THE DYNAMIC STABILITY OF EMPLOYEMENT IN A NON CLEARING MARKET

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Abstract

Undoubtedly, the theory of employment is a key issue in economic theory. The level of employment in an economy determines the output level, which in turn, decides the consumer's choice of allocating the output through consumption, investment and savings. But how does an economy's employment structure behave in situations of excess demand and supply in particular time periods? To investigate this effect, the paper discusses a dynamic model of employment through the product and money markets and determines the time path of employment. In a situation of excess supply, the time path is unstable in nature and diverges from the intertemporal equilibrium explained by the model. To explain how a stable time path for employment can be obtained, a consumer characteristic of the savings feedback is brought in, which is a result of excess supply and the particular condition under which the time path for employment will be stable, defined as the Employment's Dynamic Equilibrium Condition is derived.

JEL Classification: C3, E1, E2, J0
Keywords: Dynamic Model, Intertemporal Equilibrium, Savings Feedback, Employment's Dynamic Equilibrium Condition

1. INTRODUCTION

The term employment has been defined and described by the English Dictionary as 'the state of having paid work'. The newspapers, the TV channels, the political institutions and necessarily, the economists of every country speak about the issue of employment and unemployment. Unemployment is, of course, one of the most damaging economic circumstances. To understand the behavior of unemployment and its relation with the production of the economy and the demand by the domestic country, there is a need to realize the relation between employment and production in itself.

'Ultimately, it comes down to supply and demand' , is a famous quotation by American attorney Bradford Smith on the internet. It goes without saying, the market forces of demand and supply are the most important determinants of price levels and employment. In this paper, the very necessary question in economics: "How are employment and the market forces of demand and supply related?" is examined. Empirically speaking, there has always existed a strong positive correlation between employment and output. Supply and demand are impacted at the macroeconomic level by both domestic and global market dynamics, as well as elements like immigration, population aging, and educational attainment. Unemployment, productivity, participation rates, total income, and gross domestic product are important metrics (GDP).

At the microeconomic level, individual businesses deal with workers in terms of hiring, terminating, and changing hours and salaries. The link between supply and demand affects how many hours workers put in and how much they are paid in terms of wages, salaries, and benefits.

An economy faces a situation of excess supply when the planned or ex-ante demand of the economy is lower than the production of the economy. Observations across the world have shown that when such a situation of excess supply prevails in an economy, to equilibrate the markets, workers are often laid off, such that demand and supply equate to equilibrate the market. But what does this tell us about the trend of employment?

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In this paper, the relationships between employment and output, while taking into consideration both the money market and product market are derived and a dynamic model for employment and check whether the time paths for employment are stable or not is developed.

2. LITERATURE REVIEW

John Maynard Keynes argued in his seminal work "The General Theory of Employment, Interest, and Money" (1936) that excess demand, especially as aggregate demand, can stimulate employment growth. Keynes emphasized the role of government and respective interventions by way of implementing financial and monetary policies; emphasizing all seek and obtain full employment. His ideas formed the basis of Keynesian economics, which argued that excess demand could stimulate production and job creation. Milton Friedman, a leading figure in neoclassical economics, offered a different perspective. In "A Monetary History of the United States, 1867–1960" (1963), Friedman focused on the role of monetary policy in shaping economic outcomes. He argued that excess demand is a temporary phenomenon and markets will naturally adjust through the price process. According to Friedman, performance is largely determined by factors such as labor market conditions and productivity.

Several empirical studies have examined the relationship between excessive demand and performance, offering a nuanced perspective. Romer and Romer (2019) analyzed the impact of monetary policy shocks on employment in the United States and found that monetary policy expansion reduces excess demand and increases employment. Blanchard and Summers (1986) examined the effect of demand shocks on performance in the US. and Europe. They found that unemployment fell sharply due to the expansion of demand, supporting the Keynesian view. In contrast, Barro and King (1984) conducted a study on the relationship between government spending and employment in the United States and found limited evidence of a positive impact on employment. Their findings align with neoclassical theories, suggesting that excess demand plays a minor role in employment determination.

Debate and questions regarding wages, labor market conditions, and product market conditions and their importance in employment dynamics raise necessary questions and have been studied in the research paper entitled Supply, Demand and Employment Dynamics by Mikael Carlsson, Stefan Eriksson and Nils Gottfries of Uppsala University and Ilan Cooper. The paper investigates market conditions and reveals real wage costs and product market demand shocks have significant effects on employment. No evidence was found that unemployed workers contributed to the creation of jobs in existing firms.

The paper titled Labor Demand in the Time of Covid-19: Evidence from vacancy posting and UI claims by Lisa B. Kahn, Fabian Lange and David Wiczer studied the collapse of job vacancies by the second half of March 2020 and the underlying causality of this impact. UI, or unemployment insurance was found to be matching the patterns of this collapse. This paper was studied to understand the impact of a demand and supply shock in an economy and their effects on employment and unemployment patterns.

The research paper entitled Labor Demand Research: Towards a better match between Better Theory and Better Data by John T. Addison, Pedro Portugal and Jose Verajao models the labor market in order to understand labor market frictions and imperfections and utilizes a dynamic analysis of labor demand, wage formation and estimation.

In 1996, Professor Jean Marc-Bottazzi and Professor Thorsten Hens published their paper titled Excess Demand Functions and Incomplete Markets in the Journal of Economic Theory (Volume 68, Issue 1) that characterized noncritical spot price systems in two-period exchange economies with incomplete markets and real assets. This paper focused on the changing dynamics of price with an existing force of excess demand in the economy and how price and consumer behavior adapts to it.

The work of Professor Malcolm C. Sawyer in the book Business Pricing and Inflation looks into the effect of excess demand on businesses and their employment structure closely in the chapter entitled Excess Demand, Expectations and Price Changes. Empirical evidence pertaining to theories of price change in a competitive market environment shows it to be one of the central causes of excess demand. The chapter discusses the problems arising in testing such theories, particularly the measurement of crucial variables. The divergence between the boundaries of an industry and the corresponding market created considerable difficulties in testing the excess demand hypothesis. The effect of defining a range of goods and their belonging to a particular industry, in terms of product homogeneity has also been discussed in the chapter.

3. THEORETICAL BACKGROUND

Here, a model economy has been considered, which satisfies all conditions of a basic IS-LM structure. Therefore, the economy is assumed to have infinite firms in perfect competition, and infinite consumers. Production is assumed to be given and hence, only the demand side of the economy concerns the study.

The following is hypothised:

● In the economy, the representative consumer has the income of Y, of which he consumes only a part and saves the rest. It is assumed that there have been periods in the economy that have not been accounted for. As a result, the individual has had some savings. His consumption, therefore, will depend on two sources: his current income, and his accumulated savings.

● Further, employment in the economy depends on aggregate demand in the economy. Following a period of excess demand, employment decreases in the economy, and following a period of excess supply, employment increases in the economy.

● If the economy faces excess supply in a certain period, and the consumer follows his usual consumption pattern, the time path for employment to reach its equilibrium is unstable. The system deviates from its intertemporal equilibrium.

● When the consumer faces a situation of excess supply, she reacts to that through her consumption pattern. The consumer, since already facing an excess of supply than what she requires to consume, does not need to consume from her savings in such periods. Therefore in periods of excess supply, the consumer reacts to the excess supply by only consuming from one source, her income.

4. OBJECTIVES

The objectives of this study are as follows:

● To obtain the time path for employment in an economy under an excess supply situation

● To obtain the condition under which time path for employment will be stable in an economy under an excess supply situation

5. MODEL SPECIFICATIONS

In this paper, a model for employment, in discrete time, which is dependent on levels of excess supply in the economy in the previous time period is developed. It is expressed as follows:

$$\mathbf{Q_{t-1}{}^{S} - Q_{t-1}{}^{d} = E_0 - k.E_t}$$

where, $Q_{t-1}{}^{S}$ = quantity supplied in the $(t-1)^{th}$ time period
$Q_{t-1}{}^{d}$ = quantity demanded in the $(t-1)^{th}$ time period

$Q_{t-1}{}^{S} - Q_{t-1}{}^{d}$ = excess supply in the $(t-1)^{th}$ time period
E_0 = Autonomous employment
E_t = level of employment in the t^{th} time period

In the model, k is a constant and is positive. It measures the degree of responsiveness of change in employment levels to the effect of excess supply in the previous time period.

E_0 , which is defined as the level of autonomous employment, can be understood as the level of employment that is generated irrespective of the demand-supply environment persisting in the economy. This employment may be a result of the employer's personal preference of government schemes.

Now, quantity demanded has been defined as follows:

$$\mathbf{Q_t{}^{d} = C_t + I_t + G_0}$$

where, $Q_t{}^{d}$ = quantity demanded in the t^{th} time period
C_t = consumption demand in the t^{th} time period
I_t = Investment demand in the t^{th} time period
G_0 = government expenditure

Government expenditure is assumed to be exogenous and constant across all time periods in the model. Consumption demand is defined as follows:

$$C_t = a + bY_t + c[(1-b)Y_{t-1}]$$

where, C_t = consumption demand in the t^{th} time period
a = autonomous consumption
b = marginal propensity to consume of a consumer
Y_t = Income/output in the t^{th} time period
c = marginal propensity to consume savings
Y_{t-1} = Income/output of $(t-1)^{th}$ period

The consumption demand function of the consumer obeys certain restrictions. They are listed as follows:

- $0<b<1$ [Under the Keynesian model considered, the consumer neither consumes his entire income, nor saves his entire income]

- $0 \leq c \leq 1$ [This restriction signifies that a consumer might choose to consume her savings entirely in a time period or might not consume any of her savings in a time period, depending on the forces of excess demand or supply in the economy]

Now, the investment demand function is defined as follows:

$$I_t = d - g.r_t + m.Y_t$$

where, I_t = investment demand in the t^{th} time period
r_t = rate of interest in the economy in the t^{th} time period
d = autonomous investment demand
g = responsiveness of change of investment to change in interest rate
m = responsiveness of change of investment to change in income

Here, g is a positive constant given exogenously. m is also a constant, which is given and $0 < m < 1$.

Now, it is necessary to understand, the rate of interest in the economy will alone not depend on the goods market. There has to exist a money market and the interaction between the goods and money market will determine the interest rate for the economy.

In the simplified model that has been considered for the economy, only speculative demand for money and transactions demand for money constitute the consumers money demand, which has been defined as follows:

$$M_t^d = K.Y_t - L.r_t$$

where, M_t^d = Money demand in the t^{th} time period
Y_t = Income/output in the t^{th} time period
r_t = rate of interest in the economy in the t^{th} time period

K and L are positive constants denoting the degree of responsiveness of change in money demand to changes in income and interest rate respectively and are given in the model.

Money supply in the economy is exogenously given, and is written as:

$$M_t^S = M$$

where, M_t^S = Money supply in the t^{th} time period

M, which is equal to the nominal money supply by the price level, is exogenously given, and is a positive constant.

Having defined the money market equations, the output of the economy is to be defined.

The output of the economy in the t^{th} time period is defined, and the result previously used, as Y_t .

Now, there exists a crucial relationship between output and employment. Output is directly proportional to the level of employment in the economy, which can be written as follows:

$$Y_t \propto E_T$$

which implies that: $Y_t = j.E_T$

Here, j can be defined as an efficiency parameter that relates employment to the level of output and is positive.

The mentioned equations are used in the model to develop the time path for employment.

6. THE MODEL

In the product market, quantity demanded in the t^{th} time period is explained by the following equation:

$$Q_t^d = C_t + I_t + G_0$$

i.e $$Q_t^d = a + bY_t + c[(1-b)Y_{t-1}] + d - g.r_t + m.Y_t + G_0 \qquad (i)$$

where the terms have their usual meanings.

The quantity supplied in the t^{th} time period is given as:

$$Q_t^S = Y_t$$

It is understood that the product market does not equilibrate as there will exist an excess supply or deficient supply (excess demand) in the market.

In the money market, money demand in the t^{th} time period is given by:

$$M_t^d = K.Y_t - L.r_t$$

where the terms have their usual meanings.

The money supply in the t^{th} time period is given by:

$$M_t^S = M$$

The money market equilibrium is given by:

$$M_t^S = M_t^d$$

i.e
$$M = K.Y_t - L.r_t \qquad \text{(ii)}$$

From (ii), it can be written that:

$$r_t = \frac{K}{L}Y_t - \frac{M}{L} \qquad \text{(iii)}$$

Using (iii) in (i), it can be written that:

$$Q_t^d = a + bY_t + c[(1-b)Y_{t-1}] + d - g.\left[\frac{K}{L}Y_t - \frac{M}{L}\right] + m.Y_t + G_0 \qquad \text{(iv)}$$

Now, the excess (or deficient) supply in the market can be expressed as:

$$Q_t^S - Q_t^d = Y_t - a - bY_t - c[(1-b)Y_{t-1}] - d + g.\left[\frac{K}{L}Y_t - \frac{M}{L}\right] - m.Y_t - G_0$$

i.e

$$Q_t^S - Q_t^d = (1 - b + g.\frac{K}{L} - m).Y_t - c(1-b)Y_{t-1} - (a + d + g.\frac{M}{L} + G_0)$$

i.e

$$Q_t^S - Q_t^d = j(1 - b + g.\frac{K}{L} - m).E_t - cj(1-b)E_{t-1} - (a + d + g.\frac{M}{L} + G_0) \qquad \text{(v)}$$

Now, it is known that:

$$Q_{t-1}^S - Q_{t-1}^d = E_0 - k.E_t$$

i.e
$$Q_t^S - Q_t^d = E_0 - k.E_{t+1} \qquad \text{(vi)}$$

Using (vi) in (v) gives:

$$E_0 - k.E_{t+1} = j(1 - b + g.\frac{K}{L} - m).E_t - cj(1-b)E_{t-1} - (a + d + g.\frac{M}{L} + G_0)$$

Moving one time period forward gives:

$$E_0 - k.E_{t+2} = j(1 - b + g.\frac{K}{L} - m).E_{t+1} - cj(1-b)E_t - (a + d + g.\frac{M}{L} + G_0)$$

i.e

$$k.E_{t+2} + j(1 - b + g.\frac{K}{L} - m).E_{t+1} - cj(1-b)E_t = a + d + g.\frac{M}{L} + G_0 + E_0$$

This is a difference equation for employment.

Normalizing the equation gives:

$$E_{t+2} + \frac{j}{k}(1 - b + g.\frac{K}{L} - m).E_{t+1} - c\frac{j}{k}(1-b)E_t = \frac{1}{k}(a + d + g.\frac{M}{L} + G_0 + E_0) \qquad \text{(vii)}$$

To find the time path for employment, there is a need to find the particular solution and the complementary function.

The particular solution of the difference equation in (vii) is given by:

$$E_t^P = \frac{a + d + g.\frac{M}{L} + G_0 + E_0}{k + j(1-b+gk-m) - cj(1-b)} \qquad \text{(viii)}$$

This is the intertemporal and stationary equilibrium of the dynamic model explained.

The complementary function of the difference equation in (vii) is given by:

$$E_t^C = A_1b_1^t + A_2b_2^t$$

where A_1 and A_2 are arbitrary constants and;

$$b_1 = \frac{-\frac{j}{k}(1-b+\frac{gk}{L}-m) + \sqrt{(\frac{j}{k}(1-b+\frac{gk}{L}-m))^2 + 4c\frac{j}{k}(1-b)}}{2}$$

$$b_2 = \frac{-\frac{j}{k}(1-b+\frac{gk}{L}-m) - \sqrt{(\frac{j}{k}(1-b+\frac{gk}{L}-m))^2 + 4c\frac{j}{k}(1-b)}}{2}$$

Thus, the time path of employment can be written as follows:

$$E_t = E_t^C + E_t^P$$

i.e $$E_t = A_1 b_1^t + A_2 b_2^t + \frac{a + d + g.\frac{M}{L} + G_0 + E_0}{k + j(1-b+gk-m) - cj(1-b)}$$

where,

$$b_1 = \frac{-\frac{j}{k}(1-b+\frac{gk}{L}-m) + \sqrt{(\frac{j}{k}(1-b+\frac{gk}{L}-m)^2 + 4c\frac{j}{k}(1-b)}}{2}$$

$$b_2 = \frac{-\frac{j}{k}(1-b+\frac{gk}{L}-m) - \sqrt{(\frac{j}{k}(1-b+\frac{gk}{L}-m)^2 + 4c\frac{j}{k}(1-b)}}{2}$$

7. OBSERVATION FROM THE MODEL

This system will be unstable in nature because the roots of the complementary function, b1 and b2 are of opposite signs. This means that as time increases, the system will deviate from the intertemporal equilibrium.

8. THE CONSUMER'S SAVINGS FEEDBACK: AN EXTENSION OF THE MODEL

Suppose that in the model economy considered, there exists excess supply in the t^{th} time period. The question is, how does the consumer react to the effect of excess supply.

In this section, we hypothesize that the effect of excess supply will affect the consumer's and in turn, the economy's consumption pattern. Assuming that the economy's consumption behavior does not change, it can be said that the economy will not consume its savings of the previous period as an effect of the excess supply. A consumer in an economy will only consume from her savings when there exists a shortage in production, i.e. a situation of deficient demand. In a situation of excess supply prevailing over a period in the economy, the consumer will have no motivation to use up her savings to meet up her consumption expectations.

Therefore, in the developed model, the consumption function is modified as follows:

$$C_t = a + bY_t$$

Now, the demand function in the product market is reduced to:

$$Q_t^d = C_t + I_t + G_0$$

i.e $$Q_t^d = a + bY_t + d - g.r_t + m.Y_t + G_0$$

Keeping all other factors in the model defined unchanged, the excess supply function can be written as:

$$Q_t^S - Q_t^d = Y_t - a - bY_t - d + g.[\tfrac{K}{L}Y_t - \tfrac{M}{L}] - m.Y_t - G_0$$

i.e,

$$Q_t^S - Q_t^d = j(1 - b + g.\frac{K}{L} - m).E_t - (a + d + g.\frac{M}{L} + G_0) \qquad (A)$$

Now, it is also known that:

$$Q_{t-1}^S - Q_{t-1}^d = E_0 - k.E_t$$

i.e $$Q_t^S - Q_t^d = E_0 - k.E_{t+1} \qquad (B)$$

Using (A) in (B),

$$E_0 - k.E_{t+1} = j(1 - b + g.\frac{K}{L} - m).E_t - (a + d + g.\frac{M}{L} + G_0)$$

i.e,

$$k.E_{t+1} + j(1 - b + g.\frac{K}{L} - m).E_t = a + d + g.\frac{M}{L} + G_0 + E_0 \qquad (C)$$

This is a difference equation for employment with the savings feedback. Normalizing the equation in (C),

$$E_{t+1} + j\frac{j}{k}(1 - b + g.\frac{K}{L} - m).E_t = \frac{1}{k}(a + d + g.\frac{M}{L} + G_0 + E_0) \qquad (D)$$

To find the time path for employment, the particular solution and complementary function of the difference equation in (D) is required.

The particular solution of the difference equation in (D) is given by:

$$E_t^P = \frac{a + d + g.\frac{M}{L} + G_0 + E_0}{k + j(1-b+gk-m)}$$

This is the intertemporal and stationary equilibrium of the dynamic model explained.

The complementary function of the difference equation in (D) is given by:

$$\mathbf{E_t^C = A_3 b_3^t}$$

where A_3 is an arbitrary constant and;

$$\mathbf{b_3 = -\frac{j}{k}(1 - b + \frac{gk}{L} - m)}$$

Thus, the time path of employment can be written as follows:

$$\mathbf{E_t = E_t^C + \quad E_t^P}$$

$$\mathbf{E_t = A_3 b_3^t} + \frac{a + d + g.\frac{M}{L} + G_0 + E_0}{k + j(1 - b + gk - m)}$$

9. OBSERVATION FROM THE MODEL

This system will be stable in nature under the following condition:

$$\mathbf{-1 < -\frac{j}{k}(1 - b + \frac{gk}{L} - m) < 1}$$

i.e $$\mathbf{-\frac{k}{j} < (1 - b + \frac{gk}{L} - m) < \frac{k}{j}}$$

The economy, in case of an excess supply situation, will move towards and converge to an intertemporal equilibrium if and only if this condition holds. Otherwise, the system will be unstable and will diverge from the equilibrium. In this paper, this condition is named as the Employment's Dynamic Equilibrium Condition.

It is necessary to highlight the limitations of the paper here. This paper fails to interpret the restrictive conditions of the time path of the difference equation for employment to have a stable time path.

10. STATISTICAL RESULTS

Annual data from the World Bank, published between the years 1990 and 2021, is considered to check whether the rate of unemployment in a year following excess demand or excess supply is affected by the consumer's feedback or not. Data, particularly in regard to India, considering annual consumer spending, annual investment spending, annual government spending, imports and exports, as well as the net annual savings and unemployment rate is used. From the data provided, it was possible to calculate net aggregate demand in the Indian Economy over the years, excess demand in the economy and aggregate demand resulting from non-consumption of savings. The detailed tables of data used have been provided in the Appendix.

The descriptive statistics is as follows:

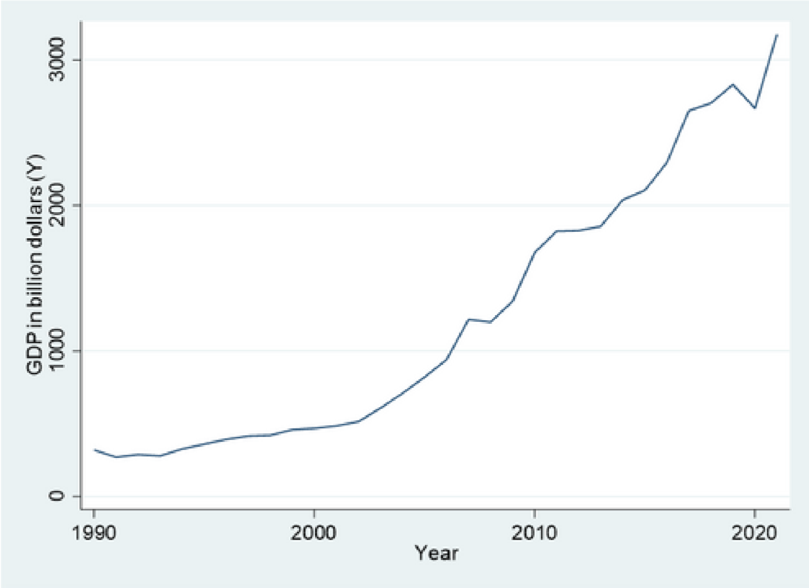
Table 1: *Descriptive Statistics*

Variable	Obs	Mean	Std. dev.	Min	Max
gdpinbilli~y	32	1234.043	928.9803	270.11	3176.3
consumersp~r	32	731.475	541.9577	199.3684	1891.902
investment~a	32	368.5803	275.8339	66.10404	907.3083
government~a	32	133.9902	101.9642	29.92475	353.5213
importsinb~s	32	279.1341	240.356	22.94	758.87
exportsinb~s	32	242.3916	207.8953	22.64	679.68
netexportsnx	32	-36.7425	38.149	-122.91	.05
aggregates~s	32	370.3225	286.3837	59.16273	930.8742
cwithoutsa~s	32	361.1525	265.3713	129.9103	1001.909
aggregated~d	32	1197.303	887.1355	298.1457	3073.541
excessdemand	32	36.74018	57.54161	-79.66358	163.7757
unemployme~e	32	7.833031	.7467165	6.51	10.195
ED_without~s	32	407.0627	333.1833	31.12703	1033.633

Source: Author's Calculation

Here, gdpinbiiliondollars stands for Aggregate Output (Y), consumerspendinginbilliondollars stands for consumption spending (C), investmentinbilliondollars stands for investment spending (I), governmentexpenditureinbilliondollars stands for government spending (G), importsinbilliondollars stands for imports, exportsinbilliondollars stands for exports, netexportsnx stands for net exports of the economy (NX), aggregatesavingsinbilliondollars stands for savings of the economy, cwithoutsavings represents consumption without savings, aggregatedemand is the summation of consumption spending, investment spending, government spending and net exports, excessdemand stands for excess of aggregate demand over Y, unemploymentrate stands for the rate of unemployment in the economy, and ED_without_savings stands for excess demand in the economy, calculated where consumption does not include the savings component

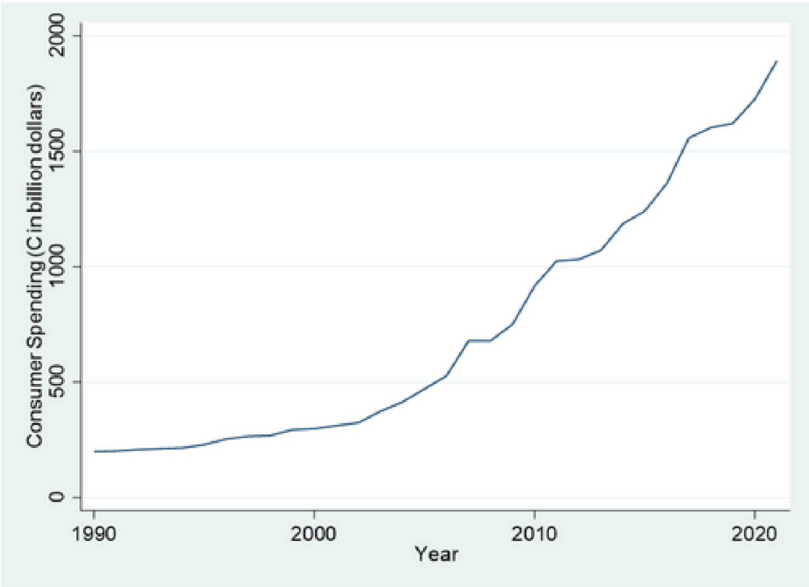
Figure 1: *Growth of India's GDP (1990-2021))*



1

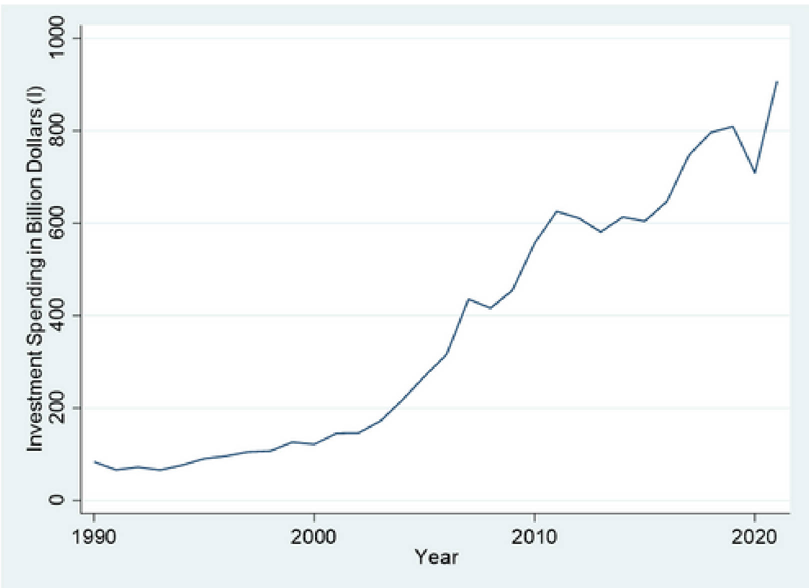
Source: Author's Calculation

Figure 2: *Consumption Spending in the Indian Economy (1990-2021))*



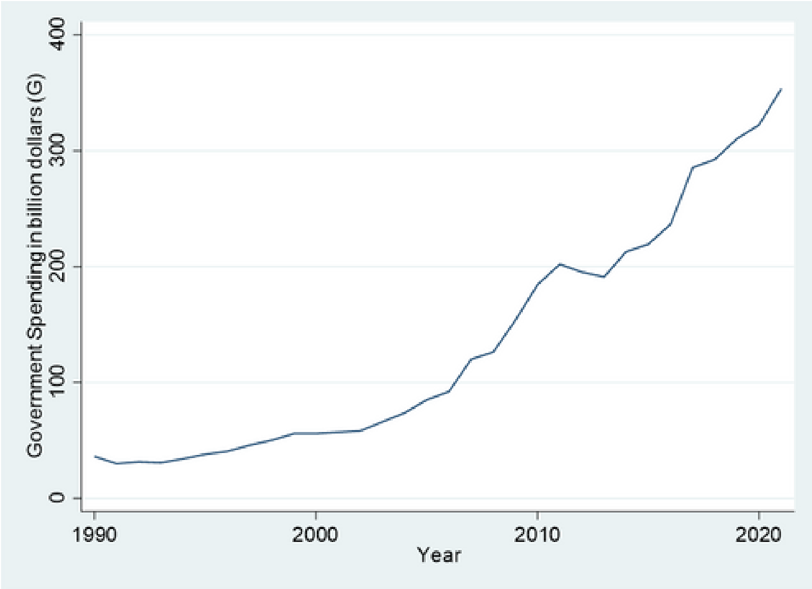
Source: Author's Calculation

Figure 3: *Investment Spending in the Economy (1990-2021)*



Source: Author's Calculation

Figure 4: *Government Spending in the Economy (1990-2021)*



1

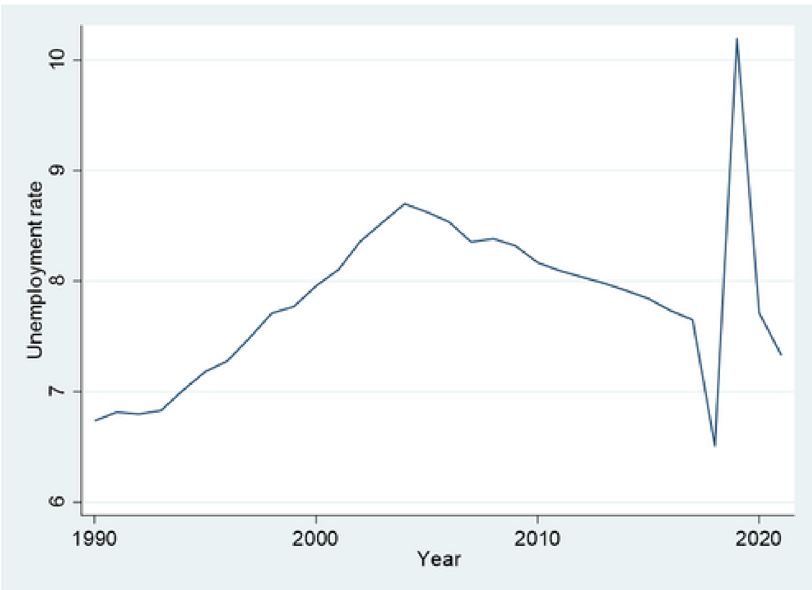
Source: Author's Calculations

Figure 5: *Net Exports of India (1990-2021)*

2

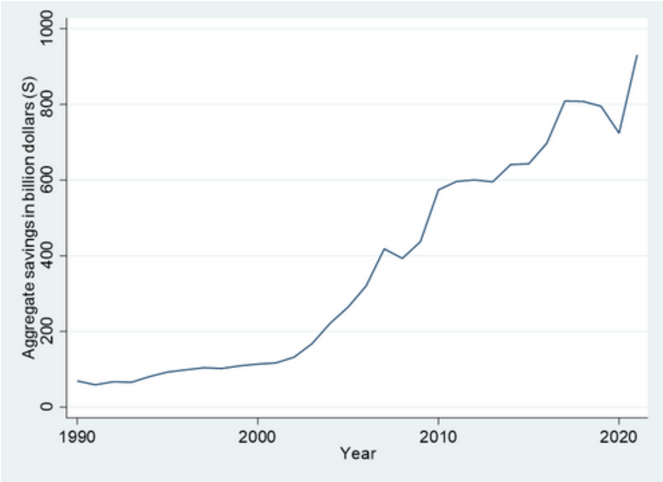
Source: Author's Calculations

Figure 6: *Unemployment Rate in India (1990-2021)*



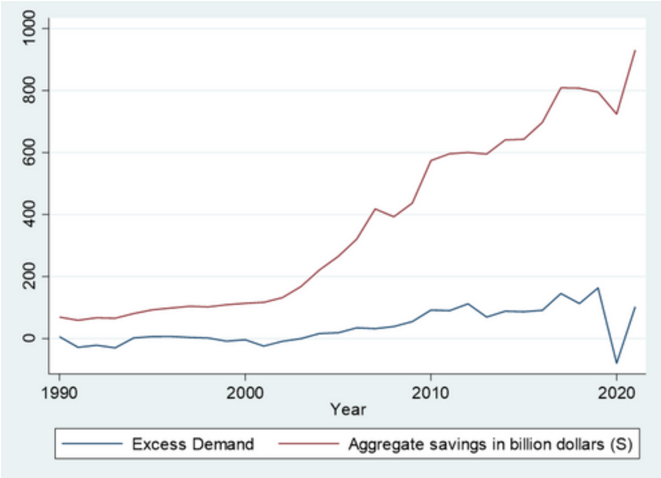
Source: Author's Calculations

Figure 7: *Savings in the Economy (1990-2021)*



Source: Author's Calculations

Figure 8: *Excess Demand and Aggregate Savings(1990-2021)*



Source: Author's Calculations

The above depicted figure shows that as excess demand increased over time, savings decreased, implying, in periods of excess demand, people consume from their savings. Notice the counter-movement near 2020. It shows as excess demand dropped, savings in the economy increased, implying, in periods of excess supply, economic agents consume only from their income.

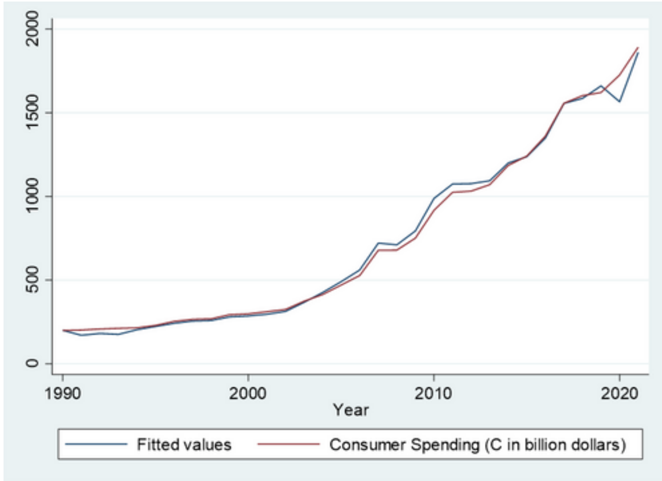
Table 2: *Regression results of consumption function*

```
. reg consumerspendingcinbilliondollar gdpinbilliondollarsy

      Source |       SS           df       MS      Number of obs   =        32
-------------+----------------------------------   F(1, 30)        =   5473.41
       Model |  9055628.53         1  9055628.53   Prob > F        =    0.0000
    Residual |  49634.2949        30  1654.4765    R-squared       =    0.9945
-------------+----------------------------------   Adj R-squared   =    0.9944
       Total |  9105262.83        31  293718.156   Root MSE        =    40.675

------------------------------------------------------------------------------
consumerspendingci~r | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
---------------------+--------------------------------------------------------
gdpinbilliondollarsy |   .5817977    .007864    73.98   0.000     .5657372    .5978581
               _cons |   13.51157   12.07807     1.12   0.272    -11.15514    38.17828
------------------------------------------------------------------------------
```

Source: Author's Calculations

Consumption dependent on income, which includes the savings is regressed, as stated before.

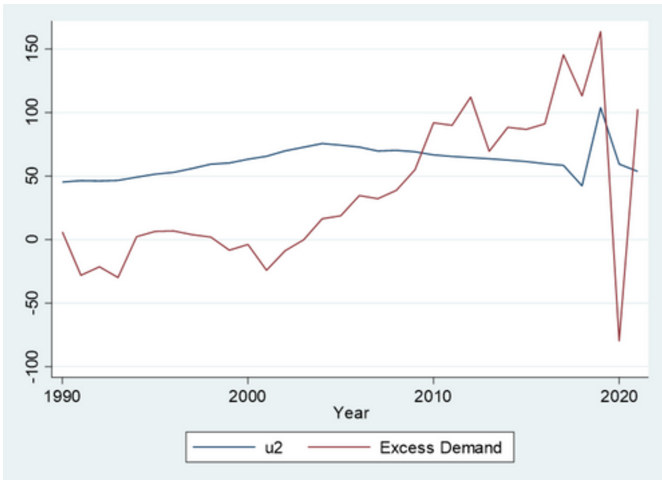
Figure 9: *Actual Consumption v/s Predicted Consumption*



Source: Author's Calculations

The impact of excess demand on the unemployment rate in the economy is visualized. However, relative to the excess demand values, unemployment rate values are obviously very small. As a result, the line diagram does not capture the effect. A quadratic transformation of the unemployment rate is taken, squaring the values, and plotted against excess demand, to show the changes in unemployment, without loss of generality.

Figure 10: *Excess Demand v/s Unemployment*



Source: Author's Calculations

Notice in the above figure that post 2000, as excess demand begins to rise, unemployment falls, which satisfies the hypothesis in the modeling.

Now, equation (vi) is looked into and the regression equation is formed as follows:

$$U_{t+1} = \_cons + (Q_t^d - Q_{t+1}^S)$$

where U refers to employment rate

The regression results are shown below:

Table 3: *Regression results of Unemployment rate*

. reg lagU excessdemand

Source	SS	df	MS			
				Number of obs	=	31
				F(1, 29)	=	0.33
Model	.190807015	1	.190807015	Prob > F	=	0.5708
Residual	16.8331395	29	.580453086	R-squared	=	0.0112
				Adj R-squared	=	-0.0229
Total	17.0239465	30	.567464884	Root MSE	=	.76187

lagU	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
excessdemand	-.0013699	.0023893	-0.57	0.571	-.0062566	.0035168
_cons	7.90094	.1638586	48.22	0.000	7.565811	8.236068

Source: Author's Calculations

The regression results show that the variable of excess demand is insignificant when the impact of excess demand on unemployment in the following period is looked into. Therefore, the 'Feedback' model for the time periods is looked into, where excess supply exists, and the possibility of better results is checked.

The regression results are as follows:

Table 4: *Regression results of Feedback Model*

. reg lagU ED_without_savings if excessdemand<0

Source	SS	df	MS			
				Number of obs	=	9
				F(1, 7)	=	44.35
Model	8.00836186	1	8.00836186	Prob > F	=	0.0003
Residual	1.26393258	7	.180561797	R-squared	=	0.8637
				Adj R-squared	=	0.8442
Total	9.27229444	8	1.1590368	Root MSE	=	.42493

lagU	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
ED_without_savings	.0052482	.000788	6.66	0.000	.0033848	.0071116
_cons	7.038301	.184628	38.12	0.000	6.601725	7.474877

.

Source: Author's Calculations

Now the regression model yields a significant result, as well as a better fit model. It can be seen that if there exists excess supply in a period, and the consumer is consuming from his income only, which if increases by 1 unit, raises unemployment in the following period by only 0.0052482 units, which is very small. This increase can be accounted for by systemic processes, not due to market mechanisms.

11. CONCLUSION

The paper began with a condition modeling an economy's behavior in the situation of excess supply. It was assumed that in this situation the money market equilibrium holds. The net real output of the industry was expressed in terms of the level of employment in the economy, which in turn was used to express the consumption and investment functions in terms of level of employment. It was assumed in the development of the model that, if there exists excess supply in the economy in a particular time period, the following period will show a fall in employment and vice versa, i.e. an inverse relation between excess supply and employment, in successive time periods was considered. However, the scope of an autonomous employment was kept while developing the model. Using the derived functions in terms of employment, a difference equation of second order was developed to derive the time path for employment. It was derived from the difference equation that the time path for employment was unstable i.e. with time, levels of employment diverged from the intertemporal equilibrium level of employment.

The model is now extended with a further scope that modifies the behavior of the consumer. It is hypothesized that the effect of excess supply will affect the consumer's and in turn, the economy's consumption pattern. Assuming that the economy's consumption behavior does not change, the economy will not consume its savings from the previous period as an effect of the excess supply. A consumer in an economy will only consume from her savings when there exists a shortage in production, i.e. a situation of deficient demand. In a situation of excess supply prevailing over a period in the economy, the consumer will have no motivation to use up her savings to meet up her consumption expectations. All other factors developed in the model were kept fixed. Using these derived functions, in terms of employment levels, a difference equation was developed to develop the time path for employment. It was derived from the difference equation that the time path for employment was stable under a particular condition, which has been labeled as Employment's Dynamic Equilibrium Condition in the paper.

APPENDIX

A.1 *Detailed data used for calculations*

Year	Imports (in billion dollars)	Exports (in billion dollars)	Consumer Spending (C in billion dollars)	GDP in billion dollars (Y)
1990	27.13	22.64	199.3683874	320.98
1991	22.94	22.94	201.8161899	270.11
1992	27.64	25.49	207.9667994	288.21
1993	27.42	27.47	212.2082372	279.3
1994	33.35	32.36	215.2971107	327.28
1995	43.32	39.07	229.5012643	360.28
1996	45.36	40.8	253.6355506	392.9
1997	49.61	44.46	265.7887015	415.87
1998	53.43	46.43	268.8590432	421.35
1999	61.31	52.54	293.6885933	458.82
2000	65.12	60.88	298.5501607	468.39
2001	65.22	60.96	311.3951555	485.44
2002	78.5	73.45	324.5635702	514.94
2003	95.07	90.84	373.7578955	607.7
2004	139.31	126.65	413.7991356	709.15
2005	183.74	160.84	470.7245401	820.38
2006	229.96	199.97	527.5793103	940.26
2007	302.8	253.08	678.4579006	1,216.74
2008	350.93	288.9	679.4958429	1,198.90
2009	347.18	273.75	750.9182463	1,341.89
2010	449.97	375.35	916.978109	1,675.62
2011	566.67	447.38	1024.685658	1,823.05
2012	571.31	448.4	1031.901767	1,827.64
2013	527.56	472.18	1070.321691	1,856.72
2014	529.24	468.35	1185.298233	2,039.13
2015	465.1	416.79	1241.269974	2,103.59
2016	480.17	439.64	1360.706916	2,294.80
2017	582.02	498.26	1557.081456	2,651.47
2018	640.3	538.64	1602.521697	2,702.93
2019	602.31	529.24	1621.119894	2,831.55
2020	509.43	499.1	1726.040715	2,667.69
2021	758.87	679.68	1891.901572	3,176.30

net Exports (NX)	Investment Spending in Billion Dollars (I)	Government Spending in billion dollars (G)	Aggregate savings in billion dollars (S)
-4.49	83.71854981	36.22417191	69.45806431
0	66.404744	29.92474746	59.16273312
-2.15	72.31044763	31.45825546	67.26998609
0.05	66.10404332	30.73044344	65.7633579
-0.99	76.44896933	34.15433033	80.91456882
-4.25	90.56330438	37.97447582	92.80550373
-4.56	96.35788859	40.59006554	98.67248227
-5.15	105.4232619	45.86516366	104.2146993
-7	107.270518	50.18232073	102.3095788
-8.77	126.336511	55.86358141	109.2680924
-4.24	121.883438	55.96246655	113.8805197
-4.26	145.3034039	57.09478234	116.950713
-5.05	145.8955033	58.26080115	132.1143358
-4.23	172.1907358	66.09472764	167.8469374
-12.66	217.7667849	73.7849467	221.5650511
-22.9	268.718234	85.04174095	264.6146344
-29.99	315.7853016	92.16870882	320.5119185
-49.72	435.7496132	119.9963069	418.2832506
-62.03	416.2336146	126.3458506	393.0558026
-73.43	455.5934866	153.7761311	437.1937215
-74.62	556.8087716	184.4456789	574.1936594
-119.29	625.5507346	202.0752769	596.2890247
-122.91	611.1067864	195.26243	600.4745944
-55.38	581.0754712	191.1522974	595.2472345
-60.89	613.3751378	212.9026434	640.9276388
-48.31	604.4275466	219.3684805	642.9502554
-40.53	646.8682977	236.5605612	697.5313251
-83.76	747.1263522	285.4890501	808.9012238
-101.66	796.3661077	292.5440205	807.8641157
-73.07	809.2924319	310.4319965	795.0786438
-10.33	709.2054447	322.4374239	724.1314371
-79.19	907.3082937	353.5212708	930.8742177

Source: World Bank

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