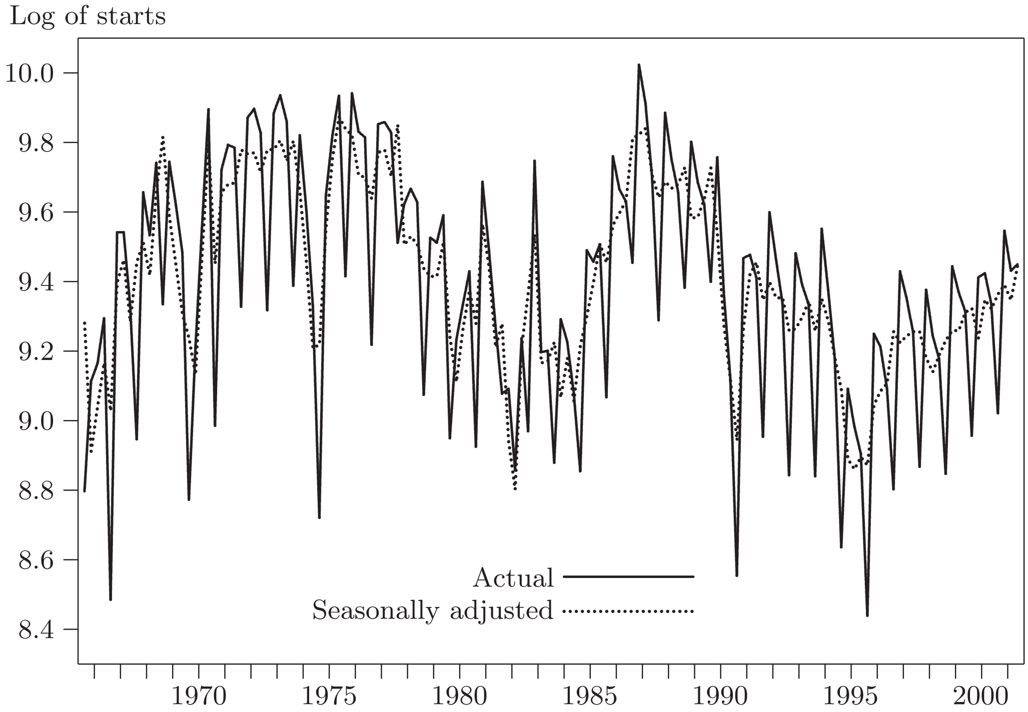

Figure 13.2 Urban housing starts in Canada, 1966-2001

implement and easy to analyze, it has a number of disadvantages, and it is almost never used by official statistical agencies.

One problem with the simplest form of seasonal adjustment by regression is that it does not allow the pattern of seasonality to change over time. However, as Figure 13.2 illustrates, seasonal patterns often seem to do precisely that. A natural way to model this is to add additional seasonal dummy variables that have been interacted with powers of a time trend that increases annually. In the case of quarterly data, such a trend would be

$$\boldsymbol{t}_q^\top \equiv [1\ \ 1\ \ 1\ \ 1\ \ 2\ \ 2\ \ 2\ \ 2\ \ 3\ \ 3\ \ 3\ \ 3 \cdots]. \qquad (13.68)$$

The reason $\boldsymbol{t}_q$ takes this rather odd form is that, when it is multiplied by the seasonal dummies, the resulting trending dummies always sum to zero over each year. If one simply multiplied seasonal dummies by an ordinary time trend, that would not be the case.

Let $\boldsymbol{S}$ denote a matrix of seasonal dummies and seasonal dummies that have been interacted with powers of $\boldsymbol{t}_q$ or, in the case of data at other than quarterly frequencies, whatever annually increasing trend term is appropriate. In the case of quarterly data, $\boldsymbol{S}$ would normally have 3, 6, 9, or maybe 12 columns. In the case of monthly data, it would normally have 11, 22, or 33 columns. In all cases, every one of the variables in $\boldsymbol{S}$ should sum to zero over each year.