CONSTRUCTION INDUSTRY CAPACITY UTILISATION AND ITS IMPLICATIONS

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This investigation began with an attempt to determine a market signal based indicator of capacity utilisation. Traditional methods of measuring an industry's capacity rely on a Cobb-Douglas production function equation, where capital, labour and technology are variables which give an indication of an industry's (or company's) productive potential. For the construction industry, most plant and machinery is hired, and it is very difficult to produce such a production function. As a result, this paper tries to estimate periods of high and low capacity utilisation by different ways of de-trending construction output. It then proceeds to construct a model to predict capacity utilisation. Finally, it estimates an equation for construction inflation, using capacity utilisation as an explanatory variable.

Keywords: capacity utilisation, inflation, output.

INTRODUCTION

This study attempts to identify a market indicator that can explain the effects of prolonged periods of high capacity utilisation such as has been recently experienced in the UK construction industry. It seeks to explore the assumption that such conditions induce construction inflation.

STEP 1: DE-TRENDING CONSTRUCTION OUTPUT DATA

The first step in attempting to measure the construction industry's capacity utilisation without a production function equation is to de-trend it using various techniques. Figure 1 shows construction output and its underlying trend using a Hodrick-Prescott filter (a similar technique to a moving average).

De-trending output data this way has the advantage that it is simple, but it also has a number of drawbacks. Firstly, it is not as reliable at the two extremes of the time period (and the particularly interest of this study lies in the late 1990s/early 2000s); and secondly, it includes no information about the factors of production that underpin the output.

The first problem is overcome by analysing the time period comfortably before the end of the time series. 1994 was chosen for two reasons: firstly, it is a sufficiently long time before the end of the time series to be reliable; and secondly, it is the ONS **(**Office of National Statistics) link year for 1995 prices – a year deemed to be sufficiently stable to give reliable price information.

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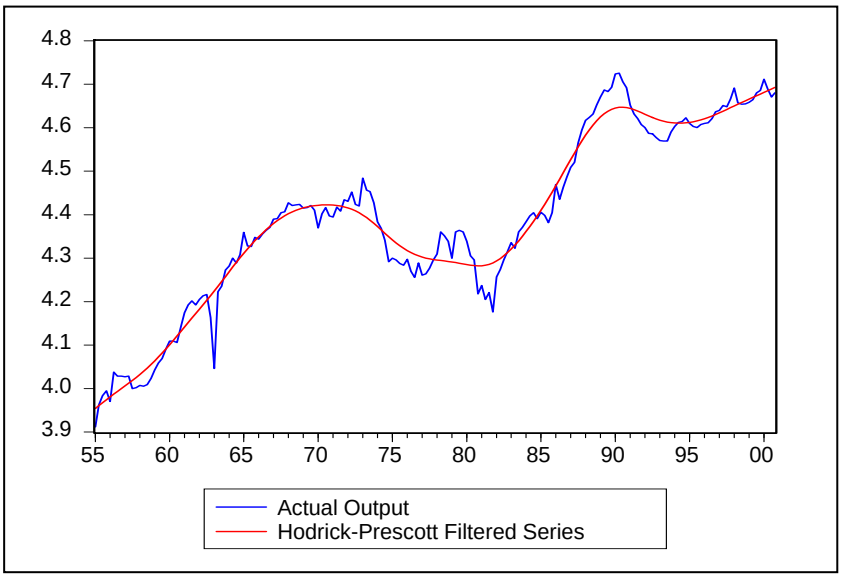
Figure 1: Output and HP-Filtered Trend



The problem of lack of information about factors of production cannot be overcome using this technique. However, an employment-based model is used to test against the HP-filtered series.

Employment based

As construction output is highly employment oriented, then an alternative to the HP filter is to fit a simple labour production function as in equation 1.

Eq.1 $$\ln Q_t = c + \ln Emp_t + Trend_t + \varepsilon_t$$

Where: Q = Output, Emp = Employment, Trend = a linear trend

Figure 2: Actual and Employment-based Trend Output

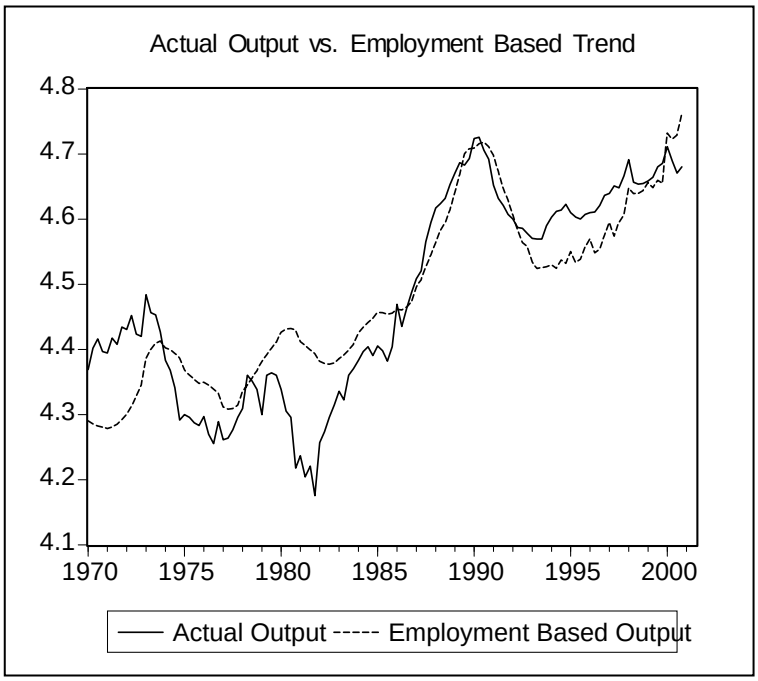


Figure 2 shows the actual and estimated output, based on the above equation. It shows low capacity utilisation throughout much of the period between 1974 to 1986, and recently, since 1999. The most recent high utilisation period is between 1993 and 1999. In its current form, this indicator is insufficiently sensitive to fully reflect significant periods of high and low capacity utilisation, and also does not fit so easily with survey and anecdotal evidence of periods of skills shortages.

Survey Data

All of the following charts are extracted from the Construction Confederation's *Construction Trends Survey*, and show two of the key capacity utilisation variables of direct interest: stated capacity utilisation, and labour availability of key construction trades.

Figure 3: Capacity Utilisation

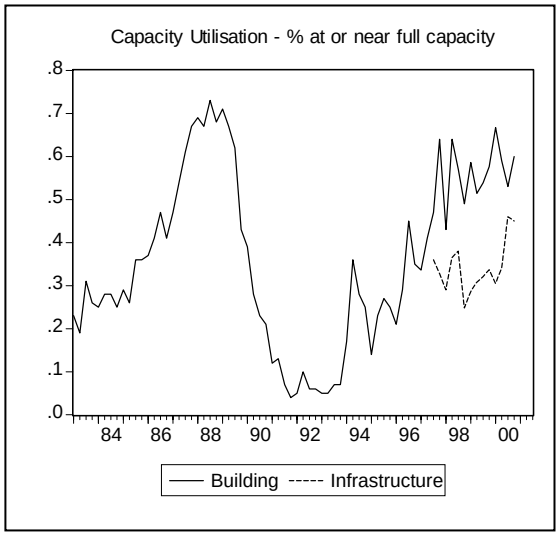
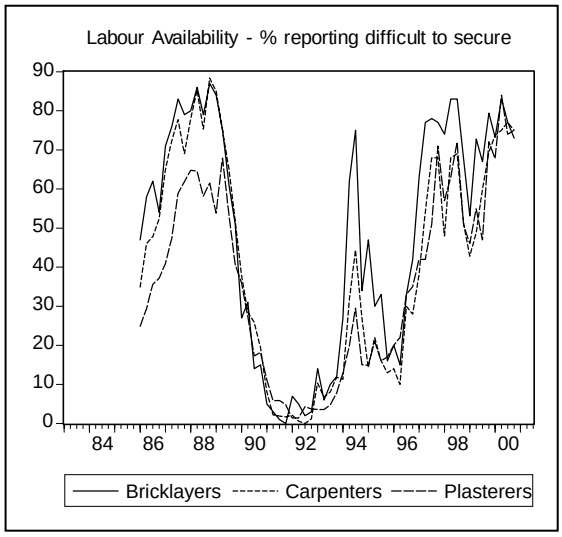


Figure 4: Labour Availability



Figures 3 and 4 provide useful evidence of the construction industry's often expressed opinions about capacity utilisation and associated problems of high capacity utilisation. However, the time periods covered are shorter than ideal, so limited use can be made of the data.

Choosing between the techniques

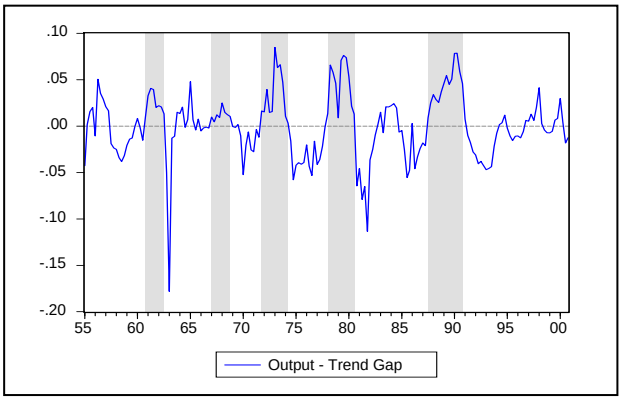
The time periods of high capacity utilisation of particular interest are those which may have an impact on inflation. An assumption is made here that brief periods of high capacity utilisation will have less inflationary consequences than more prolonged periods. In order to move beyond Step 1, a choice has to be made between the three methods of measuring capacity utilisation presented above, in order to isolate the periods of high capacity utilisation. The HP-filter technique is chosen for the following reasons: firstly, the periods of high and low (above and below trend) capacity utilisation are of a sufficiently long duration for the price mechanism to react, but sufficiently short, so that there is some allowance for a response to those price signals. This is the main weakness of the employment-based series, where the periods of high and low capacity utilisation are too long for any reaction from economic agents. The second reason for choosing the HP-filter above the employment based series, is that the former tends to agree more with other data on such other historical periods of high and low utilisation. The third reason is because of time lags in the industry's response to sharp changes in demand conditions. The employment-based

series overstates labour productivity during periods of high labour inflows and understates productivity during periods of high outflows. Finally, the HP series was chosen over the survey-based information, because of the longer time series available from the former.

STEP 2: ISOLATING PERIODS OF HIGH CAPACITY UTILISATION

Figure 5, below, shows the difference between the actual output series and the HP-filtered series. The periods of high capacity utilisation are shaded in grey. They are the periods where output remained above the HP-filtered series for eight consecutive quarters or more.

Figure 5



STEP 3: FITTING A CAPACITY UTILISATION EQUATION

From Steps 1 and 2, the periods of above trend output have been highlighted. The magnitude of the deviations will suggest the extent of high and low capacity utilisation from an average rate. However, before proceeding to look at the degree of capacity utilisation, it is necessary to determine whether the HP-filtered series really is a good representation of the construction industry's trend capacity. This is done by estimating an LOGIT equation, as it is desirable to distinguish between the periods of high capacity utilisation (the 1s in the model) from periods of low and normal capacity utilisation (the 0s). The equation uses variables that would be associated with periods of high capacity utilisation in construction. These are: high earnings, and high earnings differentials between construction and the rest of the economy; higher than normal working hours; lower than normal company insolvencies. The final variable is national unemployment, which will indicate the tightness of the labour market aside from the construction industry's market (the latter is picked up by the other variables).

The equation decided upon is detailed in equation 2, below:

Eq.2
$$OG_T = \alpha + \beta_1(HMM_{CON_T} - HMM_{HP_T}) + \beta_2(\Delta EMM_{CON_T} - \Delta EMM_{GB_T}) + \beta_3(\Delta ENMM_{CON_T} - \Delta ENMM_{GB_T}) + \beta_4 \Delta I_T + \beta_5 U_{GB_T}$$

Where: (all in logs)

OG = Output Gap

HMM_{CON} = Manual Male Weekly Hours Worked in Construction
HMM_{HP} = HP-filtered Manual Male Weekly Hours Worked in Construction
EMM_{CON} = Manual Male Earnings in Construction
EMM_{GB} = Manual Male Earnings in GB
$ENMM_{CON}$ = Non-Manual Male Earnings in Construction
$ENMM_{GB}$ = Non-Manual Male Earnings in GB
I = Number of Construction Company Insolvencies (4-Quarter Moving Average)
U_{GB} = GB Unemployment Rate (Claimant Count)

Ex-post Capacity utilisation during the late 1990s
As has been noted above, a feature of the HP filtered series is that it is less significant for the earlier and later periods. Therefore, the HP-based model is only valid up to around the mid 1990s. Data availability means that the series starts at 1970, and it has been fitted to 1994 (as this coincides with the ONS base year for the 1995 prices output series). Figure 6 below, shows the HP-based model's ex-post forecast for 1970 to 2000.

Figure 6: Ex-post Capacity Utilisation forecast

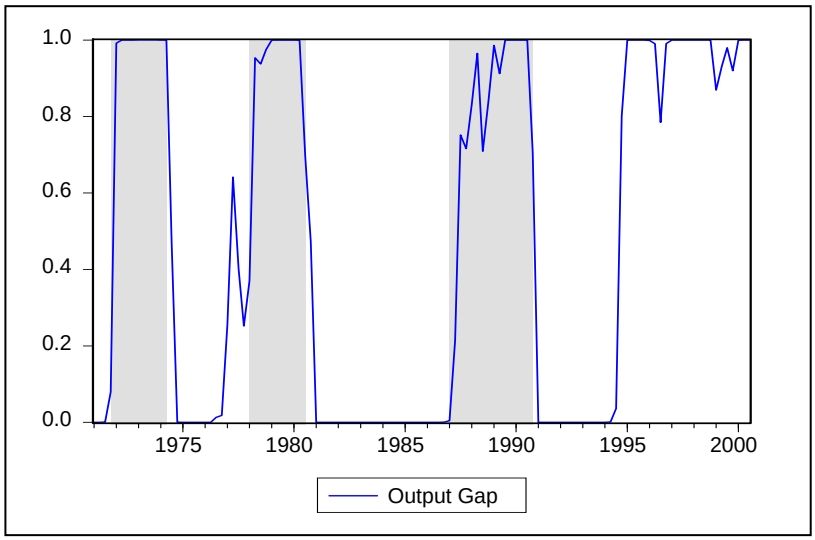


Figure 6 shows that the model has explained all of the high capacity utilisation periods between 1970 and 1994 quite accurately, and it has also predicted what has happened during the second half of the 1990s. According to the model, therefore, the second half of the 1990s was a period of high capacity utilisation.

Where does the study go from here*?*
The above equation is an acceptable formulation of *correlation* between a basket of variables and high capacity utilisation, but it does not necessarily *explain* the high capacity utilisation - that is caused by the interaction of demand for construction services and employment-based production functions. This begs the question of to what use can the equation be put, if it is not determined by the right hand side variables.

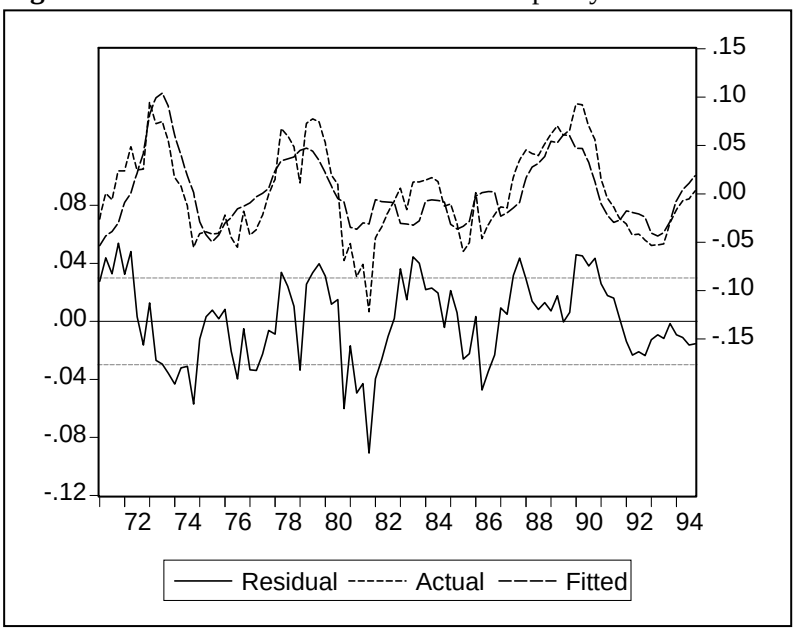
The answer is that even though the explanatory variables do not necessarily explain the level of capacity utilisation, they are the best indication of it. This portmanteau

indicator of utilisation can then be used as an explanatory variable of construction price inflation. This is the next step.

Discrete to continuous capacity utilisation indicator

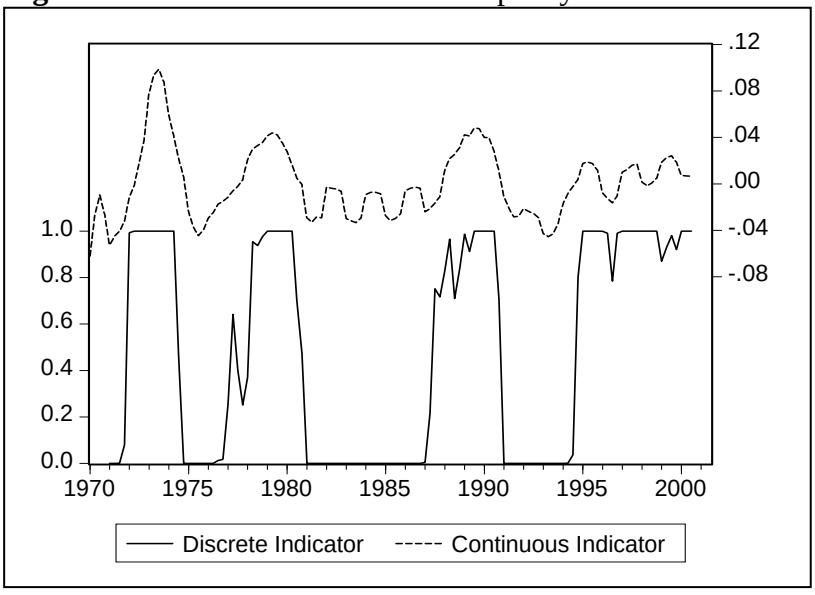
Having obtained a discrete capacity utilisation indicator which correlates highly with periods of high capacity utilisation over the past, the model is turned into a continuous indicator to give degrees of capacity utilisation, instead of the rather restrictive 'high' / 'not high' result of the LOGIT equation. This is done by re-estimating equation 2 via OLS. Figure 7 shows the actual and fitted lines.

Figure 7: 'Actual' and Fitted Continuous Capacity Utilisation Index



This fitted line then becomes the capacity utilisation variable to be used in the inflation equation. Figure 8 shows the two indicators (continuous and discrete) against each other.

Figure 8: Continuous and Discrete Capacity Utilisation Indicators



STEP 4: FITTING A CONSTRUCTION INFLATION EQUATION

Having obtained a capacity utilisation index, an attempt can be made to explain and possibly predict construction price inflation. However, inflation can be caused by a variety of factors, and there are volumes debating the nature and causes of inflation (demand pull, cost push), as well as incorporating expectations. An attempt has been made here to put together an equation which characterises both some cost push (using construction materials prices etc.) and demand pull elements (capacity utilisation indicator). Inflationary expectations are picked up to some extent by the general inflation component, as well as the equation's lag structure.

The individual components are:

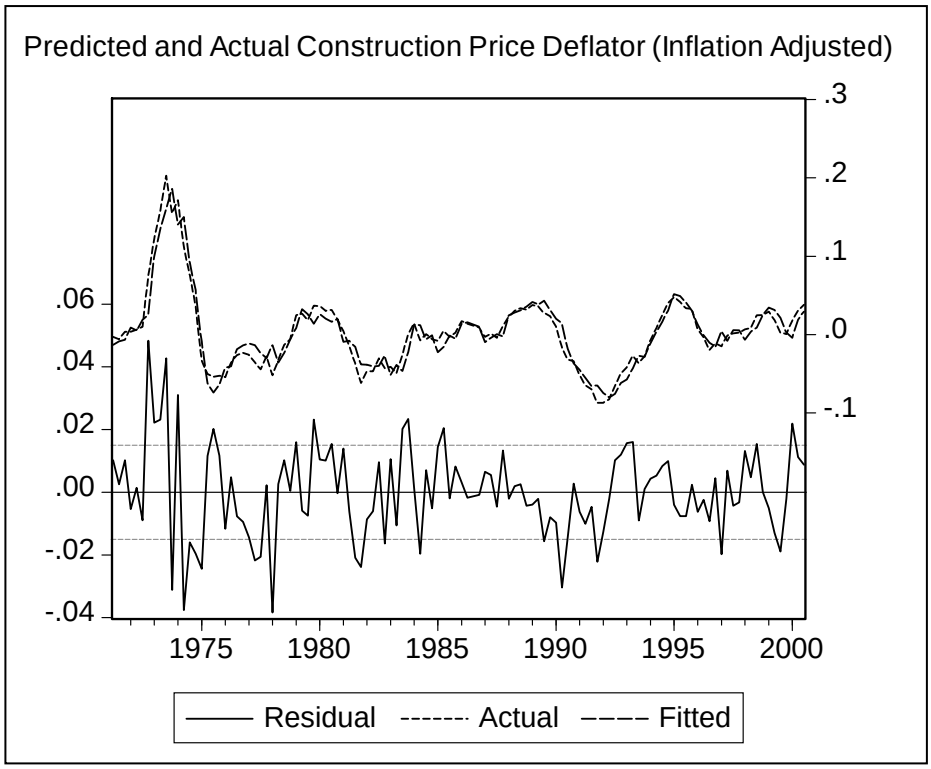
PD_{CON} = DTI total construction price deflator
PD_{GDP} = ONS' total construction price deflator
PI_{MATS} = DTI construction materials price index
CU_{CON} = Construction capacity utilisation index (derived above)
(all in logs)

And formulated below:

Eq.3
$$\Delta PD_{CON_t} - \Delta PD_{GDP_t} = \alpha + \beta_1(\Delta PI_{MATS_t} - \Delta PD_{GDP_T}) + \beta_2(CU_{CON_t} + \Delta CU_{CON_t}) + \beta_3(\Delta PD_{CON_{T-1}} - \Delta PD_{GDP_{T-1}})$$

Figure 9, below, shows the actual and fitted values for the inflation adjusted construction price deflator.

Figure 9: Actual and Predicted Construction Inflation



The results give an indication of the relative importance of the individual components in explaining construction price inflation. They show that, not surprisingly, the biggest

influence over current construction inflation is previous inflation. However, both construction materials prices and the capacity utilisation index have an important role to play.

A 1% rise in construction materials inflation will lead to a relatively modest rise of 0.1% in overall construction inflation.

The capacity utilisation index has a bigger part to play, however, as a 1% rise in the capacity utilisation index will cause a 0.17% rise in construction inflation. More significant is the rate of growth of capacity utilisation, with a 1% rise in the speed of increase of capacity utilisation leading to 0.53% higher inflation.

CONCLUSIONS

This work has shown that a capacity utilisation index can be derived from HP-filtered output data. Alternative measures were used, but were inferior to the HP-filtering technique.

One main drawback of this technique is that there is no way of adjusting for the behaviour of the labour market. It assumes that bigger deviations above the HP-adjusted trend means higher capacity utilisation. This may not be the case, and as such, the traditional test of the goodness of fit for the continuous equation can be misleading.

The best method of determining whether a capacity utilisation equation is better than an alternative one is to see which one performs better in the final inflation equation, as this is the main purpose of the study, after all.

POSSIBLE NEXT STEPS

There are a number of key areas in which the research undertaken so far can be made more robust and extended. Some suggestions are outlined below:

Alternative formulations: the research so far, has restricted the formulation of the capacity utilisation and the inflation equations to log-linear equations. This could be one area in which the research is relaxed in further research, which may improve the fit of the inflation equation in particular.

Expanding a labour market model: the behaviour of the labour market is quite fundamental to the capacity of the construction industry. The equations set out here exclude any cohort effects. This is particularly important at the moment, when there is concern over the ageing workforce.

Long term vs. short term models: there are different questions to answer when considering long term and short term capacity issues. The former will be much more concerned with cohorts (see above), training provision and technological change. The latter, on the other hand, will be more concerned with the effects of price movements and skills imbalances.

Sectorise the model: none of the sectors in the construction industry will be utilising their capacity at the same rate, a fact that does not come out of this research. Therefore, some areas will be experiencing different (and possibly contradictory) inflationary forces at any point in time. It would be valuable to enhance the model with the capability to split the industry by sectors, particularly given the current concern over the delivery of the SR2000 spending plans.

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