Appendix for

America's Role in the Making of Japan's Economic Miracle

A "structural break" is a commonly used concept in the literature of econometrics. In time-series data (e.g., stock prices, quarterly economic indicators, etc.), some policies and/or events may suddenly shift the time-series trends by increasing/decreasing the averages and/or accelerating/decelerating growth rates. Some structural breaks (e.g., major policy implementations) are known, while others (e.g., major behavioral changes in economic actors) are unknown. Estimating the effects of known structural breaks while detecting unknown structural breaks has been an important research agenda for economists and other social scientists.

The most common method to study structural breaks is called a Chow test (Chow 1960). We apply a simple version of this approach based on the following model:

$$\Delta Y_t = a + b \cdot I(t > k) + \sum_{i}^{4} \Delta Y_{t-i} + u_t$$

where ΔY_t is the difference in per capita GDP between year t and year $t-1$. The variable $I(t > k)$ is an indicator (i.e., dichotomous) variable, which is 1 for all years after k and 0 otherwise. The model also includes four lagged dependent variables based on an assumption that any change in per capita GDP is serially correlated up to four years.[1] u_t is an error term. The differenced per capita GDP fluctuates over time, but if a structural change happened in year k and the average growth rate changed after that, then the coefficient b is expected to be statistically significant. Following conventional practice (Stock and Watson 2011), we use the inner 70% of the sample period (1920-2000); namely, excluding the first and last 15%. Then, for each possible break year k, we run an OLS regression and compute a Chow F-statistic.

[1] We tried various other models but the results are robust to changes in model specifications.

The maximum Chow statistic is called the QLR statistic (Quandt 1960; see also Stock and Watson 2011). If it is statistically significant, we conclude that the year in which the Chow F-statistic is maximized is the structural break point.

The results are presented in Figure A1. The Chow F statistic is the largest in 1958, and it is statistically significant at the 1% level.[2] This result suggests that something occurred in 1958 set Japan on a faster growth trajectory in 1958, and is consistent with our historical analysis.

References for Appendix

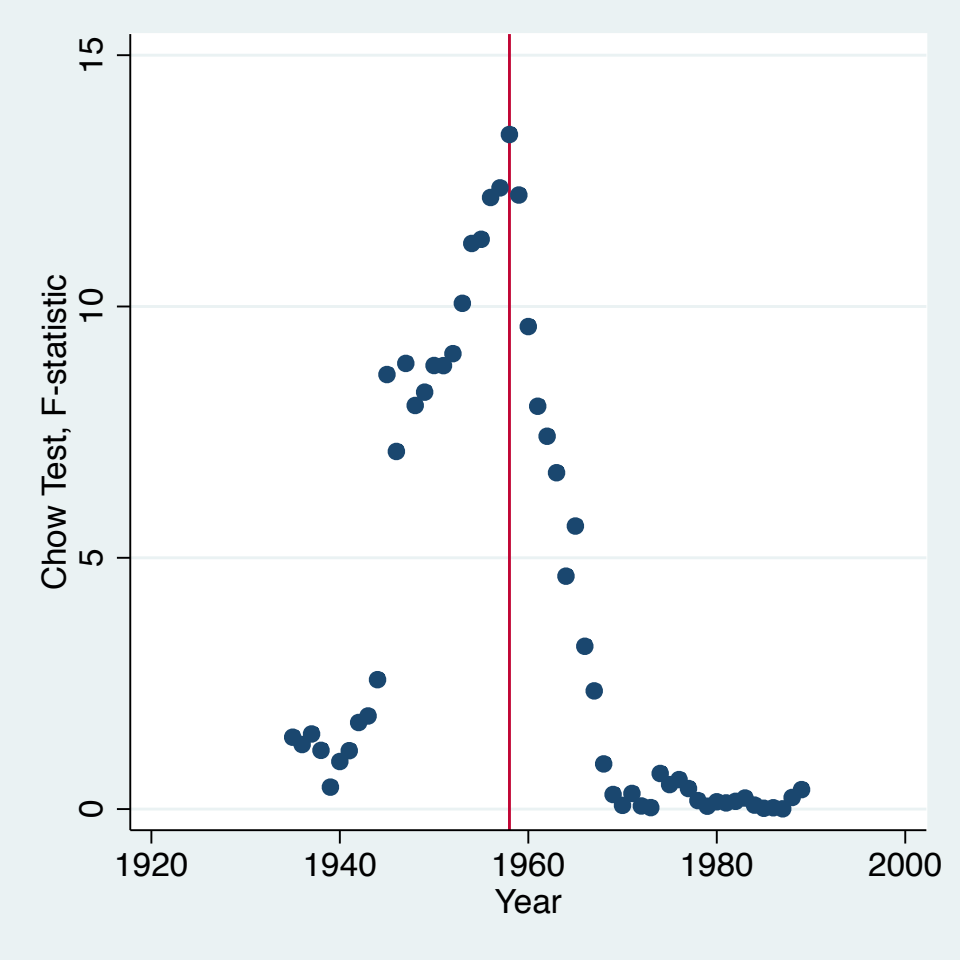
Chow, Gregory C. 1960. "Tests of Equality Between Sets of Coefficients in Two Linear Regressions." *Econometrica* 28 (3): 591-605.

Quandt, Richard E. 1960. "Tests of the Hypothesis That a Linear Regression System Obeys Two Separate Regimes." *Journal of the American Statistical Association* 55 (290): 324–30.

Stock, James H, and Mark W Watson. 2011. *Introduction to Econometrics*. Boston, Mass.: Addison-Wesley.

[2] For critical values, see Stock and Watson (2011, Table 14.6).

Figure A1: Identifying the Structural Break in Time-Series Data.



Note: The largest Chow test statistic for identifying the structural break is found in 1958. The result suggests that something happened in 1958, and the speed of Japan's economic growth accelerated in the next year.