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CBT RESEARCH NOTES IN ECONOMICS

Impact of "De Facto" Bridge Holidays*

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Abstract: In this note, we focus on the significance of the effect of bridge-days, which are defined as extra day-offs between two successive official holidays or between a holiday and a weekend, on the seasonal adjustment process by taking industrial production (IP) as our laboratory. To this end, a bridge-day variable is constructed for Turkey. Additionally, we investigate whether eves of religious feasts and Republic Day which are currently assumed to be fully worked in by TurkStat should be treated as half-day holidays in seasonal adjustment. We find evidence that modifying the currently used working day variable in the way to incorporate these days improve the seasonal adjustment process significantly and hence, half day offs have an impact on IP. More importantly, results reveal that religious bridge-days are highly influential on IP, while any significant impact cannot be claimed for national bridge-days. As a matter of fact, bridge-day adjusted IP follows a remarkably more stable pattern compared to the officially announced data, providing evidence that bridge-day effect has been a major factor lying behind the recent volatile course of IP. Finally, we conclude that bridge days should be taken into account to remove bridge-day induced fluctuations and make proper inferences regarding the dynamics of working-day sensitive variables.

Özet: Bu notta, birbirini takip eden iki resmi tatil veya bir resmi tatil ile hafta sonu arasında kalan ve ek tatil yapılabilecek çalışma günü olarak tanımlanan köprü günlerinin mevsimsellikten arındırma işlemi üzerindeki etkisinin anlamlılığı sanayi üretimi verisi üzerinde test edilmiştir. Bu amaçla, Türkiye için köprü günü değişkeni oluşturulmuştur. Ek olarak, TÜİK tarafından kullanılan çalışma günü değişkeninde iş günü olarak değerlendirilen dini bayramlar ve Cumhuriyet Bayramı'nın arife günündeki yarım günlük tatilin sanayi üretimine etkisi incelenmiştir. Hali hazırda kullanılan çalışma günü değişkeni yarım günlük arife günü tatillerini içerecek şekilde revize edildiğinde mevsimsellikten arındırma işleminin önemli ölçüde iyileştiğine dair deliller bulunmuştur. Daha önemli olarak, sonuçlar dini bayramlar öncesi veya sonrasındaki köprü günlerinin sanayi üretimi üzerinde belirgin biçimde etkide bulunduğunu gösterirken, milli bayramlarla ilişkili köprü günlerinin istatistiksel olarak anlamlı olmadığına işaret etmektedir. Köprü günü etkisi arındırılmış sanayi üretiminin resmi istatistik kurumu tarafından yayımlanan seriye oranla oldukça istikrarlı bir seyir izlemesi, son dönemde sanayi üretiminde görülen dalgalı seyrin altında yatan önemli unsurlardan birinin köprü günü etkisi olduğuna yönelik bilgi sağlamaktadır. Sonuç olarak, köprü günü etkisinden kaynaklanan dalgalanmaları gidererek çalışma günü sayısına duyarlı verilerin dinamiklerini daha doğru bir şekilde yorumlayabilmek için köprü günlerinin dikkate alınması gerektiği düşünülmektedir.

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1. Introduction

The volatile course of working-day sensitive variables during and aftermath of months with religious holidays brings the volatility-inducing role of bridge-days, which are defined as extra day-offs between two official holidays or between a holiday and a weekend, at the focal point. In this respect, we aim to shed some light on the impact of bridge-days by testing whether inclusion of bridge-days improves seasonal adjustment quality. Additionally, in this note, we intend to investigate whether eves of religious feasts, which are currently assumed to be fully worked in by TurkStat, should be treated as half-day holidays in seasonal adjustment. We adopt the industrial production index (IP) as our laboratory to check the significance of these effects since IP is known to be highly sensitive to the number of working days.

Bridge days are quite important for the production sector in Turkey as there is a common practice among employees to combine two successive official holidays or a holiday with the proceeding weekend by taking the working days in between off. Not only employees but also firms might opt to declare those working days as “mandatory holiday” for all employees in line with their production plans. Analysis ignoring such “de facto” holidays could lead to attribution of fluctuations stemming from these holidays to other factors and wrong inferences as to the tendencies in economic activity.[1]

There are various attempts to incorporate bridge-day effects in seasonal adjustment process. A recent and prominent document on this issue is the December, 2012 Monthly Report of Deutsche Bundesbank, which includes a section analysing the impact of bridge-days on the seasonal adjustment process and economic activity. Additionally, the Guidelines on Seasonal Adjustment which is issued in 2009 by Eurostat provides technical information regarding the methodology used in the treatment of bridge-days in seasonal adjustment.

This note attempts to contribute to the methodology introduced by Atabek et al (2009). First, here, we construct alternative working-day variables that take into account eve days, religious bridge-days and national bridge days. Then we test whether eve days, which are defined in the note as the days before religious holidays and the Republic Day, should be treated as half-day holidays in the construction of the working-day regression variable. Here, please note that present working-day regressor used by TurkStat assumes that production (or any other kind of economic activity) continues as usual in eve days although workers are half-day off by law in those days. Finally, and arguably more importantly, we analyse whether inclusion of bridge-days improves the quality of seasonal adjustment by conducting the analysis on IP.

[1] Günay (2010) shows that the difference between market expectations and realizations are higher for the months when number of working days change.

Results reveal that modifying the currently used working day variable eliminates excess volatility in seasonally adjusted series significantly which provides evidence that half day offs in the production sector casts impact on production. On the other side, religious bridge-days are found to be materially influential on IP, while any significant impact cannot be claimed for national bridge-days. Finally, IP data seasonally adjusted with the bridge-day adjusted variable pursue a more stable pattern compared to the officially announced data, providing further evidence that bridge-day effect could be the major factor lying behind the recent volatile course of IP.

2. Methodology

Number of working days in a specific period (e.g. a month) may directly determine the production level or sales in that period. In this respect, seasonal adjustment analysis without taking into account the effect of holidays might lead to attribution of holiday-induced fluctuations to other factors and wrong inferences as to the tendencies in economic activity. Country specific holidays complicate the issue further and necessitate a tailor-made solution for those countries. To tackle with this problem for the case of Turkey, Atabek et al. (2009) introduce “the working day variable” which incorporates the effects of moving Ramadan and Sacrifice holidays, together with national holidays for Turkey.

Briefly, in their note, Atabek et al. (2009) calculate number of working days for the months between 1974 and 2015 on a monthly basis as follows:

$$WD_i = D_i - S_i - OH_i \qquad (1)$$

where $\mathrm{WD_i}$ represents the number of working days in month *i*, $\mathrm{D_i}$ stands for the number of total days in the same month, $\mathrm{S_i}$ is the number of Sundays and $\mathrm{OH_i}$ is the number of official holidays which are not overlapping with Sundays in that month. Then, this variable is converted to the deviation from its long run averages for each month[2] to obtain the working day regressor $\widetilde{WD}_{it}$. Specifically;

$$\widetilde{WD}_{it} = WD_{it} - \overbrace{\frac{\sum_{t=1974}^{2015} WD_{it}}{42}}^{average\ of\ WD_{it}\ for\ month\ i} \qquad t = 1974, 1975, \dots, 2015 \qquad (2)$$

However, this specification of the working-day variable also used by TurkStat treats eve days as if they are full working days despite half-day offs by law in these days. Additionally, in Turkey there is a common practice among employees to combine two successive official holidays or a holiday with the proceeding weekend by taking the working days in between off. Not only

[2] For more detailed information about the construction of working day variable see Atabek et al. (2009)

employees but also firms might opt to declare those working days as “mandatory holiday” for all employees in line with their production plans. Such “de facto” holidays could not be reflected on seasonal adjustment by currently-used working day variable and hence, their effects remain in the supposedly seasonally adjusted data.

The two issues addressed above necessitate the proper treatment of eve days and bridge-days in the seasonal adjustment process. In this context, we pursue a two-step approach. In the first step, we revise the currently-used working day variable in the way to take half-day offs into account, as below:

$$\widehat{WD}_i = D_i - S_i - OH_i - HD_i \tag{3}$$

where $\mathrm{HD_i}$ represents number of half off-days in month *i*. Here, the only difference from equation (1) is the inclusion of half-day offs.[3] Thus, equation (2) becomes:

$$\widetilde{\widehat{WD}}_{it} = \widehat{WD}_{it} - \frac{\sum_{t=1974}^{2015} \widehat{WD}_{it}}{42} \tag{4}$$

After the construction of the modified working day variable as above, we test whether it improves the seasonal adjustment process by comparing diagnostic test results from the estimation of the two models, including currently-used and modified working day variables.

In the second step of the analysis, we construct bridge day regressors for the period from 1974 to 2015. To this end, we initially determine bridge-days, the days employees could make off to combine two successive official holidays or a holiday with the weekend. Calendar in Figure 1a illustrates an example of bridge-days between an official holiday and a weekend in November 2010. In the calendar, red cells represent the Sacrifice Holiday and the green one stands for the eve day. In this circumstance, a worker could have an eight-day holiday instead of a mere four and a half day by taking half of the 15th and the entire day of 20th of the month off. In the same vein, as an example for two successive official holidays, in October of 2005, he could have an eight-day holiday instead of three and a half days by taking the 26th, 27th and half of 28th of the month off as shown in Figure 1b. In these examples, number of bridge-days for these months is 1.5 and 2.5, respectively.

[3] For the consistency purposes we take the half days as 0.5.

Figure 1a. Calendar of November 2010

Mon	Tue	Wed	Thur	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Figure 1b. Calendar of October 2005

Mon	Tue	Wed	Thur	Fri	Sat	Sun
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Once we determine the number of bridge days for each month ranging from 1974 to 2015, we formulize the bridge-day regressor as the deviations of each month from the long-run averages of that month:

$$BD = \, Extra\ Day\ Off\ Btw\ Two\ Holidays + Extra\ Day\ Off\ \ Btw\ the\ Holiday\ and\ a\ Weekend \qquad (5)$$

$$\widetilde{BD}_{it} = -(BD_{it} - \frac{\sum_{t=1974}^{2015} BD_{it}}{42}) \qquad (6)$$

For the sake of consistency with the working day variable, we add a minus sign to equation (6) since bridge-days would reduce the level of variables related to economic activity, in contrast with working days. We construct two different bridge-day variables, religious holidays induced and national holidays induced bridge-days. As the next step, we analyze whether these two types of bridge-days have an impact on IP, which is one of the main indicators for economic activity that is highly working-day sensitive, and seek out the extent of improvement in seasonal adjustment with the inclusion of these variables in the model.

3. Results

As the first step of the above-mentioned approach, we modify present working day regressor by including eve-days, which are presently deemed full working days, as half-day holidays and test whether such a modification improves the seasonal adjustment ability of the current model in use.[4] To this end, we compare the diagnostic test results for the seasonal adjustment process of

[4] We perform seasonal adjustment via TRAMO/SEATS4 seasonal adjustment methodology and by fixing the model currently used by TurkStat throughout the analysis.

IP utilizing the conventional and modified working day regressors, represented as Model 1 and Model 2, respectively in Table 1.

Table 1: Main Diagnostic Test Results for Seasonal Adjustment Models with the Regressor Currently in Use and the One Including Half Day Offs

	Model 1	Model 2
Decomposition		
Seasonal. Innovation Variance	0.027	0.016
Irregular. Innovation Variance	0.185	0.199
Model Adequacy		
Loglikelihood	-216.3	-213.1
AIC	438.6	432.1
AICC	438.9	432.4
BIC	445.8	439.4
BIC (Tramo definition)	2.439	2.330
Hannan-Quinn	441.5	435.0
Parameter Estimates		
Regressor Currently In Use	3.4	-
	(18.3)	
Regressor Containing Half Day Official Holidays	-	3.1
		(19.3)

AIC: Akaike Information Criterion, AICC: Corrected Akaike Information Criterion, BIC: Schwarz-Bayes Information Criterion.

$$AIC_N = -2L_N + 2n_p$$

$$AICC_N = -2L_N + 2n_p\left(1 - \frac{n_p + 1}{N}\right)^{-1}$$

$$Hannan - Quinn_N = -2L_N + 2n_p logN$$

$$BIC_N = -2L_N + n_p logN$$

where N shows number of observations, n_p stands for number of estimate parameters and L_N is the loglikelihood function. t-statistics are represented in parenthesis.

Results in Table 1 could be interpreted in three sub-sections. First, innovation variance of seasonal component and innovation variance of irregular component, which are widely used as measures for model performance, indicate the superiority of the second model in the sense that variance of the irregular component is higher while variance of the seasonal component is lower.[5] Second, model adequacy criteria decline with the use of the modified regressor which provides another evidence for the improvement in seasonal adjustment. t-statistic for the estimated parameter of the working-day regressor is slightly higher in Model 2 than in Model 1, again pointing to the superiority of the model with the modified working-day regressor taking eve days as half-day holidays. In light of these findings, we opt to continue with the modified working-day regressor in the remainder of the note.

[5] Please see Grudkowska (2011) for a detailed explanation on this issue.

Second and the main part of the analysis focuses on the extent of the impact of bridge-days on IP. For this, national and religious bridge-day regressors, that are constructed as explained in detail previously, are inserted in seasonal adjustment process both separately and jointly. Model selection criteria for various regressor settings are presented in Table 2.

Table 2: Main Diagnostic Test Results for Seasonal Adjustment Models with National and/or Religious Bridge-Day Regressors

	Model 3	Model 4	Model 5
Decomposition			
Seasonal. Innovation Variance	0.011	0.008	0.004
Irregular. Innovation Variance	0.207	0.214	0.224
Model Adequacy			
Loglikelihood	-212.8	-206.8	-206.6
AIC	433.5	421.6	423.3
AICC	434.0	422.1	424.1
BIC	443.1	431.2	435.3
BIC (Tramo definition)	2.356	2.190	2.211
Hannan-Quinn	437.4	425.5	428.1
Parameter Estimates			
Working-day regressor covering half-day holidays	3.1	2.5	2.5
	(18.9)	*(10.7)*	*(10.6)*
Religious bridge-days regressor	-	1.0	1.0
		(3.6)	*(3.6)*
National bridge-days regressor	0.5	-	0.3
	(0.8)		*(0.6)*

In Table 2, Models 3, 4 and 5 include national bridge days, religious bridge days and both, respectively. When compared with Model 2 in Table 1, diagnostic test results suggest that adding religious bridge-day regressor into the model contributes to the quality of seasonal adjustment considerably. Table 2 also point to the insignificance of national bridge day regressor and high level of significance of the religious bridge day regressor, regardless of whether the two regressors are used in models separately or jointly (Models 3, 4 and 5). In a nutshell, results indicate that religious bridge-days are materially influential on IP, while any significant impact cannot be claimed for national bridge-days. This result is consistent with the fact that religious holidays are perceived by Turkish people as opportunity to visit their hometowns and spend religious holidays there with relatives. This fact provides people incentive to combine official holidays by taking days in between off. Not only workers but also firms are inclined to declare factory-wide holidays and request workers use part of their annual leaves at those dates. Additionally, some sector-specific maintenance activities are conducted through bridge-holidays.

Statistical insignificance of the national bridge day regressor makes it necessary to compare Model 4 with Model 2 in Table 1. In this context, both innovation variances and model selection criteria underpins the improvement with the inclusion of the religious bridge day regressor. In addition, despite the addition a new regressor, t-statistics of the modified working day regressor, which covers half day holidays, is still high in Model 4, revealing the robustness of this variable. It is also worth mentioning that estimated value of coefficient of the religious bridge-day regressor is 1 which suggests that any additional religious bridge-day reduces IP index by 1 point. On the other hand, any additional official holiday leads to fall in 2.5 point in IP. Put it differently, the impact of an additional religious bridge-day on the level of IP is as large as forty percent of additional one day official holiday's (1/2.5=0.4). This rate is compatible with our a priori expectations, since each worker is not allowed to or may not opt to have extra vacation. That is why; a bridge day does not slash production in an amount as much as an official holiday would do.

Impact of bridge-days on IP is supposed to be varying depending on two prominent factors: time of the year religious holidays occur in and level of demand for produced goods at the time of the bridge-day period. More clearly, on side of the workers, workers would be more inclined to connect official holiday with the weekend or another holiday during summer periods and averse during winter periods. On side of the firms, they will opt to reduce or stop production during religious bridge-days in face of weak demand conditions and high stock level. In this respect, estimated coefficient of religious bridge-day regressor in Table 2 should be taken as an average of the impact throughout the estimation period.

Seasonal Adjustment of Industrial Production with and without Bridge-Day Effect: Recent Trends

As depicted in Figure 2a, IP has recorded an almost crawling pattern in the last one year which has been accompanied by high level of volatility, being more pronounced in the last couple of months. However, based on our empirical findings, a significant share of the recent volatility can be attributed to the omitted bridge-day effect. As seen in Figure 2b, August and October of 2012 contained large number of religious bridge-days, the effects of which are supposed to be amplified by the coincidence of religious holidays with the summer period and arguably more importantly weak total demand conditions in this period.

Figure 2a. Seasonally Adjusted IP* and Volatility in Monthly Changes in Seasonally Adjusted IP**

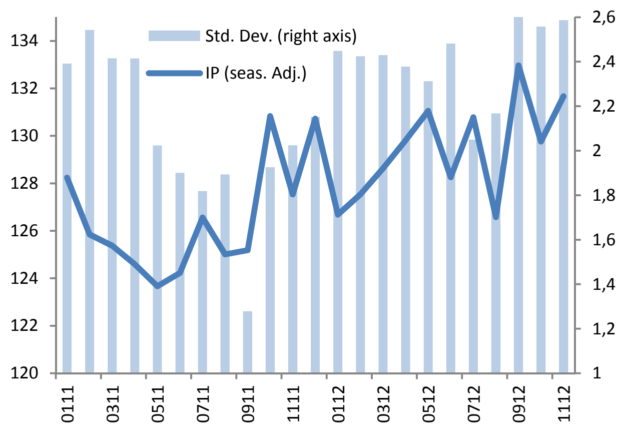
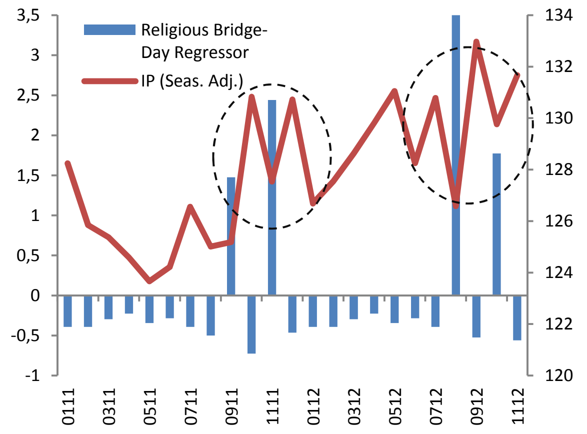


Figure 2b. Values of Religious Bridge-Day Regressor and Seasonally Adjusted IP for 2011 and 2012



*IP is seasonally adjusted using the model currently used by TurkStat.
**Nine months moving standard deviation of monthly changes in seasonally adjusted IP.
Source: TurkStat, authors' calculations

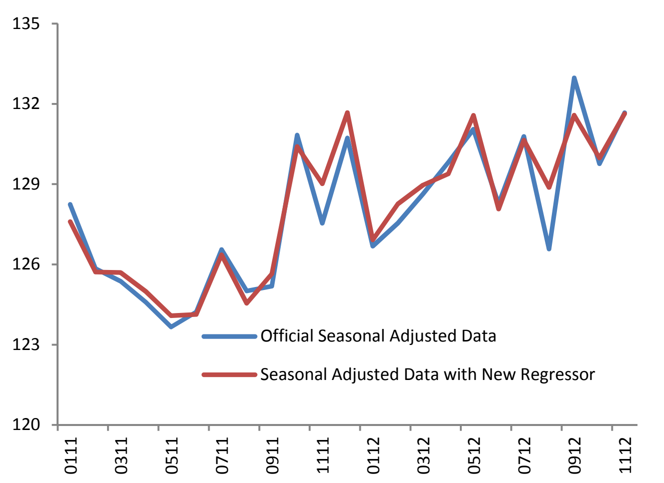
To extract the bridge-day effect from IP, we construct a new working-day regressor by combining the modified working-day regressor, which also takes eve days as half-days, with the religious bridge-day regressor with a weight of 0.4 and conduct seasonal adjustment using this variable. Model evaluation indicators for models with and without bridge days are reported in Table 3. These indicators reveal that combining bridge-day variable with the working day variable improves the seasonal adjustment model.

Table 3: Main Diagnostic Test Results for Models with and without Bridge Days

	Model 1 (conventional wd)	Model 6 (new wd with coef=0.4)
Decomposition		
Seasonal. Innovation Variance	0.027	0.008
Irregular. Innovation Variance	0.185	0.215
Model Adequacy		
Loglikelihood	-216.3	-206.8
AIC	438.6	419.6
AICC	438.9	419.9
BIC	445.8	426.8
BIC (Tramo definition)	2.439	2.136
Hannan-Quinn	441.5	422.5
Parameter Estimates		
Working day regressors	3.4	2.5
	(18.3)	*(21.2)*

Figure 3 shows IP seasonally adjusted by using bridge-day adjusted working-day regressors mentioned above together with the official monthly changes. Figure clearly reveals that seasonally adjusted IP follows a remarkably more stable pattern once we take into account the effect of religious bridge-days. Recent volatility in IP decreases remarkably as well, standard deviation of monthly changes since 2011 decreasing from 2.2 to 1.7.

Figure 3. IP Figures Seasonally Adjusted with the Official Regressor and the Regressor Containing Bridge-Days



Source: TurkStat, authors' calculations

4. Conclusions

In this note we test for the significance of bridge-days, which are defined as extra day-offs between two official holidays or between a holiday and a weekend, by taking industrial production index (IP) as our laboratory. To this end, we construct religious and national bridge-days variables, test whether inclusion of these variables improves the quality of seasonal adjustment of IP and also intend to quantify the bridge-day effect on IP. Additionally, we investigate whether eves of religious feasts, which are currently assumed to be fully worked in by TurkStat, should be treated as half-day holidays in seasonal adjustment.

Results reveal that religious bridge-days are materially influential on IP, while any significant impact cannot be claimed for national bridge-days. This result is consistent with the fact that religious holidays are perceived by Turkish people as opportunity to visit their hometowns and spend religious holidays there with relatives. An additional religious-bridge day in a month is estimated to be reducing the IP by one point. However, the impact of bridge-days on IP is supposed to be varying depending on two prominent factors: time of the year religious holidays occur in and level of demand for produced goods at the time of the bridge-day period. We also find evidence that modifying the currently used working day variable in the way to incorporate half day holidays improve the seasonal adjustment process significantly, hence half day offs in the production sector have an impact on production. As for the volatile course of IP, we conclude that bridge-day adjusted IP follows a remarkably more stable pattern compared to the officially announced data, providing evidence that bridge-day effect has been a major factor lying behind the recent fluctuation of IP. These results once more highlight the necessity to take bridge days into account to remove bridge-day induced fluctuations and make proper inferences regarding the dynamics of working-day sensitive variables.

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