

An investigation into change in agricultural and industrial products output-price relationships drawing from Nepalese experience

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Abstract:

Purpose: *This research article explored the relationship between change in output and domestic price of both agricultural and industrial products and the variability or consistency of the annual growth rate of change in price and output of both agricultural and industrial sectors of Nepal.*

Objectives: *The research aimed to establish the relationship between change in the price of agricultural products and change in the price of industrial products in Nepal.*

Method: *The study applied descriptive and analytical approaches to measure the relationship or correlation between changes in output and prices of products in the agricultural and industrial sectors. The parameters were analysed by comparing the standard deviation and coefficient of variation. The relation of agricultural and industrial product output with price is established by using a simple correlation analysis.*

Limitations: *Based on secondary data collected from various economic surveys of Nepal covering 17 years from fiscal year 2002/03 to 2018/19. It measured the relationship between the annual change in price and output of agricultural and industrial production using simple statistical tools like mean, standard deviation, and correlation.*

Results: *It was found that there is a moderate positive correlation between the change in price of agricultural and industrial products. Similarly, there is a low degree negative correlation between change in output and price in both the agricultural and industrial sectors.*

Implications: *There was a positive relationship between the price of agricultural products and industrial products. Therefore, it is necessary to give high priority to the development of the agricultural sector. Industrial development is impossible without the development of the agricultural sector because they are interdependent with each other. The agricultural sector and industrial sector are uplifted simultaneously. There was a low degree negative correlation between price and output of the product of both the agricultural and industrial sectors. Therefore, output increasing activities must be performed by private and public sectors.*

Key-words: agricultural product, industrial product, correlation, exogenous, variability, consistency

1. Introduction

Agriculture is an economic activity or occupation which involves the production of food grains, animal husbandry, horticulture, and floriculture. Agriculture is the backbone of the Nepalese economy as around 66 percent of the total active labour force is engaged in agriculture and 27 percent of the total GDP is obtained from this sector [1]. An agricultural product is a product that we can get from plants or animals to sustain or enhance human life. Agricultural products fall into one of four groups i.e. food, fuels (i.e. ethanol from sugarcane), fibers (i.e. wool or silk), and raw materials. Agriculture is the cultivation of land and breeding of animals to provide food, fiber, medical plants, and other products to sustain and enhance life [2].

While industry on other hand, refers to all the manifold activities of a country that offers employment. The goods and services produced from the cottage, small and organized industries are called industrial products. In the broad sense, industrial goods are made up of machinery, manufacturing plants and materials, and any other goods or components used by other industries or firms. Consumer goods are for the consumption and satisfaction of human wants such as clothing or food. The goods produced by industries are called industrial product. Machinery, manufacturing plants, materials, and other goods or parts for use or consumption by other industries or firms or consumers are the industrial goods [3].

The correlation is a statistical tool that studies the relationship between two variables and correlation analysis involves various methods and techniques used for studying and measuring the extent of the relationship between two variables [4]. Two variables are said to be correlated if the change in one variable results in a corresponding change in the other variable. The effect of analysis is to reduce the range of uncertainty of our prediction. If the values of the two variables deviate in the same direction i.e. if the increase in the values of one variable results, on an average, in a corresponding increase in the values of the other variable, or if a decrease in the values of one variable results, on an average, in a corresponding decrease in the values of the other variable, correlation said to be positive or direct. Correlation analysis is the statistical tool used to describe the degree and direction of the linear relationship between dependent variables [5].

Among the various determinants of the price of agricultural products, the price of industrial products is also the most important determinant. The agricultural products are used as raw materials in industries and industrial production also affect the price of agricultural product. That means, the price of agricultural products depends upon industrial products and the price of the industrial product depends upon agricultural products. They are interdependent with each other [6].

In an open economy, the price of the industrial product does not only depend upon the domestic price of agricultural products. Similarly, the price of agricultural products also depends upon the price of the industrial product. But the influence of the price of agricultural products is more on industrial products than on agricultural products by the price of the industrial product. The

industrial products: fertilizer, tools, equipment, machines can affect the agricultural product and its price.

The price of commodities is affected by international causes too. The relation of the price of agricultural products and industrial products cannot be established independently by ignoring the international situation of price[7]. Normally, changes in output and price are inversely related. If other things remain unchanged, price decreases with the increase in output, and price increases with the decrease in output. But in Nepal, change in output and change in price both are changing in the same direction.

2. Literature Review

In order to bring to fore the knowledge of the relationship of change in output and domestic price of both agricultural and industrial products, it is imperative to review some related literature in this field of study.

Heady [8] in his work observed the high degree positive relationship between the price of agricultural products and industrial products. His research further explored the relationship between agricultural output and industrial input. More particularly, the relation of change in the price of output in the domestic market and change in output was explored. This research explored that the price of output in the domestic market has inverse relation with the change in output, i.e. if change in output is positive, change of price in the domestic market is negative and vice-versa. This was mentioned to be the reason behind decrease in price of goods when the goods are sufficiently available and increase in price of goods during the period of shortage.

Another research work was done by Melzer [9] titled “Variability of Prices, Output and Money under Fixed and Floating Exchange Rates”. Using Japan and the United States as case study, the author could not find the fixed and permanent rate of change in price, output, and money. He examined that the price and output of American products were more variable than the price and output of Japanese products.

Borton and Cooper [10] research work also found that the industrial development depends upon the condition of agriculture of the nation and that there was an interrelationship between agriculture and non-farm industries. According to them, an increase in the productivity of farm labour, increases the volume of farm output and ultimately the volume of industrial output.

Kumar [11] examined that the production function of an industrial sector depends heavily upon the production quantity and strategies of the agricultural sector. Aditya [12] discussed the effect of change in price of industrial products in the relation of change in output that is domestically produced. He found the moderate (0.532) degree of a long-run relationship between change in the price of agro product and volume of industrial output. He further noticed that price of agricultural products and industrial products are positively related even in a short period.

Tomek and Kaiser [13] explained the Influence of output and price of agricultural products on the price and output of the industrial product. The Co-integration model was used to find the

interrelationship between the price and output of agricultural and industrial products. Not only production but the supply of agricultural products also affects the quantity and price of the industrial product.

All these studies examine the relationship between the price of agricultural products and industrial products. Similarly, many researchers tried to find out the relation of the price of the agro product and industrial product. But nominal studies are carried out about the relationship between change in the average price of agricultural product in the country and domestic annual change in the output of the same sector. Similarly, there are nominal research carried out on the association between the domestic annual change in industrial products and its price. This study tries to fill-in the gap. So, it is claimed to its significance.

3. Statement of the Problem

Nepal is considered an agricultural country. According to the Ministry of Finance of Nepal [14], the annual production and price both are increasing. The problem is raised when the domestic product cannot influence its price. We can derive such type of conclusion because output and price are changing in the same path. Nepalese domestic market are dominated by the product of foreign countries. Nepalese economy is suffering from low production and high consumption. Nepalese agricultural and industrial products share a small portion of total demand. It indicates the position of the Nepalese economy. In this study, the following research questions are determined:

- a.) Are the change in agricultural and industrial production interrelated to each other?
- b.) What is the relationship between change in the output of agricultural products and their prices?
- c.) Does the annual change in industrial product affect its price?

4. Objectives of the Study

The study attempts to seek the following objectives:

1. To establish the relationship between change in the price of agricultural products and change in the price of industrial products in Nepal.
2. To examine the relationship between the change in agricultural product and its price.
3. To explore the relationship between the change in industrial product and its price.

5. Research Methodology

5.1 Research design.

This research study used descriptive, analytical as well as the exploratory research design. The quantitative data are used to analyse and describe the objectives of the study. Similarly, the mathematical calculations and graphical presentation are used to explore the objectives of the study.

5.2 Data collection and processing.

Secondary data are used in this study, which are collected from various published sources especially from economic surveys and various periodic plans published by the ministry of finance and NPC respectively. The collected secondary data are edited as per the need of the researcher. Simple mathematical calculations, such as standard deviation, mean, coefficient of variation, and correlation are used to analyze the data.

6. Limitations of the Study

To make the study-specific, the following limitations are determined:

1. It is based on secondary data collected from the various published sources
2. It covers the data of 17 years from fiscal year 2002/03 to 2018/19
3. It only measures the relationship between the annual change in the price of agricultural and industrial products. Similarly, it also establishes the correlation of change in output and price of both: agricultural and industrial products.

7. Presentation and Analysis

7.1 Relation of change in price of agricultural output and industrial product in Nepal

Agriculture is the primary sector of the Nepalese economy. It is considered as the backbone of the economy. The general conclusion is that there is a high degree of positive relationship between the change in price of agricultural products and industrial products. It is because the agricultural product may be used as raw materials in the industrial sector and some industrial products are used as capital assets in the agricultural sector. It is found that there is a positive relationship between change in price of agricultural and industrial products. The following table 1 shows the condition of annual change in the price of agricultural and industrial production during 17 years from fiscal year 2002/03 to 2018/19.

Table 1: Relation of Change in Price between Agricultural and Industrial Product.

Fiscal Year	Agriculture (P_A)	Industry (P_I)
2002/03	0.7	4.1
2003/04	2.8	5.4
2004/05	3.5	5.5
2005/06	4.4	3.6
2006/07	6.1	5.7
2007/08	3.3	11
2008/09	21.4	14
2009/10	25.1	9.2
2010/11	15.6	8.9
2011/12	1.4	8.3
2012/13	4.6	8.2
2013/14	6.4	5.9
2014/15	4.1	6
2015/16	4.7	7.2

2016/17	6.9	11
2017/18	5.4	5.2
2018/19	1.9	4.6

Source: - Economic surveys of Nepal 2007/08[14] and 2019/20[15]

According to table 1, the annual growth rate of the price of agricultural products was highest (25.1%) in fiscal year 2009/10 and lowest (0.7) in fiscal year 200/03. Similarly, the price inflation of industrial products was highest (14%) in fiscal year 2008/09 and lowest (3.6%) in fiscal year 2005/06. The following table 2 shows some statistical measurement of annual change in the price of agricultural and industrial products.

Table2: Some statistical calculations of the change in price by sectors.

Descriptions	Mean	Standard deviation	Coefficient of variation	Correlation
Agriculture	6.95	6.98	101	
Industry	7.3	2.86	39.2	0.59

Note: - Calculations are made by using Minitab 19.

According to the table 2, the standard deviation of agricultural sector (6.98) is more than industrial sector (2.86), so the mean of the industrial sector is more representative than the mean of agricultural sector. Recall that the standard deviation indicates the representativeness of mean, the coefficient of variation of the agricultural sector is more (101) than industrial sector (39.2), so the annual change in price of agricultural sector is more variable than industrial sector. The correlation coefficient is 0.59. Therefore, the change in price of agricultural products and industrial products is positively correlated. There is a moderate correlation between the change in price of agricultural products and industrial products. Normally, people believe that there is a high degree of relationship between the prices of agricultural products and industrial products, but this calculation cannot prove it. Various other factors are responsible for the changes in price of agricultural products and industrial products. So, it indicates indirectly that, some other exogenous factors may affect their prices.

$$\text{Probable Error (PE}_r\text{)} = 0.6745 \times \frac{1-r^2}{\sqrt{N}} = 0.6745 \times \frac{1-0.59^2}{\sqrt{17}} = 0.1067 \quad (7.1)$$

Now, $r > \text{PE}_r$ i.e. $0.59 > 0.1067$, so r is significant.

7.2 Relation of change in output and change in price

7.2.1 In industrial sector.

The change in output affects the price of the product, but in the open economy, the influence of change in the output of the domestic country normally affects the price of the commodity. The general conclusion is that the change in output and change in price are inversely related, i.e. increase in output generally leads to a decrease in price, and a decrease in output generally leads

to an increase in price. The share of industrial production in the total consumption is very nominal in Nepal. The price of industrial products is indeed affected by the international price and output, not only by the product of Nepal. The following calculation can establish the relation of change in output and price of industrial sector of Nepal.

Table 3: Relation of Change in Output and Price of the Industrial Sector of Nepal.

Fiscal Year	Output (Y_I)	Price (P_I)
2002/03	3.1	4.1
2003/04	1.5	5.4
2004/05	2.9	5.5
2005/06	4.4	3.6
2006/07	4	5.7
2007/08	1.64	11
2008/09	-0.63	14
2009/10	4.05	9.2
2010/11	4.4	8.9
2011/12	2.95	8.3
2012/13	2.69	8.2
2013/14	6.92	5.9
2014/15	1.42	6
2015/16	-6.45	7.2
2016/17	12.24	11
2017/18	9.6	5.2
2018/19	7.7	4.6

Source: - Economic Surveys of Nepal 2007/08 and 2019/20

According to table 3, the annual change in industrial product (Y_I) ranges from -6.45 to 12.24 percent. The annual change in price of industrial product (P_I) was the lowest (3.6) in fiscal year 2005/06 and the highest (14%) in 2008/09. The following table 4 shows some statistical measurement of annual change in price and output of industrial sectors.

Table 4: Statistical calculations of change in output and price of industrial sector

Description	Mean	Standard deviation	Coefficient of variation	Correlation
Output (Y)	3.67	4.14	112.67	
Price(P)	6.96	3.33	47.80	-0.138

Note: - Calculations are made by using Minitab 19

According to table 4, the standard deviation of annual change in price (3.33) is less than the annual change in product of the industrial sector (4.14). So, the average growth rate of price is more representative than the average of the industrial product. Similarly, the coefficient of variation of change in price is less than the change in output. So, the annual growth rate of price of industrial sector is more consistent than the change in output. The correlation coefficient

between change in price and output of the industrial product is -0.138. It indicates that there is a low degree negative correlation between change in output of industrial product and its price. Normally, price decreases with an increase in output and price increases with the decrease in output. This calculation proves the negative relationship between change in output and price but shows the nominal relation. The price of industrial products is affected by the availability of the foreign industrial product. In Nepal, a large portion of demand for the industrial product is covered by foreign products, especially from India and China. It means the total industrial products of Nepal occupy a small portion of the total domestic demand for industrial products. It may be the reason for the low degree negative correlation between production and price of the industrial sectors.

7.2.2 In agricultural sector.

Among various factors, the produced quantity of agricultural products is also a determinant of its price. More production means more supply, which automatically decreases the price, i.e. price decreases with the increase in supply and vice versa. Normally, produced quantity and its price are inversely related. The price of agricultural products is also affected by the price of neighbouring countries, generally from the south of Nepal. It is clear that the relation of the output of agricultural products and its price cannot be measured independently with the domestic product of Nepal. The following calculations can explore the relationship between change in production of agricultural sector and its own price in Nepal:

Table 5: Relation between Change in Production of Agricultural Sector and its Price in Nepal

Fiscal Year	Price (P_A)	Output (A_Y)
2002/03	0.7	3.3
2003/04	2.8	4.7
2004/05	3.5	3.5
2005/06	4.4	1.9
2006/07	6.1	1
2007/08	3.3	5.82
2008/09	21.4	2.99
2009/10	25.1	2.01
2010/11	15.6	4.48
2011/12	1.4	4.63
2012/13	4.6	1.1
2013/14	6.4	4.64
2014/15	4.1	1.12
2015/16	4.7	-0.01
2016/17	6.9	5.3
2017/18	5.4	2.8
2018/19	1.9	5.1

Source: - Economic survey of Nepal 2007/08 and 2018/19

Table 5 shows the condition of annual change in output and price of agricultural sector from fiscal year 2002/03 to 2018/19. The annual change in price ranges from 0.7 to 25.1 percent and change in output ranges from -0.01 to 5.82% during the analysis period of 17 years. The following table 6 shows some statistical calculations about the change in price and output of Agricultural sector.

Table 6: Statistical calculation of the change in output and price of Agricultural sector

Description	Mean	Standard deviation	Coefficient of variation	Correlation
Price	6.64	7.18	108.04	
Output	3.20	1.77	55.36	-0.133

Note: - Calculations are made by using Minitab 19

According to the table 6, the standard deviation of output of the agricultural product is less than the change in the output of the same sector. So, the average annual change in output is more representative than the average price of the same sector. The growth rate agricultural output is more consistent than the growth rate of price because the coefficient of variation of output is less than the price. The correlation coefficient between change in output and price of the agricultural sector is -0.133. So, this calculation indicates that there is a low degree negative correlation of change in output of agricultural product and its price. It means the price of agricultural products is nominally dependent upon the domestic agricultural product. It indirectly indicates that the price of agricultural products is also affected by the output and price of neighbouring countries, especially from the southern and northern borders. To some extent, the price of agricultural products is also exogenously determined. The following figure 1 shows the trend of annual change in agricultural product and its market price:

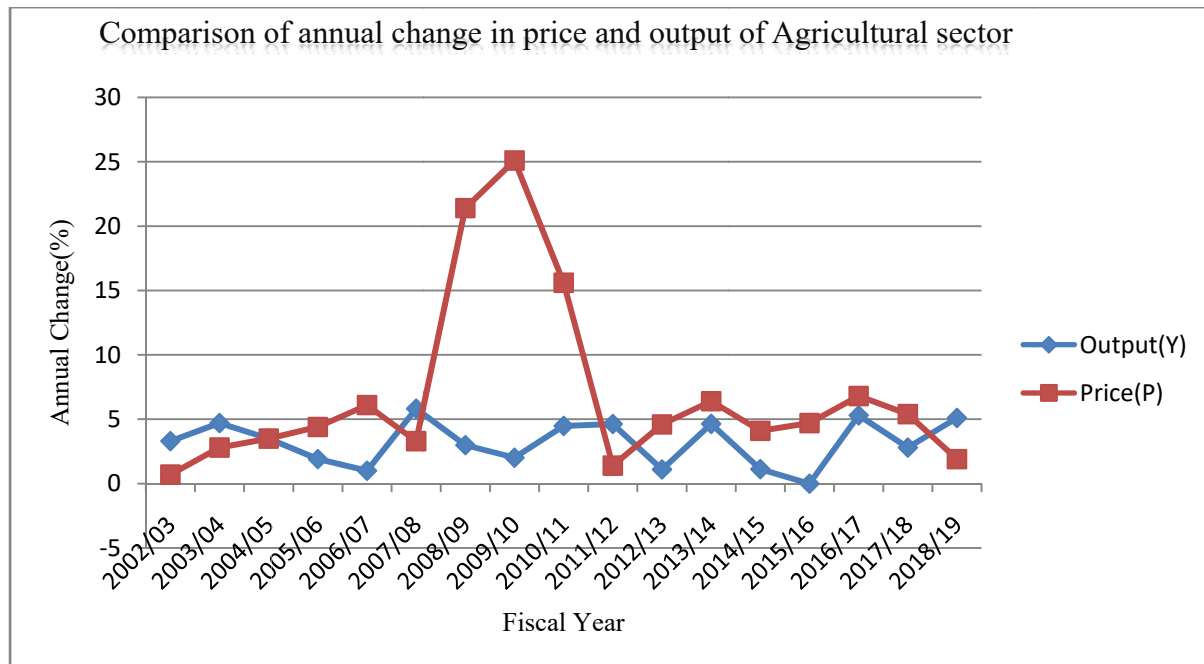


Figure 1: Comparison of changing trend of price and output of agricultural sector.

8. Conclusion and policy implications

There is a moderate correlation between the price of agricultural products and the number of industrial products. It means the price of agricultural products affects the number of industrial products because agricultural products are the raw materials for industries in some cases. In the context of change in price of agriculture and industry, the price of the industrial sector is found more consistent than the price of agricultural products. There is a low degree negative correlation between the annual change in output and price of industrial sector and the price of it is consistently increasing in comparison to the growth rate of industrial output. Similarly, a low degree negative association is observed between change in output and price of agricultural product. The average output of agricultural sector is found more representative and the annual change in output is more consistent than the price of agricultural sector because the coefficient of variation of output is less than the price. Nepalese products only cannot control the price of agricultural and industrial products. Nepalese product covers the small share of the total domestic demand of Nepal. It indirectly indicates that the price of agricultural and industrial products is affected by various exogenous factors rather than its product.

The result of the present study indicates some important points to formulate policies in the respective fields. There is a positive relationship between the price of agricultural products and industrial products. It means the price of agricultural products affects the number of industrial products. Therefore, it is necessary to give high priority to the development of the agricultural sector. Industrial development is impossible without the development of the agricultural sector because they are interdependent with each other. The agricultural sector and industrial sector are

uplifted simultaneously. There is a low degree negative correlation between price and output of the product of both the agricultural and industrial sectors. It means there is a low influence of domestic output in its price. Therefore, output increasing activities must be performed by private and public sectors.

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