Capacity Utilization and Inflation in Turkey

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Abstract

Capacity utilization is an important measure of resource use and economic activity concerning the real side of the economy. Hence, there has to be a relation between the capacity utilization rate and the inflation rate in line with the Phillips curve concept. Moreover, the long term inflation forecasting appears to be a central concern for the policy makers. Thus, alternative approaches other than utilizing monetary aggregates gained importance, particularly the use of NAICU (Non-accelerating Inflation Rate of Capacity Utilization). Accordingly, this paper examines the validity of this relation for the Turkish economy, and develops alternative models for the estimation of NAICU using several capacity utilization and inflation rates, and assesses the robustness of the results.

JEL: C13, C22, E22, E31

1. Introduction:

Measurement of the inflationary pressures gained importance as the monetary authorities seek to preserve the value of money, hence to reach a lower rate of inflation in general. From this point forward, several

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indicators are used to forecast inflationary pressures such as unemployment rate, potential output and output gap. Additionally, capacity utilization is another measure of inflationary pressures in a given economy. Hence, several economists (Garner 1994, Emery and Chang 1997) recently utilized the rate of capacity utilization for forecasting inflationary measures for the US economy. In this paper, we apply a similar technique to Garner and Emery & Chang for the Turkish case.

The following section of the paper presents a brief background arguments about the capacity utilization and inflation relationship. Additionally, some literature review about the concept of NAICU (Non-accelerating Inflation Rate of Capacity Utilization) is also provided. Section 3 comprises methodology and application results for the Turkish Manufacturing Industry Capacity Utilization rate and alternative inflation rates. The last section provides final evaluation and the conclusion.

2. Literature and Background Arguments:

There are many studies involving the measurement of the inflationary pressures and/or process, both theoretical and empirical. Franz and Gordon (1993) and Cecchetti (1995) found significant relationship between inflation and the capacity utilization. Majority of the studies conducted in this field did not explicitly and solely dealt with the capacity/inflation relation. Main problematic of these studies was to identify the alternative indicators of the inflationary pressures instead of monetary aggregates, only. However, Garner (1994), and Emery & Chang (1997) also drew attention to the insufficiency of the monetary aggregates in search for an additional inflation forecasting structure and employed capacity utilization rate.

The basic argument provided by these studies originates from the Phillips curve. Thus, the duality between unemployment and capacity utilization rate (in the short-run) is highlighted. Many believe that inflationary pressures built after capacity utilization rises above a certain level (Garner, 1994). As the overall demand for goods and services exceeds the supply, inflationary pressures emerge. This normally, activates the unused productive resources and reaching a higher production level. Thus, economy in general grows, and/or economic activity picks up. The measurement of the economic activity in general, uses GDP or GDP growth rate augmented with unemployment (or employment) rate. Unemployment rate itself is a measure for excess supply in the labor market. Hence indicating unused resources from the view of the labor market. Another and probably the broadest measure is the real output gap which shows the deviations from the "estimated" potential output. These three are the approaches that estimate the inflationary pressures from the real side of the economy.

The unemployment rate is a direct indicator for the labor market, hence its implications for the economic activity is limited. Additionally, for

empirical reasons, unemployment data is a very low frequency data in Turkey and two different series are disseminated biannually by State Institute of Statistics and Labor Placement Office. This generates a major problem for the policymakers and economic analysts.

Similar problems are involved with the measurement of the real output gap. First of all, GDP series are disseminated quarterly, with a 6-month releasing lag. Moreover, there are several methodologies to estimate the potential output, hence the output gap. Even though the most common approach to estimate the potential output is the Hodrick-Prescott Filter, there is not a unified opinion on this matter. Thus this creates a discussion about the measurement of the inflationary pressures by this methodology. Nevertheless, this approach is the broadest one as mentioned above.

Capacity utilization rate has no such data problems. This data is disseminated at monthly frequency by the State Institute of Statistics. Thus, a regular and reliable data is available at the present time. In addition, capacity utilization rate measures the operating rate of the nations industrial capacity. Hence, it can be said that this rate reflects the whole economic activity at least on the base of the goods and services. SIS distributes the capacity utilization data with the "Monthly Manufacturing Industry Tendency Surveys". In this survey, capacity utilization rate is reported only for manufacturing industry namely excluding the agriculture, mining and service sectors. The manufacturing industry is captured by ISIC classification. SIS reports the capacity utilization rates in two formats: while one of them is weighted on firms, the other one is based on weighted production values.

In the literature, the relationship between capacity utilization and inflation is examined in a similar way with unemployment – inflation relationship. A natural rate concept (NAICU – Non-accelerating Inflation Rate of Capacity Utilization) is claimed in the literature. In other words, inflationary pressures come out when the capacity utilization rate increases above a certain level: NAICU.

There are some arguments contending that capacity utilization is not a reliable indicator for measuring the inflationary pressures. Some of them put forward the openness of the economy. Thus, unused resources do not decrease so much because they can be supported by the foreign trade. This argument is not valid because there are many domestically produced goods and services, which are not traded. In addition, exchange rate implications must be considered. Other arguments emerge from the rapid productivity growth and controls over the inflation rate. But these arguments do not eliminate the relationship; they can only increase NAICU level for a particular economy and/or weaken the relation.

3. Application for the Turkish Data

3.1. Estimation Equation

The estimation equation for the inflation capacity utilization rate is obtained from a short-run Phillips curve (Garner, 1994). Thus this is a standard OLS model in the following form:

$$\pi_t = \alpha_1 + \alpha_2 U_t + \sum_{i=1}^{n} \lambda \pi_{t-i} \tag{1}$$

where π_t is the inflation rate and U_t is the unemployment rate. The latter part of the equation $\left(\sum_{i=1}^{n} \lambda \pi_{t-i} \right)$ is a distributed lag of past inflation capturing the inflationary expectations.

Thus, for the manufacturing sector, the slow down is measured by the capacity utilization rate, where as above, the unemployment data is utilized as a proxy for the general economic activity.

Whilst, Emery & Chang (1997) used this model to estimate the relationship between capacity utilization rates and inflation, Garner (1994) utilized an enhanced version of the estimating equation. This came from the fact that apart from the capacity utilization variable, the inflationary process is to be estimated by including other determinants of the process.

Hence, the estimation equation of Emery & Chang is as follows;

$$\Delta \pi_t = \alpha_1 + \alpha_2 CU_{t-1} + \sum_{i=1}^{n} \lambda_i \Delta \pi_{t-i} + u_t \tag{2}$$

where as Garner (1994) estimates the below equation.

$$\Delta \pi_t = \alpha_1 + \alpha_2 CU_{t-1} + \sum_{i=1}^{n} \lambda_i \Delta \pi_{t-i} + \sum_{j=1}^{m} \delta_j z_{jt} + u_t \tag{3}$$

In equation (3) $\left(\sum_{j=1}^{m} \delta_j z_{jt} \right)$ is the vector for the other supply variables for determining the inflationary process, such as petroleum prices, exchange rate and supply related dummies.

Hence, in this study an estimation equation like equation (3) is adopted. This estimation equation is chosen in order to avoid definitional gaps in explaining the inflationary process, as much as possible in a simple framework.

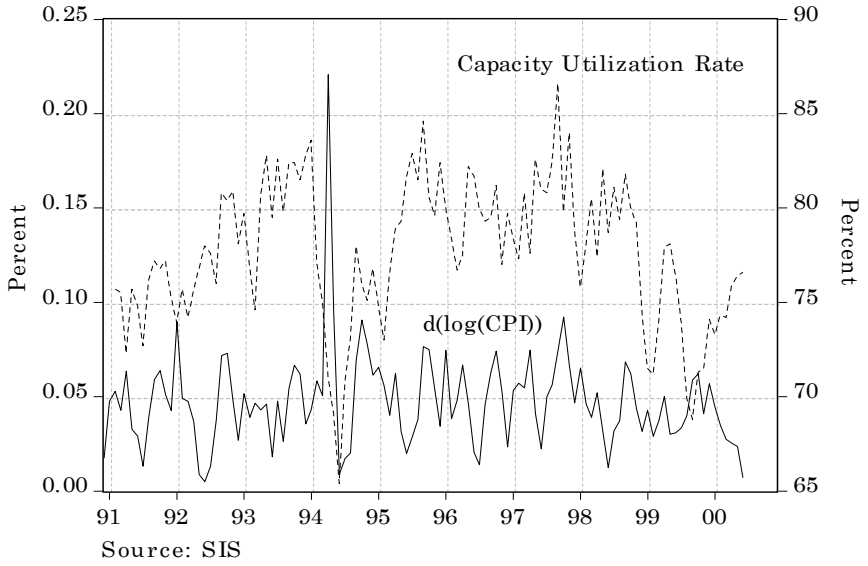
3.2. Data and Application

In this study the basic data comes from the SIS Monthly Manufacturing Industry Tendency Surveys. SIS reports these surveys by the second half of the following month (usually by the 20th of the following

month) by a news bulletin. This bulletin is being published since 1991. Hence, out data coverage starts from February 1991.

The second major data source is also from SIS. In particular, these are SIS-Wholesale Price Index (WPI) and SIS-Consumer Price Index (CPI). For the sample range purposes 1987=100 SIS indices are used and extended to the date by using SIS's new 1994=100 WPI and CPI.

Graph 1:
Capacity Utilizaiton and the CPI Infilation Rate



Source: SIS

Graph 1 displays the monthly capacity utilization rate for the Turkish manufacturing industry and CPI inflation rate. However, as the capacity utilization rate only involves the manufacturing industry, not only the relationship between CPI and WPI is explored, but SIS- Wholesale Price Index Private Manufacturing Industry Prices were also tested.

Regarding the structure of the estimation equation [eq. (3)] the main purpose is to capture the pressures caused by (high) capacity utilization rate on the inflation rate itself. Hence, the changes in the inflation rate, the first difference of the inflation rate are employed.

The data set starts from February 1991 and ends at April 2000. However, by mid 1998 Turkish economy entered a slack mainly due to the external shocks (Far-East Crisis followed by the Russian Crisis). Additionally, from this time onward, the volatility in petroleum prices weakened the relation between the inflation rate and the capacity utilization rate. Therefore, with in this data set we have studied two sample ranges (one is from February 1991 to June 1998, and the other is from February 1991 to April 2000).

Table 1: OLS Results for CPI and Total Capacity Utilization

Dependent Variable: D(D(LOG(CPI)))

Sample(adjusted): 1991:03 2000:04

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.118424	0.033317	-3.554418	0.0006
CUT(-1)	0.001494	0.000428	3.494110	0.0007
D(D(LOG(CPI(-1))))	-0.420125	0.063459	-6.620440	0.0000
D(D(LOG(CPI(-2))))	-0.410460	0.065761	-6.241702	0.0000
D(D(LOG(CPI(-3))))	-0.367067	0.063799	-5.753502	0.0000
D(D(LOG(CPI(-4))))	-0.315479	0.063670	-4.954901	0.0000
D(D(LOG(CPI(-5))))	-0.175680	0.061808	-2.842364	0.0054
D(D(LOG(CPI(-12))))	0.267813	0.054278	4.934121	0.0000
DUM94	0.164994	0.017179	9.604672	0.0000
DUMR	0.028049	0.012162	2.306323	0.0232
D(D(LOG(PP)))	0.027391	0.015667	1.748298	0.0835
R-squared	0.727464	Mean dependent var		-0.000250
Durbin-Watson stat	1.840601	Prob(F-statistic)		0.000000

Table 1 reports the OLS results for the estimation equation of CPI (Consumer Price Index) and the total capacity utilization in the Turkish private manufacturing industry (CUT). Above equation is solved using the broader sample range. In this equation the coefficient of CUT is very significant and is 0.001494. This coefficient may be viewed as rather low, however, the estimation equation utilizes the second difference of the price index as mention in eq.(3). Examining the basic goodness of fit criteria for the above equation, a 72 % R^2 is an acceptable ratio. Additionally, the estimation equation is also acceptable according to the F-Statistics Test.

NAICU is then calculated according the formula given below using the estimated coefficients.

$$NAICU = \frac{|\alpha_1|}{\alpha_2} \times 100 \qquad (4)$$

where α_1 is the constant and α_2 is the coefficient of the capacity utilization rate.

Thus, NAICU calculated from this equation is 79.3 %. Additionally, NAICU, which is calculated from the same variables but the truncated sample range (February 1991 to June 1998) comes to 79.6 %.

The estimation of NAICU is generally based on CPI and total capacity utilization rates in the literature. However, one way to test the robustness of the calculated NAICU rate is to estimate and compare this rate by using other indicators of inflation in a given economy. Hence, we have estimated alternative rates of NAICU by using Wholesale Prices (WPI) and Private Sector Manufacturing Industry Prices (WIP) –also a proxy for core inflation-.

Table 2: OLS Results for WPI and Total Capacity Utilization

Dependent Variable: D(D(LOG(WPI)))
Sample(adjusted): 1991:03 2000:04

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.056408	0.038848	-1.452021	0.1498
CUT(-1)	0.000698	0.000498	1.400645	0.1646
D(D(LOG(WPI(-1))))	-0.530764	0.061396	-8.644934	0.0000
D(D(LOG(WPI(-2))))	-0.544815	0.072152	-7.550889	0.0000
D(D(LOG(WPI(-3))))	-0.613709	0.074335	-8.255957	0.0000
D(D(LOG(WPI(-4))))	-0.548100	0.081755	-6.704164	0.0000
D(D(LOG(WPI(-5))))	-0.476438	0.086627	-5.499900	0.0000
D(D(LOG(WPI(-6))))	-0.458708	0.083661	-5.482952	0.0000
D(D(LOG(WPI(-7))))	-0.409677	0.077683	-5.273722	0.0000
D(D(LOG(WPI(-8))))	-0.268434	0.074240	-3.615762	0.0005
D(D(LOG(WPI(-9))))	-0.244133	0.068127	-3.583500	0.0005
D(D(LOG(WPI(-10))))	-0.176657	0.060234	-2.932853	0.0042
DUM94	0.217541	0.019059	11.41428	0.0000
DUMR	0.021919	0.013122	1.670449	0.0981
D(D(LOG(PP)))	0.045933	0.017139	2.679965	0.0087
R-squared	0.756180	Mean dependent var		-0.000238
Durbin-Watson stat	1.653715	Prob(F-statistic)		0.000000

According to the Table 2 which reports the OLS results for the estimation equation of WPI and CUT. This equation is again solved using the broader sample range. The coefficient of CUT is also very significant and is 0.000698 in this equation. Basic goodness of fit criteria for the above equation is very sufficient: 76 % R^2 and acceptable F-Statistic Test. The calculated NAICU for the WPI is the 80.8 % where the NAICU for the short sample is the 80.1 %.

Table 3: OLS Results for WIP and Total Capacity Utilization

Dependent Variable: D(D(LOG(WIP)))				
Sample(adjusted): 1991:03 2000:04				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.112607	0.037696	-2.987215	0.0035
CUT(-1)	0.001427	0.000485	2.943991	0.0040
D(D(LOG(WIP(-2))))	-0.216088	0.067958	-3.179735	0.0019
D(D(LOG(WIP(-3))))	-0.186148	0.065674	-2.834430	0.0055
DUM94	0.193594	0.021151	9.152954	0.0000
D(D(LOG(PP)))	0.074508	0.018024	4.133769	0.0001
R-squared	0.592682	Mean dependent var		-4.56E-05
Durbin-Watson stat	2.167526	Prob(F-statistic)		0.000000

Table 2 is representing the OLS results for the estimation equation using the WIP and CUT with broader range. The coefficient of CUT is again very significant and is 0.001427 in this equation. Basic goodness of fit tests are acceptable for this equation. R^2 is 59 % which is maybe rather low but acceptable and F-Statistic Test shows that equation is significant. The calculated NAICU for the WIP is the 78.9 % where the NAICU for the short sample is the 79.3 %.

4. Conclusion

This study basically points out that there is a valid relation between inflation and capacity utilization in Turkey, and the established rate of capacity utilization rate of around 79-80 % causes no significant inflationary pressures. This rate of capacity utilization is slightly lower than the estimated rate of around 82 % for the US economy (Garner, 1994).

Estimation of inflationary pressures using employment and production is more customary compared to capacity utilization rates. We believe that one advantage of using capacity utilization rate is that is posses a dynamic aspect to itself. Meaning that as it is a rate and does not inherit problems of trend, technological shifts etc.

It should be noted that a similar rate of NAICU is also estimated for the Turkish data using the quarterly data. However, due to the data frequency and dissemination periodicity, using monthly data is more useful in the sense of forecasting the inflationary pressures. Unfortunately, we are not able to compare our results, as there are no NAICU estimation prior to this study.

Finally, we must note that the sample period we have used is quite short due to data restrictions. Hence, further in time, new estimations of NAICU should be done and utilized.

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