem arises when we employ lower frequency data because the weak form of efficiency is mathematically based on a martingale series of a stock return and the series is invariant under a wide range of transformations.

We use the monthly average stock price data from January 1931 to December 1940 to estimate the time-varying degree of market efficiency. Figures A.1, A.2, and A.3 show the time-varying degree of market efficiency with 99% confidence intervals.

(Figures A.1, A.2, and A.3 around here)

From the above figures, we can not state that the market was completely efficient in the 1930s Japanese stock market, such as the period of the Great Depression. Moreover, we confirm the robustness of the above empirical under the 95% confidence intervals. Figures A.4, A.5, and A.6 also show the time-varying degree of market efficiency with 95% confidence intervals.

(Figures A.4, A.5, and A.6 around here)

Figures show that the 1930s Japanese stock market was almost inefficient. We find that the differences in the sample period and the empirical method lead to quite different empirical results. Therefore, we conclude that we must employ the sample period and the empirical method more carefully to obtain accurate empirical results.

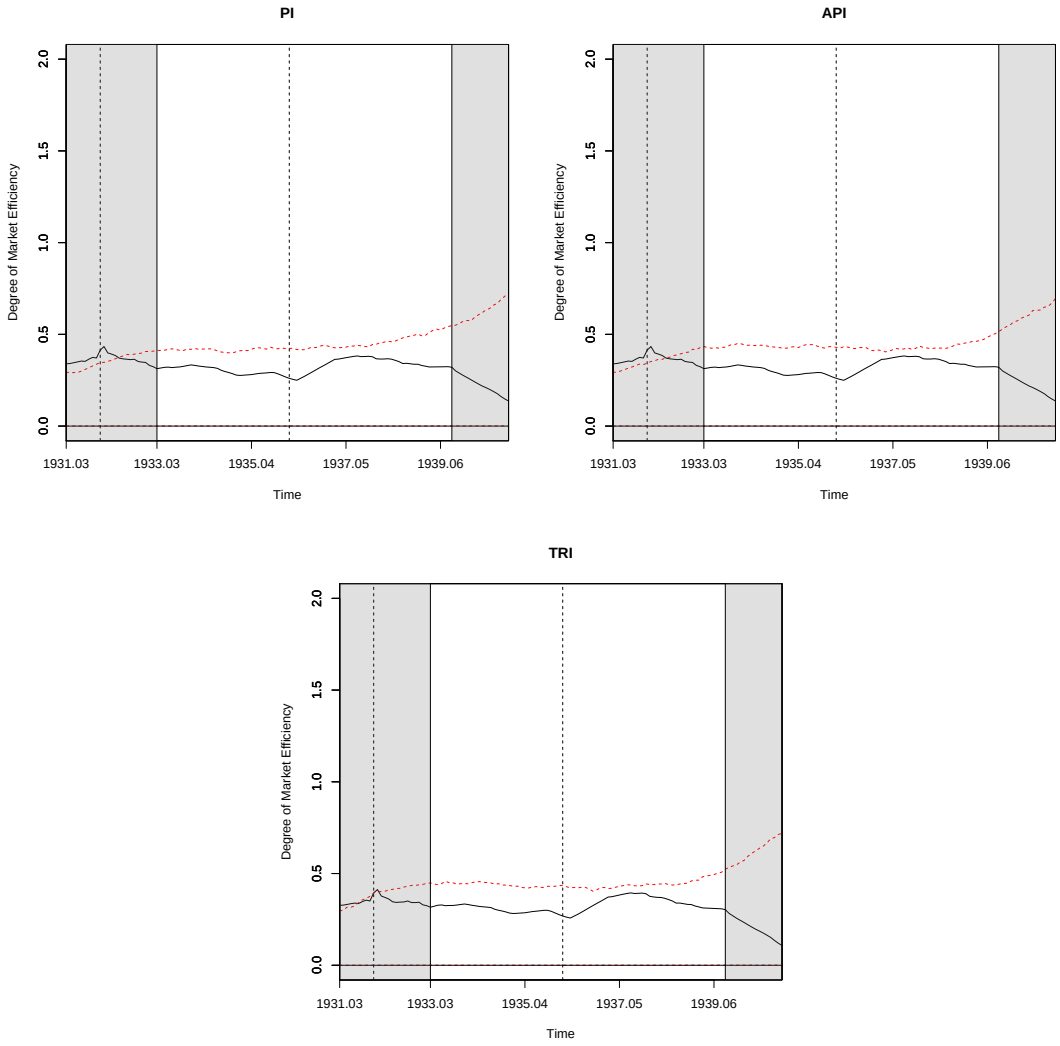
References

Bassino, J. and Lagoarde-Segot, T. (2015), "Informational Efficiency in the Tokyo Stock Exchange, 1931–40," *Economic History Review*, 68, 1226–1249.

Fama, E. F. (1970), "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*, 25, 383–417.

[1] *Nihon Keizai Nenpo* was publised by Toyo Keizai Shimpo Sha.

Figure A.1: Time-Varying Degree of Market Efficiency with 99% CI (Old TSE Shares)



Notes:

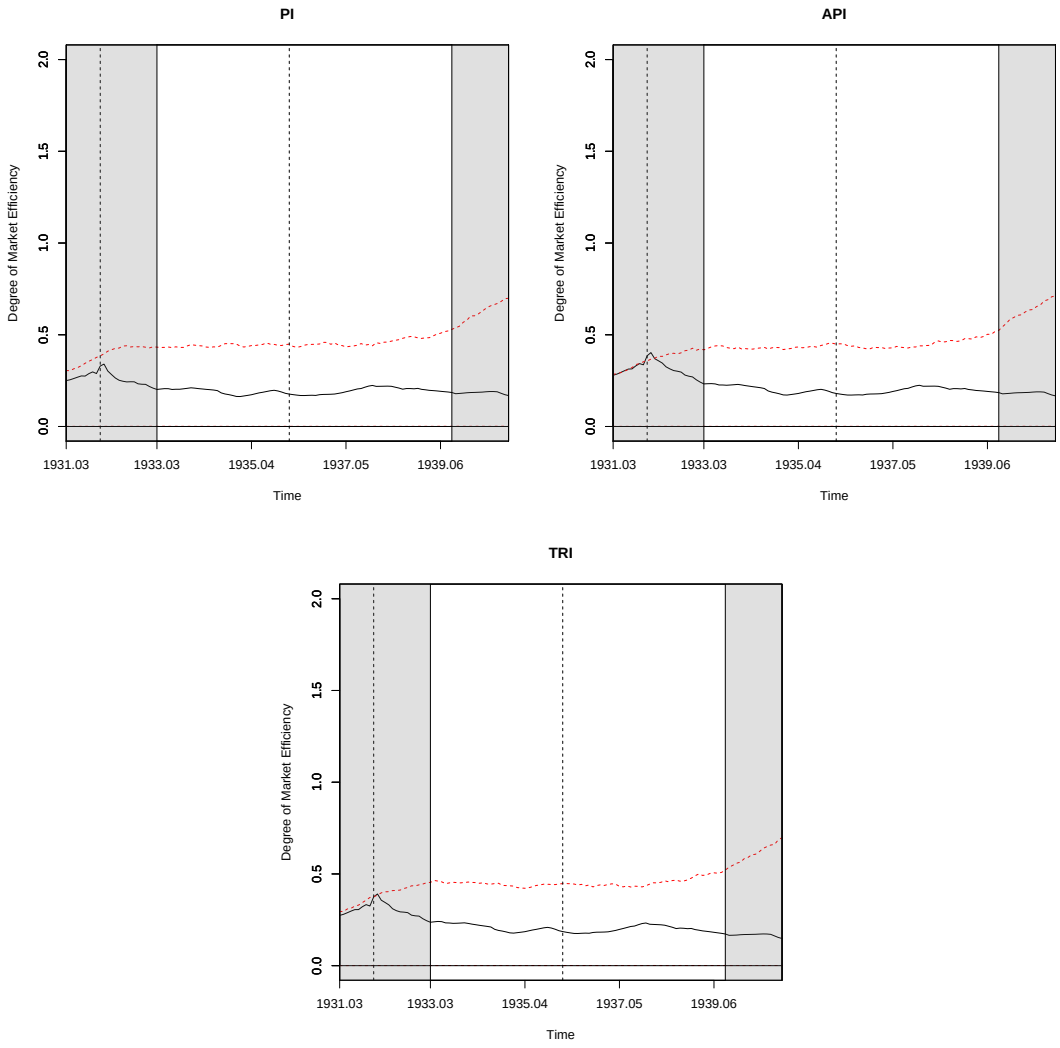
(1) The panels of the figure show the time-varying degree of market efficiency for the PI (first panel), API (second panel), and TRI (third panel).

(2) The dashed red lines represent the 99% confidence intervals of the efficient market degrees.

(3) We run the bootstrap sampling 10,000 times to calculate the confidence intervals.

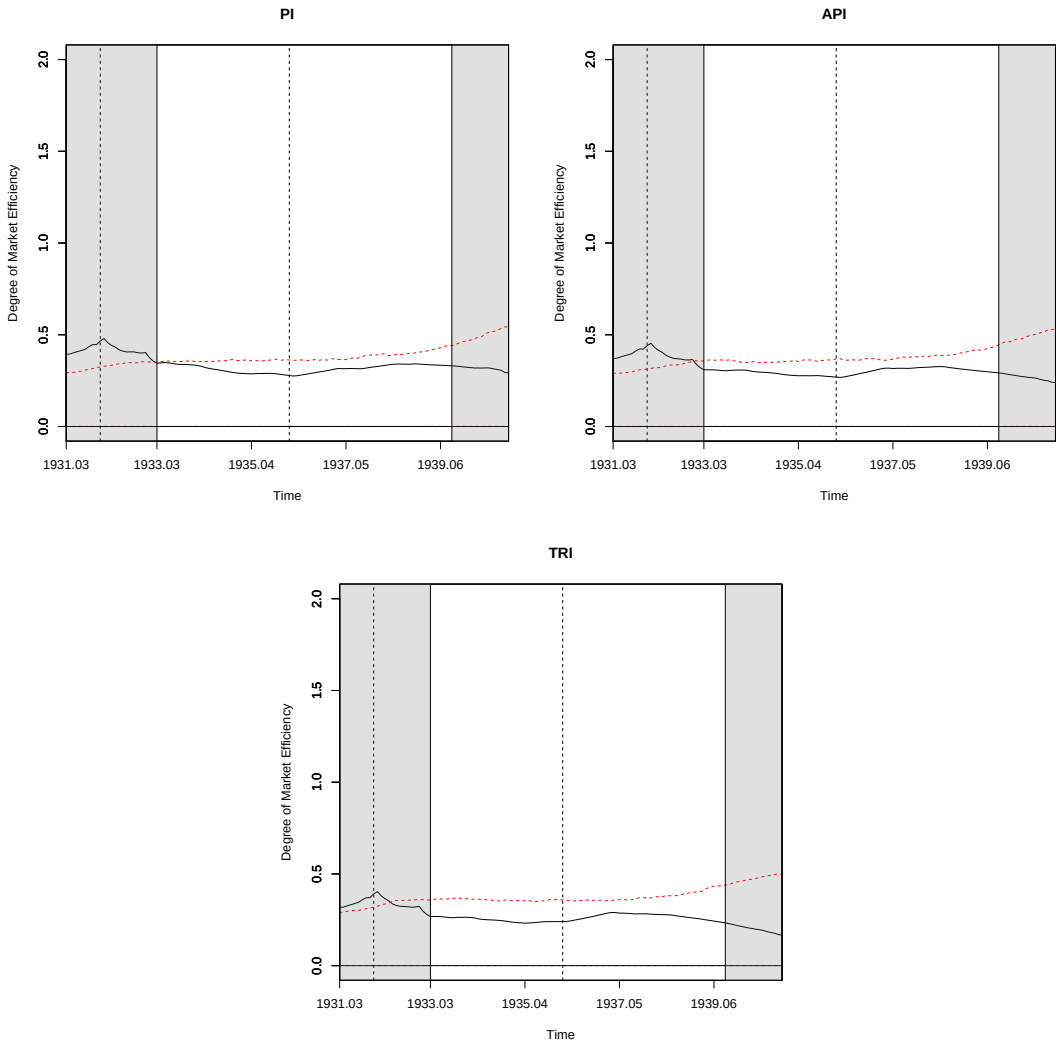
(4) R version 3.6.1 was used to compute the estimates.

Figure A.2: Time-Varying Degree of Market Efficiency with 99% CI (New TSE Shares)



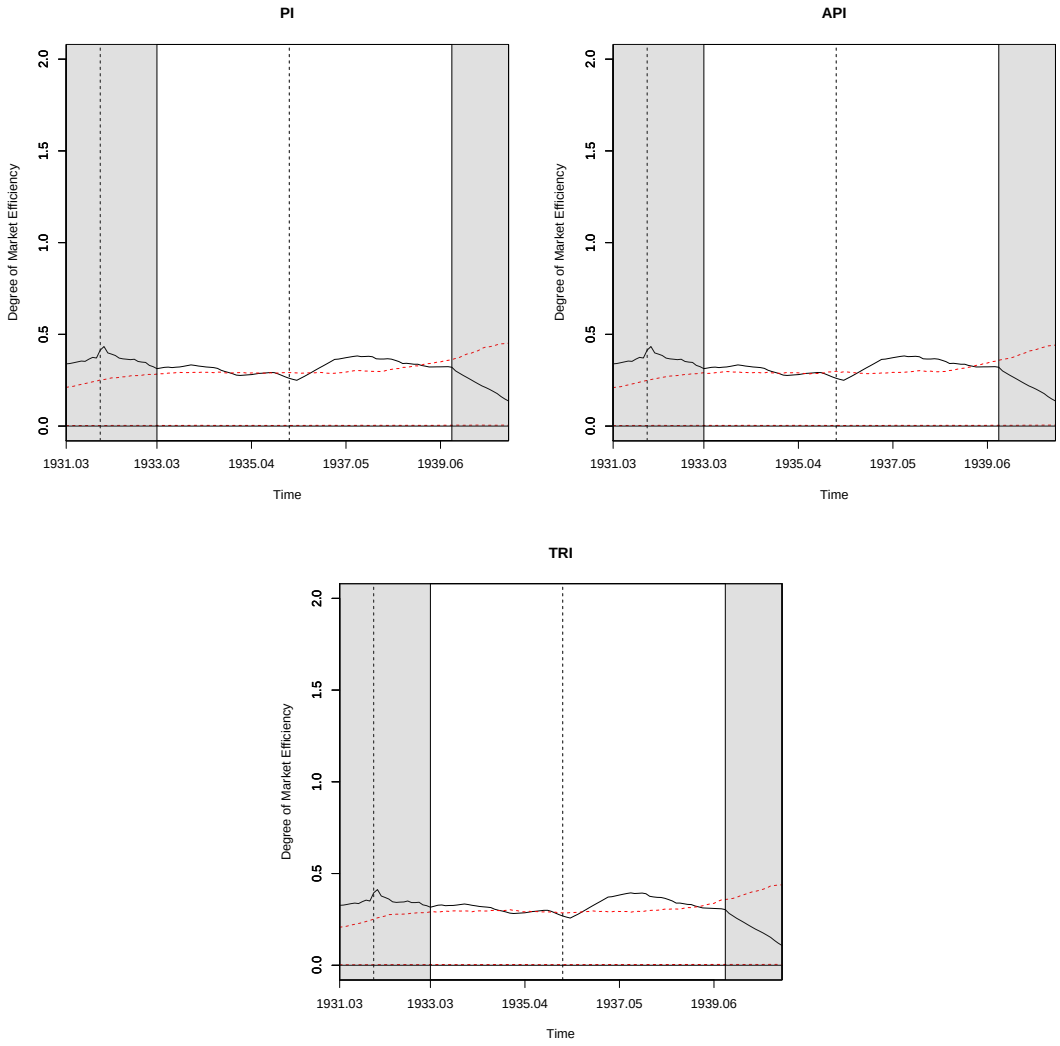
Note: As for Figure A.1.

Figure A.3: Time-Varying Degree of Market Efficiency with 99% CI (EQPI)



Note: As for Figure A.1.

Figure A.4: Time-Varying Degree of Market Efficiency with 95% CI (Old TSE Shares)



Notes:

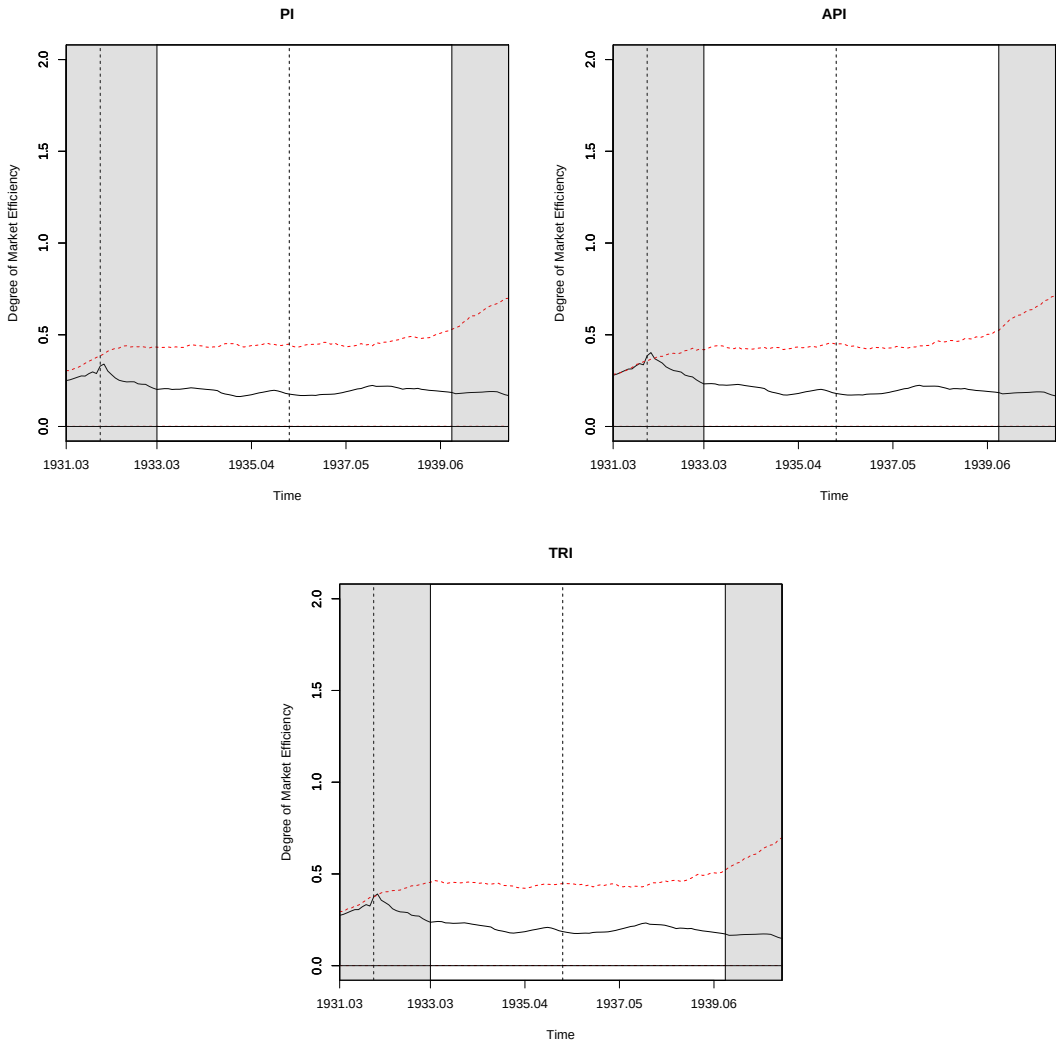
(1) The panels of the figure show the time-varying degree of market efficiency for the PI (first panel), API (second panel), and TRI (third panel).

(2) The dashed red lines represent the 95% confidence intervals of the efficient market degrees.

(3) We run the bootstrap sampling 10,000 times to calculate the confidence intervals.

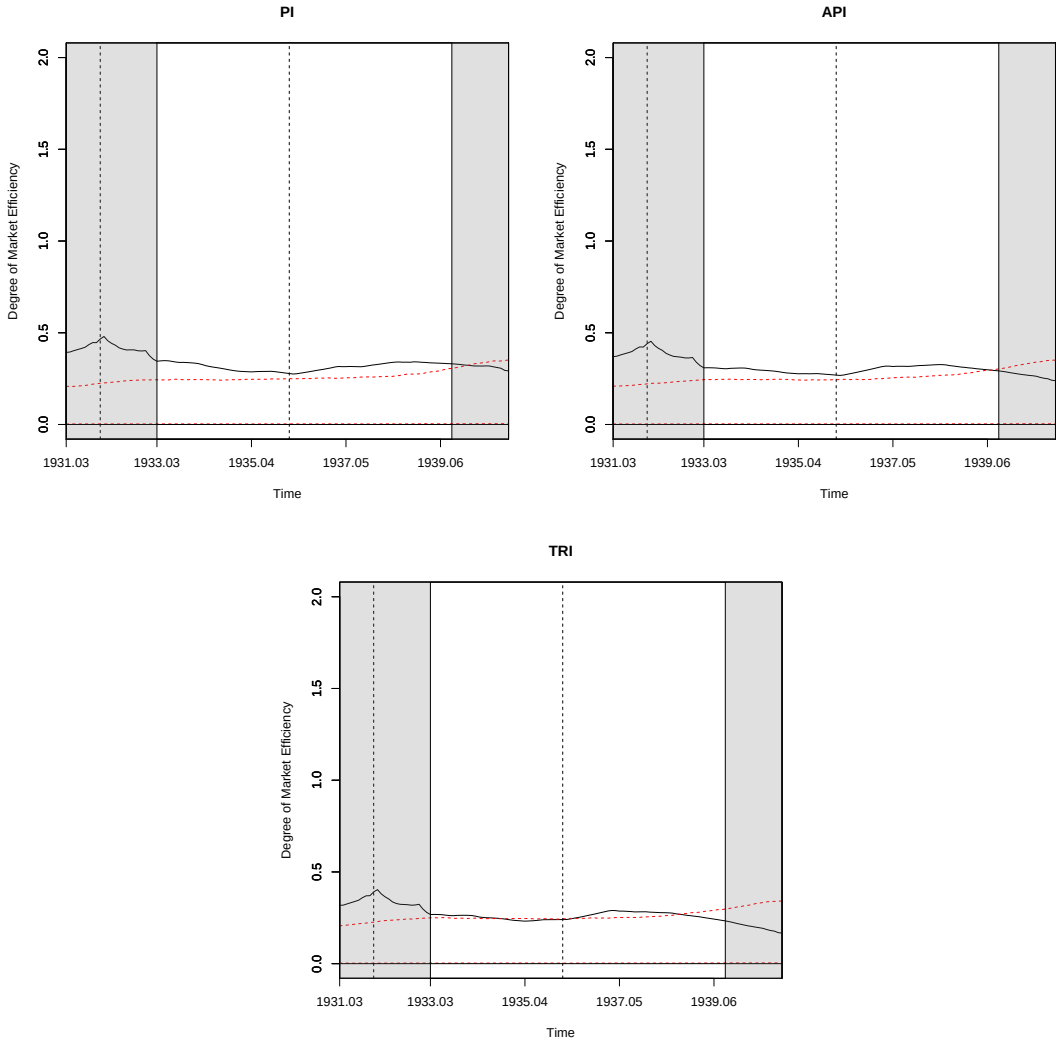
(4) R version 3.6.1 was used to compute the estimates.

Figure A.5: Time-Varying Degree of Market Efficiency with 95% CI (New TSE Shares)



Note: As for Figure A.4.

Figure A.6: Time-Varying Degree of Market Efficiency with 95% CI (EQPI)



Note: As for Figure A.4.