Daily seasonality in 19th century stocks -- some evidence from the Dublin stock exchange
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We document, for a new data set, the existence of daily seasonality. The data set consists of the trades in four equities and two bonds on the Dublin stock exchange for the mid nineteenth century.

I. Introduction

An interesting philosophical and empirical question is whether or not financial markets were efficient in the early stages of development. This article examines one such market – the Dublin stock exchange, over a 30-year period in the mid nineteenth century. In particular, we focus on the issue of the extent of daily seasonality in the market – persistent and significant patterns in the daily returns to assets should, in an efficient market, be arbitraged away to the degree that there is a profitable trading possibility. This article thus provides the first evidence on the existence of seasonal patterns at the daily level in the nineteenth century. The evidence from previous econometric studies of nineteenth century British security markets is that, by and large, a great deal of efficiency was present. See for example Brown and Easton (1989) and Mitchell et al. (2002).

II. Previous Research on Seasonality

The existence of persistent calendar anomalies or serial dependence in security returns is a potential contradiction to the efficient market hypothesis. Regardless, various articles have established the existence of anomalies in the distribution of stock price returns, be they on a daily, monthly or other basis.

Stereotypically, studies of US and other markets have found a tendency for returns to decline on Mondays. (See for example Cross, 1973 and French, 1980). Later studies (see for example Connolly, 1989; Brusa et al., 2003) have cast some doubt on the stability of this effect in the USA. In the UK, Arsad and Coutts (1997) similarly found a significant negative Monday return on the FT30 over the period 1935 to 1994. Further, Coutts and Hayes (1999) documented a weekend effect in the FT30 between 1979 and 1994. Theobald and Price (1984) found evidence of a negative Monday effect between 1975 and 1981. They also consider the effects of thin trading, suggesting that indices which are more thinly traded are likely to exhibit stronger evidence of seasonality. In the Irish markets, Donnelly (1991) found a negative Tuesday effect between 1975 and 1988, as did Lucey (1994). Unusually, Lucey (2000) found a ‘persistent and positive Wednesday effect’ but no negative Monday or Tuesday effects. Finally, using robust measures to adjust for sample size and nonnormality, Lucey (2004) found that evidence of daily seasonality in the four main Irish stock exchange indices is ‘very weak’.

While much research has focused on equity markets, Jordan and Jordan (1991) test for such effects in corporate bond returns (Dow Jones...
composite bond average between 1963 and 1986) and found no significant day of the week effects. However, Gibbons and Hess (1981) found evidence of a significant negative Monday return in US Treasuries between 1962 and 1968.

Lakonishok and Smidt (1988) note that it is likely that scepticism with regard to security price anomalies will persist until evidence is provided from a broad range of securities and over a broad range of time periods. In particular, security markets prior to the twentieth century are a neglected subject, albeit most likely due to the relative scarcity of data. This note, so far as we are aware, is the first to extend back the analysis of daily seasonality to the nineteenth century. This data set is thus immune from charges of datamining and thus can provide the surcease that Kane seeks. The market structure analysed here displayed considerably different features to modern market structures and thus can hopefully provide an interesting addition to the anomalies literature. This study seeks to investigate a new set of data, one previously unexamined for the presence of the sort of anomalies outlined above. Thus, the charge of data mining can hopefully be avoided. The study is essentially a replication of some of those outlined, using a different data set. Its aim is to contribute to the body of knowledge on the subject of security pricing anomalies and the efficient markets hypothesis. The findings provide information with respect to the generalisability of previous studies. Mittelstaedt and Zorn (1984) suggest that this type of replication study, using the same statistical methods on a different data set, ‘comes the closest to replication in the experimental sciences’, a goal for any econometrician. Kane (1984) notes:

If an empirical finding is a fact, other researchers should be able to observe it, too. Successful and independent repetition of an econometric experiment increases professional confidence in the experiment’s alleged results.

III. The Data

The data analysed in this study are the end of day prices of five securities traded on the Dublin stock exchange between 1 January 1850 and 18 November 1879, collected from stock exchange records in the National Archives of Ireland. The exchange was open for 6 days each week, Monday to Saturday, implying 9047 potential trading days, after purging for holidays. It should be noted, however, that none of the securities were traded on every day in the sample period. This accounts for the considerable variation in the number of observations for each security. In the case of all five securities, the highest frequency of ‘no trade days’ occurs on a Saturday, suggesting that although the market was open (unlike most modern markets), volumes were perhaps lower than on other days of the week. A related problem is that on days when an end of day price was recorded, there was no information as to the volume of trades on that day, an issue which may limit the conclusions which can be drawn. It may be, for example, that only a single trade took place on a particular day shortly after the market opening and thus this price was recorded as the ‘end of day’ price.

3% consols and 3% stock

These were the two principle forms of Irish government securities (bonds in effect) at the time. Both were transferable into and from their parallel Bank of England-issued security under specific terms of transfer. Whilst prior to 1861, the Bank of England ‘shut’ its transfer books periodically for several weeks at a time in order to carry out dividend payments on such securities, no such shutting were evidenced in trading on the Dublin stock exchange. Consequently, no transactions for cash could be executed in London during these shutting, as the security holder was unable to deliver. Such transactions were possible in Dublin. Further information on the operation of shutting is available in Thomas (1986), but it is instructive to note that Mitchell et al. (2002) concluded that the statistical effect of shutting was minimal. Brown and Easton (1989) consider the market for 3% Consols traded on the London stock exchange between 1821 and 1860 and conclude that this market ‘exhibited a degree of weak form efficiency which is at least comparable to that found in… contemporary markets’. However, neither of these studies examined daily seasonality in the returns of the securities. Nor have other studies been published, as evidenced by a search of Econlit.

Bank of Ireland

The Bank of Ireland (BoI) was formed in 1783. BoI was prohibited from lending against property, ensuring that its surplus funds were invested in realisable assets, thus removing a prevalent cause of failure at the time'. During the sample period, BoI operated as both as a commercial bank and acted as the government’s banker. As regards its commercial activities, Hall (1949) notes ‘unquestionably the most important function of the Bank . . . was the discounting of trade bills’. Bank of Ireland remains on the
Irish stock exchange and is generally the largest or second largest company by market capitalization.

Mining company of Ireland

The sample period covers a large part of the mining company of Ireland’s (MCI) history, well-described in Legge (1973). Formed in 1824 when it took over the copper mines of Co. Waterford, the firm made almost continuous profits from 1824 to the mid 1860’s, when declining prices for its products and the gradual exhaustion of their major properties led to a decline ending in the suspension of all mining activity in 1889.

Great southern & western railways

Great southern and western railways (GSWR) was first listed on the Dublin stock exchange in 1844, a year which saw seven other new railways come to the market (prior to 1844 there were only three lines listed). Its main line from Dublin to Cork was completed in 1849. Thomas (1986) notes that GSW was the ‘largest and most important’ railway share on the Dublin stock exchange at that time. GSWR continued in existence into the twentieth century, eventually becoming a near-monopoly prior to being amalgamated into a state transport company in the 1930s.

Summary statistics of the data are provided in Table 1. It is clear from inspection that the data are far from normal. In addition, as noted earlier, there is a significant degree of thin trading: over the period investigated there were 9047 days on which trades could take place and it is clear that no asset traded each day.

IV. Results

Shown in Table 2 are results of runs tests and in Table 3 results of autocorrelation analyses. There is significant evidence of nonrandomness, indicating that at this period the premises of the Efficient markets hypothesis were not evident in the data. Both the bond series and the BoI (which was also acting as noted as a central bank at the time) show small, but statistically significant short-run negative autocorrelation, and the two pure equity series show positive autocorrelation. Brown and Easton (1989) find for the UK consol data a positive, statistically significant, but still small first order autocorrelation coefficient. In terms of the runs data Brown and Easton (1989) suggest that their data are consistent with independence – we find the data not to be so here. Thus there is prima-facie evidence of different degrees of market efficiency in the nineteenth century. The evidence from Brown and Easton (1989) indicates that in broad the London consols market behaved ‘efficiently’ whereas the evidence here is that the market for both consols and stocks are not consistent with efficient markets.

Shown in Table 4 are results of parametric (Ordinary least squares with the associated p-values estimated with heteroskedastic consistent SE) and
nonparametric (Kruskal–Wallis $H$-statistics) estimates of daily seasonally. What is immediately evident is that there appears to be a significant ‘end of week’ effect. For each series examined we note that the coefficients in the OLS examination for either Friday, Saturday or both days are significantly different from zero. The $F$-statistic is generally in favour of overall seasonality, being a joint test of equality of the coefficients to each other and zero and this being rejected at the 10% level in all cases and in four out of five at the 1% level. It is instructive however to note that the Kruskal–Wallis $H$-statistic is not in agreement with the $F$-stat., a feature that is common to later Irish studies, such as Lucey (2004) and Lucey and Whelan (2004). The day with the largest return is in all cases significant, whereas this is not the case for the lowest returns. Shown in Table 5 are the results of a Levene test of homogeneity of variance. We can see that the hypothesis of equality is rejected for both bond series but not for the three equity series.

### V. Summary and Conclusion

We have shown that in a previously unreserched data set there is evidence of daily seasonality in both the mean and the variance of stock and bond returns. The end of the week shows significantly greater returns than the start of the week. The evidence also indicates that the returns were not independent, the overall impression being one that is not favourable towards the efficient markets hypothesis.

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1. These test procedures being well-known details of their construction are omitted, but are available from the authors on request.
2. We also estimated the impact of daily seasonality using least absolute deviation and least trimmed squares estimators, methods which are robust to outliers and have high breakdown points. The results were in all cases qualitatively the same.
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References


