THE PHILIPPINE REVIEW OF ECONOMICS
VOL. XLIV NO. 2 DECEMBER 2007 P. 111-124

Fix- or flex-price behavior?: evidence from the Malaysian manufacturing sector

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Industries can be classified into fix-price and flex-price sectors according to their pricing behavior. Although Hicks [1985] and Morishima [1984] have broadly classified manufacturing industries into fix price and the rest of the economy into flex price, using the cost-based input-output model, the present paper reclassifies the Malaysian manufacturing industries into fix-price and flex-price categories. By compiling annual sectoral price indices, both for intermediate and primary inputs, the paper found that most of the flex-price manufacturing industries are from non-agro-based industries whereas most of the fix-price industries are from agro-based industries.

JEL classification: D4
Keywords: Input-output, fix price, flex price, residual profits

1. Introduction

The employment condition in the neoclassical temporary equilibrium method requires that all markets in an economy be at equilibrium, even in the very short term. Unemployment in any sector, including manufacturing, is incompatible with equilibrium conditions and leads to adjustments in the labor market in the form of changes in wage rates. Such an assumption, which is Marshallian in nature, is extremely difficult to accept because of what is actually happening in modern manufacturing industries. This paradox has led to the formulation of Keynesian theory, which assumes the coexistence of stationary prices and wages, and unemployment. But the dropping of the temporary equilibrium method does not necessarily mean an automatic adoption of Keynesian general theory, but rather the emergence of what Hicks [1985] has described as the fix-price and the flex-price methods.

In the flex-price system, prices are allowed to change in order to clear the market where it is said to be in equilibrium by equating demand and supply for commodity. The price level in this case provides a signal to producers who will decide either to expand or contract production depending on whether they consider the level of price to be high or low relative to the normal production costs. In the fix-price system, on the other hand, prices remain unchanged over a certain period of time. In a disequilibrium situation, however, an excess (a shortage) in demand over supply will be shown as a stock run-down (pileup). Disequilibrium in such a market, therefore, as in the flex-price system, still plays a role in informing producers—a shortage in the markets gives a signal to expand production, and surplus to contract it.

Although Morishima [1984][1] broadly identified the manufacturing industry as fix price and the rest of the economy as flex price, some industries within the broad manufacturing sector are closely related to agriculture. These industries use a relatively large proportion of output from agriculture as their inputs; so much so that their classification according to the fix-price and flex-price criterion has to be reviewed. By using the cost-based input-output model, this paper attempts to classify individual industries in the manufacturing sector into fix-price and flex-price categories. In addressing this issue, those industries that experience their residual profit falling over time may be grouped in the fix-price category while industries whose residual profit does not fall over time may be lumped in the flex-price category.

The remainder of this paper is organized as follows. Section 2 presents an analytical framework of an input-output model. Data sources associated in this study are presented in section 3. Section 4 presents the results, followed by conclusions in section 5.

2. Input-output model

The column-wise balance equation of an input-output model can be interpreted as the price that each productive sector receives per unit of its output, which equals the total outlays incurred in production cost. These outlays comprise input purchased from its own industry as well as other industries and value added or factorial payment, which consists of compensation of employee, indirect taxes, interest rates, and profits. Each of these inputs has its own price. This relationship for sector i can be written:

[1] Morishima [1984] calculated the degree to which real world economies are mixed according to the fix-price and the flex-price systems by measuring the ratio of the value of output produced in the flex-price sector to the value of output produced in the fix-price sector; or roughly by the ratio of the value of the output produced in agriculture, forestry, fishing, and mining to the value of output produced in manufacturing. He computed this ratio for 1960 and 1973 for industrialized economies and found that these economies are nearest to the pure type of fix-price economy.

$$P_i = \Sigma_i a_{ij} P_i + V_i \tag{1}$$

where P_i and V_i represent price and value added of sector i. Apart from the given structural matrix, the equation can be further disaggregated into labor and capital inputs as a labor coefficient vector and a capital coefficient matrix:

$$P_i = \Sigma_i a_{ij} P_i + w l_i + u \Sigma_k b_{ki} P_k \tag{2}$$

where w and u are wage rate and rate of return on capital, respectively, while l_i and b_{ki} are labor coefficient and capital coefficient of sector i. Equation (2) can be written in matrix notation as:

$$P = wL(I - A - uB)^{-1} \tag{3}$$

where L is the labor coefficient vector, B is the capital coefficient matrix, A is the structural matrix, P is the price vector, w is the wage rate vector, and u is the vector of rate of return on capital.

If we incorporate the disaggregation of labor and working capital as well as fixed capital into various sectors of the economy, we may say that, except for the interest rate, as far as the price structure (including wage rate) is concerned, the system is technologically determined, i.e., by vector of labor coefficients, structural matrix, and capital coefficients. The matrix of capital coefficients that shows, column-wise, the capital requirement of each industry for the purpose of producing its output, can be divided into working and fixed capital components. Returns on working capital are the opportunity costs of holding equity, approximated by the market interest rate. Returns on fixed capital, on the other hand, are the expected rates of return on the stock of machinery, building, and motor vehicles, the opportunity cost of which is almost zero and may be represented by a residual, after meeting the variable costs.

Taking into account the above disaggregation of stock of capital, equation (2) can be written as:

$$P_i = w l_i + \Sigma_i a_{ij} P_i + r \Sigma_i P_i^w b_{ij} + u_k \Sigma_i P_i^f b_{ij} \tag{4}$$

As the returns to fixed capital are the quasi-rents, in the short run, what a firm has to cover is its total variable costs. Equation (4), therefore, can be written as:

$$P_i = w l_i + \Sigma_i a_{ij} P_i + r \Sigma_i P_i^w b_{ij} \tag{5}$$

Equation (5) can be expressed in matrix notation as:

$$P = wL + PA + rP^{w}B$$

or

$$w^{-1}(P) = L\left[I - A - r^{w}b_{ij}\right]^{-1} \tag{6}$$

As the model uses a framework based on input-output model, which assumes fixed production coefficients, the long-run (supply) price of any commodity is therefore determined not by the scale of outputs, but rather by invariant unit costs. In other words, the model does not account for the short-run (demand) variation in output. It is thus suitable for explaining the price formation in the commodities whose pricing is less relevant to those that follow the competitive market behavior. Even so, it needs some modification so as to allow for price changes in the formation of prices in the fix-price industries. In view of the above, how can the model classify industries in the input-output model into fix-price and flex-price categories?

2.1 Fix price–flex price

Markup pricing is an approach to obtaining a "fair" return on capital. Unless the industry uses the best-practice technique,[2] the reduction in the markup on the old technique does not guarantee a profit. On the contrary, those industries whose pricing policy is based on competitive market forces may adjust their prices as directed by demand and supply so as to be able to maintain the use of a vintage capital.

A fix-price industry predetermines the desired rate of profit and the technique of production from a spectrum of available feasible techniques that can deliver the highest rate of profit. Applying this pricing method on both the marginal and the best-practice technique (from the spectrum of feasible techniques), the latter will give the highest residual surplus, whereas the former, which is considered as a technique on the verge of obsolescence, will earn normal profits sufficient to cover the total average variable costs. In other words, given a technique, over time, with changing price structure, the rate of profit will gradually decline until it reaches a point where a negative profit rate emerges, indicating the nonfeasibility of the technique.[3]

We may expect such behavior for the residual profits found in our model because the pricing mechanism is cost-based and demand is considered an exogenous element in an open static input-output model like ours. On the

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[2] The best-practice technique is the technique of production that gives the highest surplus, given the current price structures. The terminology was first introduced in Salter [1960].

[3] This idea was first introduced in Mathur [1977] and then extended in Rashid [1989a, 1989b].

other hand, if such behavior of residual profits is not observed in our model, then we are entitled to believe that demand is now an endogenous element in the formation of the price of that commodity. We may thus say that those commodities whose residual profit falls over time may be considered commodities that follow the fix-price rule, and those commodities whose residual profit does not fall over time may be considered commodities that follow the flex-price rule.

Based on the above theoretical framework, we may obtain the residual profits as a proportion of the total value of output for each industry via the following expression:

$$R_i^t = \left[P_i^t - w_i^t l_i - \Sigma_I a_{ij} P_i^t - r\Sigma_I P_i^{mt} a_{ij}^m \right] \times I/P_i \tag{7}$$

where:

R_i^t residual profits (proportion) of industry I in year t

P_i^t index of producer prices of industry I in year t

W_i^t index of wage rate of industry I in year t

l_i labor coefficient of industry I in year t

a_{ij} domestic input coefficient for the base year

P_i^{mt} index of import prices of industry I in year t

a_{ij}^m import input coefficient for the base year

If we classify the industries into fix-price and flex-price sectors while allowing for inter-industry transactions between them, the structural and import coefficients matrices, and labor coefficients vector may be partitioned accordingly. The residual profits after partitioning may be derived as follows:

Let industries $1, \ldots, m$ follow the fix-price rule and industries $m+1, \ldots, n$ follow the flex-price rule. Let the matrices A and wB be partitioned as follows:

$$\begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \quad \begin{pmatrix} {}^{w}B_{11} & {}^{w}B_{12} \\ {}^{w}B_{21} & {}^{w}B_{22} \end{pmatrix}$$

Similarly,

$$(P_1 \quad P_2) \qquad (L_1 \quad L_2) \qquad \text{and} \quad (W_1 \quad W_2) \tag{8}$$

where:

A_{11}	Partition matrix having intersectoral trade in intermediate inputs between fix-price sector only
A_{21}	Partition matrix where flex-price sector supply intermediate inputs to fix-price sectors
${}^{w}B_{11}$	Partition matrix where working capital matrix includes only trade in working capitals requirements within fix-price sectors
${}^{w}B_{21}$	Partition working capital matrix where flex-price sectors supply fix-price sectors
P_1	Partition output price vector for fix-price sectors
P_2	Partition output price vector for flex-price sectors
L_1	Partition labor coefficient vector for fix-price sectors
W_1	Partition wage rate vector for fix-price sectors

3. The data

In this study, we used the latest input-output tables for year 1991 and various annual issues of the Industrial Surveys as well as unpublished annual data on the producer price indices from the Department of Statistics, Malaysia (DOS). Since the published producer price indices for the domestic production are classified by the Standard Industrial Classification (SIC) and imports prices are classified by the Standard Industrial Trade Classification (SITC), for harmonization, we have reclassified these two price indices by using the Malaysia Industrial Classification (MIC) at two-digit level. In some cases where more than one price index (SIC or SITC) corresponds to a particular sector in the input-output table, a simple average of them represents that industry's index. Ideally, this study prefers to use a weighted average index (Lespeyres) if gross outputs of the respective industries for 1991 base years are given. These indices represent the input prices of domestic production and imports.

In estimating the wage rates for various industries, this study prefers to use earning figures to represent wage rates. However, due to the unavailability of such information, price of labor is now defined as the ratio of salary and wages to the number of employees in an establishment. These prices are given in value term which has to be converted to 1991-based indices before it can be applied to the model. Subsequently, salary and wages figures were obtained from published figure by the survey conducted by DOS.

4. Results and discussion

The results presented in this discussion are the residual profits of the 31 industries in the manufacturing sector. Table 1 shows the variation of the residual profits in the manufacturing sectors, which is derived from the cost-based pricing mechanism of the input-output model. Overall, the manufacturing sector has experienced continuous decline of residual profits as shown in Figure 1. This implies that the manufacturing sector, in general, can be considered to belong in the fix-price sector.

However, by examining the movement of the residual profits for each industry in the manufacturing sector, Table 2 reveals that 52 percent of a number of manufacturing industries in the economy have experienced continuous decline of residual profits while the remaining 48 percent of the industries experienced noncontinuous decline of residual profits. This indicates that 52 percent or 16 industries in the manufacturing sector can be considered as falling under the fix-price rule whereas others, 48 percent or 15 industries, can be considered as falling under the flex-price rule. What are these two broad industry categories?

To answer this question, the model allows us to classify the manufacturing sector into agro-based and non-agro-based industries (see Table 2). The results indicate that except for the bakery and confectionery, animal feeds, beverages, and furniture and fixture industries, most of the agro-based industries have experienced noncontinuous decline in residual profits. Thus, according to the Hicks-Morishima theoretical exposition, these industries can be classified under the flex-price industries. On the other hand, most of the non-agro-based industries tend to behave as fix-price industries since these experienced continuous decline in residual profits. We may believe that residual profits behave the way they do because the industries' pricing policy is somehow affected by demand forces.

Table 1. Residual profit as a proportion of output value of the manufacturing sector, 1991-2001

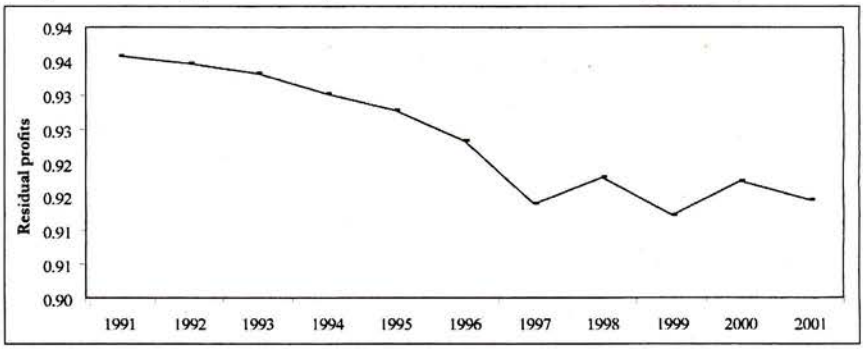
Industry	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*
1. Dairy product	0.9864	0.9861	0.9871	0.9805	0.9791	0.9789	0.9803	0.9807	0.9798	0.9817	0.9815
2. Vegetables & fruit	0.9440	0.9357	0.9312	0.9374	0.9382	0.9353	0.9318	0.9323	0.9333	0.9409	0.9407
3. Oil & fats	0.8939	0.8980	0.9038	0.9082	0.9133	0.9132	0.9146	0.9440	0.9145	0.8981	0.8923
4. Grain mill	0.9976	0.9974	0.9975	0.9971	0.9971	0.9975	0.9973	0.9975	0.9976	0.9975	0.9974
5. Bakery & confectionery	0.9707	0.9677	0.9660	0.9601	0.9580	0.9593	0.9597	0.9678	0.9669	0.9349	0.9331
6. Other foods	0.9804	0.9779	0.9823	0.9786	0.9795	0.9799	0.9803	0.9846	0.9834	0.9815	0.9810
7. Animal feed	0.9695	0.9674	0.9649	0.9633	0.9660	0.9666	0.9564	0.9649	0.9580	0.9572	0.9563
8. Beverages	0.9607	0.9379	0.9359	0.9284	0.9323	0.9290	0.9220	0.9126	0.9045	0.9182	0.9177
9. Tobacco	0.9373	0.9541	0.9843	0.9629	0.9822	0.9774	0.9726	0.9707	0.9747	0.9732	0.9744
10. Textiles	0.8953	0.8756	0.8822	0.8693	0.8508	0.8469	0.8354	0.8564	0.8352	0.8440	0.8388
11. Wearing	0.9880	0.9868	0.9865	0.9858	0.9858	0.9853	0.9844	0.9858	0.9858	0.9860	0.9857
12. Sawmills	0.9856	0.9851	0.9858	0.9862	0.9860	0.9853	0.9852	0.9846	0.9845	0.9852	0.9857
13. Furniture & fixture	0.8246	0.8011	0.7963	0.7833	0.7628	0.7518	0.7187	0.7464	0.7448	0.7500	0.7445
14. Paper printing	0.9804	0.9791	0.9803	0.9786	0.9809	0.9813	0.9799	0.9803	0.9805	0.9851	0.9850
15. Industrial chemical	0.9507	0.9489	0.9470	0.9421	0.9420	0.9305	0.9316	0.9343	0.9325	0.9344	0.9286
16. Paints, etc	0.9317	0.9329	0.9220	0.9092	0.9081	0.9039	0.9000	0.9060	0.9125	0.9060	0.9043
17. Other chemical products	0.8898	0.9095	0.8945	0.8798	0.8811	0.8737	0.8676	0.8771	0.8765	0.8755	0.8726

Table 1. Residual profit as a proportion of output value of the manufacturing sector, 1991-2001 (continued)

Industry	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*
18. Petrol product	0.9923	0.9919	0.9916	0.9887	0.9881	0.9877	0.9891	0.9880	0.9886	0.9902	0.9895
19. Rubber processing	0.8486	0.8470	0.8416	0.8591	0.8844	0.8698	0.8037	0.8003	0.7251	0.8047	0.7756
20. Rubber product	0.9069	0.8960	0.8842	0.8889	0.8742	0.8665	0.8492	0.8545	0.8544	0.8665	0.8635
21. Plastic product	0.9031	0.8894	0.8801	0.8596	0.8585	0.8501	0.8364	0.8416	0.8400	0.8460	0.8409
22. Glass product	0.9272	0.9251	0.9060	0.9167	0.8823	0.8743	0.8543	0.8450	0.8366	0.8635	0.8619
23. Cement	0.9355	0.9378	0.9292	0.9393	0.9158	0.9111	0.9063	0.9058	0.9071	0.9064	0.9056
24. Nonmetallic	0.9795	0.9785	0.9763	0.9779	0.9711	0.9770	0.9716	0.9699	0.9681	0.9696	0.9693
25. Basic metallic	0.9495	0.9441	0.9434	0.9372	0.9341	0.9353	0.9313	0.9315	0.9312	0.9347	0.9308
26. Other metallic	0.8375	0.8924	0.8961	0.8850	0.8955	0.8858	0.8705	0.9019	0.8938	0.8899	0.8858
27. Non-electric machinery	0.8642	0.8645	0.8685	0.8644	0.8624	0.8323	0.7752	0.7681	0.7558	0.7898	0.7831
28. Electrical machinery	0.8596	0.8553	0.8554	0.8553	0.8462	0.8410	0.8368	0.8288	0.8234	0.8290	0.8269
29. Motor vehicle	0.9713	0.9733	0.9737	0.9717	0.9714	0.9715	0.9715	0.9710	0.9709	0.9712	0.9714
30. Other transport	0.9614	0.9551	0.9560	0.9552	0.9506	0.9469	0.9439	0.9447	0.9461	0.9475	0.9469
31. Other mfg. products	0.9827	0.9815	0.9791	0.9829	0.9803	0.9755	0.9741	0.9761	0.9747	0.9779	0.9771
Average	0.9357	0.9346	0.9332	0.9301	0.9277	0.9232	0.9139	0.9178	0.9123	0.9173	0.9144

Source: Computed from equation (7).

Figure 1. Average residual profits of the manufacturing sector, 1991-2001



Source: Derived from Table 1.

Table 2. Manufacturing industries classified according to the continuously declining and non-declining residual profit

Industry	*Continuously declining*	*Continuously non-declining*
Agro-based Industry		
1. Dairy Product		X
2. Vegetables& Fruit		X
3. Oil & Fats		X
4. Grain Mill		X
5. Bakery & Confectionery	X	
6. Other Foods		X
7. Animal Feed	X	
8. Beverages	X	
9. Tobacco		X
10. Sawmills		X
11. Furniture & Fixture	X	
12. Rubber Processing		X
13. Rubber Product		X
14. Paper Printing		X

Table 2. Manufacturing industries classified according to the continuously declining and non-declining residual profit (continued)

Industry	*Continuously declining*	*Continuously non-declining*
Non Agro-based Industry		
15. Textiles	X	
16. Wearing		X
17. Industrial Chemical	X	
18. Paints. Etc	X	
19. Other. Chemical Product	X	
20. Petrol Product		X
21. Plastic Product	X	
22. Glass Product	X	
23. Cement	X	
24. Non Metallic	X	
25. Basic Metallic	X	
26. Other Metallic		X
27. Non-Electric Machinery	X	
28. Electrical Machinery	X	
29. Motor Vehicle		X
30. Other Transport	X	
31. Other Mfg. Product		X

Figure 2 shows an example of the noncontinuous decline in residual profits of the vegetables and fruits industry, which describes the phenomenon of the flex price in economy. This result supports Hick's and Morishima's proposition that manufacturing is classified as fix price, whereas agriculture and the rest of the economy can be classified as flex price. The electrical machinery industry (Figure 3), for instance, is an example of the continuous decline in residual profits, which describes the phenomenon of the fix price in the economy. The fix-price industries, however, may be evident in the agro-based industries because of the peculiarities of the industries that can hold stock such as bakery and confectionery, animal feed, and beverages. Similarly, not all the industries in the non-agro-based industries are fix price. Some industries that have strong linkages with the nonmanufacturing industries may be flex price such as petrol product, motor vehicle, and other metallic products.

Our model enables us to distinguish between the fix-price and the flex-price industries among the manufacturing sector. The distinctions between these two behavioral industries have implications on the microeconomic equilibrium. In the flex-price industries, the supply and demand are equated in a single period (temporary equilibrium theory), and may contain stock elements as well as flow elements. Supply of the output of the flex-price industry comes partly from stock carried over and partly from new production. Demand, on the other hand, is partly a demand for use and partly a demand that is carried forward. The analysis of the flex-price method does not require that the stock and flow be separated.

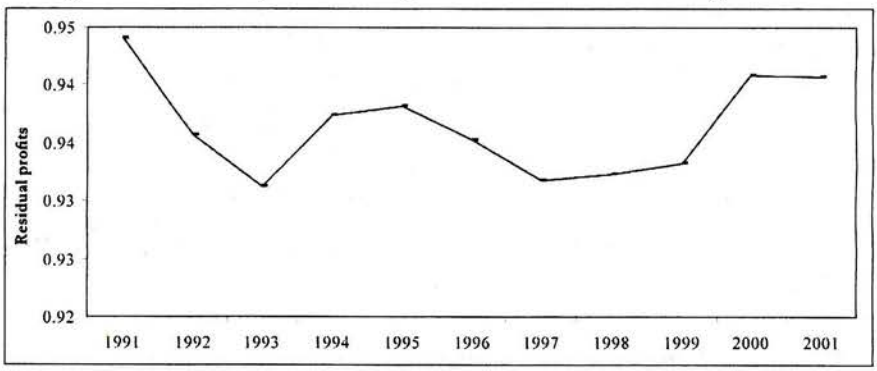
In the analysis of the fix-price industry, on the other hand, the concept of stock equilibrium—that is, a firm's position at a point of time is a position that is chosen—is most important. The microeconomics of the fix-price method recognizes disequilibrium in other markets as well as, apart from that in the labor market, for an economy to be described as in an unemployment position. In maintaining the stock equilibrium, expectations of demand rather than expectations of price and interest rate (applied to the flex-price method) have to be taken into account, and this requires an appropriate level of capital stock that can satisfy both the current level of demand and demand that is increasing from its present level.

5. Conclusion

Industries can be classified into fix price and flex price based on the formation of their prices. From the microeconomic point of view, the distinction between these two prices behavior is important in determining

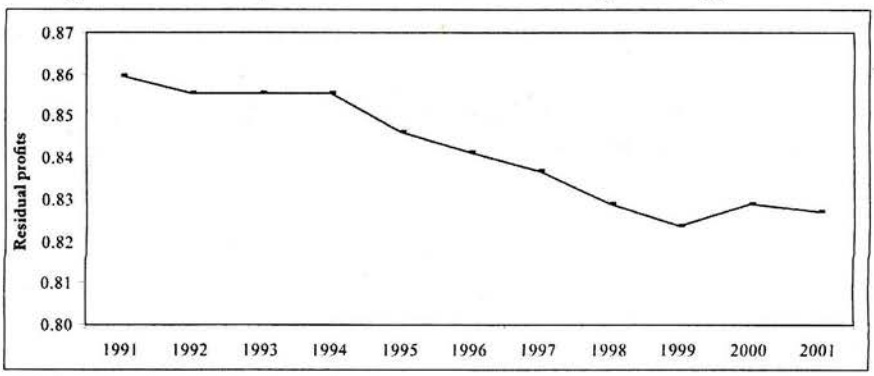
whether an economy is fix price or flex price so as to be able to prescribe the correct policy to remedy any disequilibrium that may occur in an economy. By using the cost-based input-output model, this paper attempted to classify individual industries into fix price and flex price. The results reveal that most of the flex-price manufacturing industries come from agro-based industries while most of the fix-price industries come from non-agro-based industries. These results supported Hicks's [1985] and Morishima's [1984] proposition that agriculture industries can be classified into flex-price price and non-agriculture industries into fix-price price. The paper also provides additional important information regarding to the treatment of equilibrium in the economy as a whole, since both fix-price and flex-price industries need a somewhat different theoretical foundation as far as the maintenance of flow and stock equilibrium is concerned.

Figure 2. Residual profits of vegetables and fruits industry, 1991-2001



Source: Derived from Table 1.

Figure 3. Residual profits of electrical machinery industry, 1991-2001



Source: Derived from Table 1.

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