

Export Potential of Iran's Agricultural Sub Sectors (An Experience of Modern Statistical Methods)

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ABSTRACT

The present paper aimed to estimate the exports potential value of agricultural subsectors in Iran and compare them with the actual value. The research period was since 2010 until 2016 on a monthly basis. Hodrick-Prescott, Baxter King and Christiano Fitzgerald filters were used in this study to estimate the potential export value in the agricultural subsectors including crops, horticulture, Fisheries, food products, livestock, forest and rangelands. The potential values calculated by the Baxter King filter were greatly consistent with the actual amount that is not compatible with the economic theory. The potential value estimated by Christiano Fitzgerald filter, which depends on the duration of the period under study, was lower than actual value at the beginning and the end of the period and higher than the actual value in the middle of the period under review; however, the most logical filter, to explain the potential amount and display its differences with the actual value, was Hodrick Prescott filter that displayed potential value with little fluctuations and generally, represented lower amount of actual export than the potential amount. Finally, it was recommended to pay more attention to equip the infrastructure and funding for potential capacity of different subsectors.

KEYWORDS

Export potential, Hodrick Prescott's filter, Baxter King's filter, Christiano Fitzgerald's filter, Agriculture.

INTRODUCTION

Agricultural sector is of great importance in Iran's economy for the reasons such as community food security, income generation, production of raw materials required by other sectors of the economy, massive and rapid job creation, creating balance in the labor and capital market, comparative and natural advantages in the production of certain agricultural products, lack of need to

technology and highly complex expertise, requiring little foreign investment, short payback time and many other issues (Akbari & Sharif, 2006). In 2014, this sector was account for the 3.9 percent of GDP, 14% of exports, 20 percent of total employment in the country and more than 80 percent of the country's food (Central Bank of Iran, 2014). Also, identifying key subsectors of the agricultural sector is very important for appropriate policy making decisions including the allocation of resources and identifying priorities for investment.

Now, one of the important strategies in economic development is the development of non-oil exports, which should have a leap growth in the economic development programs. This means that by using vacant capacity, as well as new investment, exports can be increased to several times than the current rate (Soltani, 2009). According to the country's facilities, the export development strategy should also be specified so that, based on it, practical solutions be provided to exporters and the authorities involved in the business planning.

According to the provided statistics, agricultural exports in 2015, with a reduction in weight of 12.3% compared to 2014 has reached 4756.93 thousand tons and in terms of value, by 13.83% reduction has reached about 5447.01 million dollars; among the reasons for such stagnation of production, the following items can be noted: high cost of domestic raw material compared with the raw material produced abroad, impose import duties on raw material, the temporary restrictions for importing some goods and taking some wrong policies in this area (Islamic Republic of Iran Customs administration, 2015).

Also if we want to separate the share of subsectors of the total value of agricultural exports in 2015, horticultural subsector has the highest share with 45.95 percent, followed by crops (25.95%), livestock and poultry (22.8 %), Fisheries (4.31), forest and rangeland (0.95) and Veterinary (0.02%) (Islamic Republic of the Iran Customs administration, 2015).

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It can be said that one of the basic requirements for successful export activities in each country is to recognize the country's export potential and choosing the products appropriately, according to the desired target market. Fortunately, Iran has a diverse range of export potential and this makes it possible to create the opportunity of success in export for the Iranian merchants by the accurate knowledge and suitable selection.

Despite the many studies that have been conducted in the field of export and its potential in the agricultural sector, no study is conducted up to now on potential export estimation using statistical filters in the agricultural subsectors. Among the studies to estimate the potential value the following cases can be mentioned:

Taiebnia and Ghasemi (2010), in a study entitled "Measuring the business cycles in Iran", after the introduction of Band-pass and Hodrick Prescott (HP) statistical filters, calculated the Iran's trade periods and showed that Iran has passed seven business cycles.

Rezai et al. (2010), in a study entitled "examine Iran's agricultural export potential of the OIC Member States (OIC)", have calculated Iran's export potential using the cosine index.

Hozhabr Kiani and Moradi (2012), in a study entitled "Estimation of Potential Production and Production Gap in Iran's Economy (Based on Data-Filtering Methodology and Economic Policy Effect Analyzing)", have shown that different methods of estimating potential amount, leads to the formation of different results. Among the methods presented in this paper, two methods of HP and Rotemberg Filter as the non-parametric approaches and state space model and Kalman Filter as parametric approach have been preferred over the other methods.

Larsson and Vasi (2012) in an article entitled "Comparison of detrending methods", studied the differences between cyclical components extracted from some macroeconomic time series using four commonly used methods of de-trending (HP, BK, CF and FOD). Finally, it was concluded that HP, BK and CF methods create the similar cycles using quarterly data; however, in annual data, HP methods is differentiated from CF and BK methods. First Order Difference (FOD) method extract cycles which are not similar to any of the three filters under study.

Annand et al (2014) in a study entitled "Potential Growth in Emerging Asia" estimated the potential growth using statistical filters and multiple filters in China, India and South East of Asia. The most important findings are: both China and India have recently been plagued with slow potential growth. In contrast, the growth trend for the five member countries of ASEAN has been relatively stable and has experienced a slow increase.

Zaki et al (2015) in their study entitled "Trade Determinants and Potential of Syria", have investigated the factors affecting export potential in Syria between 1995-2010 using gravity model and they have also assessed the effect of war on the country's export potential. The results show that the sanctions lead to the collapse of more than 70% of its economy in short-term.

Fedderke and Mengisteab (2016) in their study entitled "Estimating South Africa's output gap and potential growth

rate", estimated potential growth rate and output gap in Africa using several single-variable filter and adopting the production function approach and found that the growth rate is in the range of 1.9 to 2.3%.

METHODOLOGY

Several different methods exist to estimate the potential economic variables. However, it should be borne in mind that the calculation of the potential values is extremely difficult and complex.

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Empirical studies indicate that if the estimates of the potential values of different methods and techniques are used, various estimates will be obtained. This is because the potential values have not been observed and they should be derived from the economic variables. Therefore, relying only on the results of a single method may be misleading in the economic analysis; particularly, according to the analysis that have recently been proposed, some of the traditional methods is not viable anymore (Azizi, 2003). The study seeks to solve the aforementioned flaws by considering this issue and ultimately, provides optimal Statistics of potential value added in the agriculture sector to researchers in order to conduct future research.

1. Approaches to estimate potential variables:

One of the most important issues in business cycle analysis is to separate the economic trend and season in time series. Although this analysis can be considered a statistical issue, but most economists believe in transformation of economic growth during a certain direction in the short-run fluctuations, so that the way can be considered as trend. However, the economy is affected by two types of shock that some of these shocks have permanent effects and others have temporary effects. Basically, trend is a part of the production, which is caused by permanent shocks, and structurally, such a series should be non-viable. In contrast, the part of production that is caused by temporary shocks is related to economic season and should be structurally a stationary component. Different approaches are used for separating long-term trends of data. However in general, there are two basic methodologies (i.e. the statistical detrending methods) and (estimating structural relationships) for this purpose (Hozhabr Kiani and Moradi, 2012).

- The first approach is a pure statistical method that tries to divide the intended time series to permanent and swinging elements. Among these methods, we can refer HP, Baxter King (BK), Christiano- Fitzgerald (CF), Kalman filter, Rotemberg filter and Beveridge – Nelson (Univariate and multivariate) Decomposition.
- The second approach is based on economic theory and attempts to assess the effects of fluctuations in the production of structural effects and fluctuations on production. The methods available in the second group include the production function methods, trend line between adjusted peaks, Output/ Capital Ratio

Method, Okun method, the actual trend method and the method of inverse demand of production factors.

The methods for prediction of potential variables and the gap between potential and actual values according to the approaches used in this study will be briefly presented in the following:

1.1 Hodrick-Prescott filter:

HP Filter is firstly presented in 1980 to analyze the business cycle; however, this filter was released in 1997 after 17 years of delays. This method is a single equation method and is more popular than other filtering methods such as BK, filtering. HP filter is a simple statistical smoothing technique and is one of the most common methods used to estimate production yields.

Suppose that a visible time series (y_t) implies on real output. HP Filter breaks down (y_t) to a time trend (τ_t) and a time series of Stationary circular elements, both of which are unobservable. So that:

$$y_t = \tau_t + c_t \tag{1}$$

Since c_t is a stationary process, it can be considered that y_t is obtained from a sum of τ_t with a time series like c_t .

Therefore, the main problem is extracting τ_t from y_t . The problem statement in designing HP filter is:

$$\text{Min} \quad \sum_{t-1}^T (y_t - \tau_t)^2 + \lambda \sum_{t-2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \tag{2}$$

The strength of the filter is its flexibility and its weakness is sensitivity to the coefficient λ .

In this study, y_t is the true value of the given variable (real export value per year (t) and τ_t is the potential export value, T is the number of observations and λ a reinforcing agent (balancing factor) that determines the trend smoothing value. Generally, the series will be smoother with an increase in this parameter, and they will be more fluctuated by reducing it.

The usual process is that λ will be considered equal to 6.25 and 1600 for yearly and quarterly data (Ravn and Uhlig, 2002).

1.2 Band-Pass filters:

A. Baxter King Filter (BK):

Baxter and King (1999) have introduced moving average process in equations (3) and (4) for the extraction of compounds with specific periods from the examined series of $\{y_t\}_t^T = 0$. In this regard, L is the lag operator.

K parameter determines the length of lag and series precedence. Naturally, the higher the priority and lag exist for the moving average process, more accurate estimates can be obtained. Instead, a greater number of observations from the beginning and end of the series will be deleted. Usually 3 or 6 deal is selected for this parameter. g_u weights are also called theoretical filtering weights which are the function of the two parameters of a and b that specify the period scope

of extracted compounds; for the quarterly data usually six seasons are selected as the lower bound and 32 seasons are selected as the upper bound. Two filters of BK and CF seek to estimate these weights in limited amount of data (Mojab and Barakchian, 2013).

$$G_K(w) = \sum_{u=-k}^k g_K L^u \tag{3}$$

$$g_K = g_{-u} = g_u + \frac{1 - \sum_{j=-k}^k g_j}{2k + 1}, u = 0, \dots, k \tag{4}$$

$$g_u = \frac{\sin bu - \sin au}{\pi u} \quad u = \pm 1, \pm 2, \dots, g_0 = \frac{b - a}{\pi} \tag{5}$$

B. Christiano Fitzgerald filter (CF):

CF filter is the generalized form of BK filter. The moving average process of the filter is defined as the relationship (6):

$$G_{p,f}(w) = \sum_{u=-f}^k g_u^{p,f} L^u \tag{6}$$

The value p and f are generally a function of time. Three different modes can be considered:

- Cons = f = p, means that these two values are equal and not as a function of time.
- f = p, which means that the length of process lags and precedence are equal, but change over time.
- 'No restrictions', which means that, for example, for the second observation, a lag and the number of T-2 precedence (where T is the total number of observations) exists. For each of these cases, different weights to the moving average can be obtained. In general, these weights are not so different from the weights of equation (4).

The filters are used for extracting a specific frequency range of a time series. These filters are consistent with Burns and Mitchell definitions of business cycle at the National Bureau of Economic Research (NBER) and can be used to separate the production series to two components of trend and cycle. Burns and Mitchell know the business cycle as the production series with a period of six to thirty-two seasons (Baxter and King, 1999).

In this study, the BK, HP and CF filtering techniques have been used to estimate the potential value of Iran's agricultural subsectors exports (in dollars) with possession of monthly data of export value during the period 2009-2015 from the Islamic Republic's Customs databases. Before estimating the potential value, Dickey-Fuller and Phillips-Perron stationarity test results are reported to examine the rational behavior of variables expressed in the period.

RESULTS AND DISCUSSION

1. Examining variables stationarity:

The results of Dickey Fuller and Phillips-Perron stationarity tests for variables have been provided in Tab 1.

Tab.1. Stationarity test results for the variables of export value

Test	variables statistics	Livestock and Poultry	Fisheries	Crops	Horticulture	Forest and rangeland	Food products
Generalized Dickey Fuller	on level	-2.70	***_ 5.07	***_ - 5.51	***_ 7.02	***_ 8.14	***_ 9.32
	on difference	***_ 11.96
	Stationarity state	I(1)	I(0)	I(0)	I(0)	I(0)	I(0)
Test	Variables statistics	Livestock and Poultry	Fisheries	Crops	Horticulture	Forest and rangeland	Food products
Phillips-Perron	on level	***_ 6.88	***_ 6.07	***_ - 5.27	***_ 6.99	***_ 8.16	***_ 9.36
	Stationarity state	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)

Source: research findings (***) significant at 1%

2. The results of the statistical filtering:

In Figures 1 to 6, the real dollar value of agriculture subsectors in the period of 2009 to 2015 has been compared with the potential value estimated by the filters mentioned in the study in a monthly manner.

It can be seen in all the charts that the potential value calculated by BK filter is largely matched the actual value of exports which is not consistent with the economic logic. Also, due to the nature of estimation and filtering procedure in the filter, initial and final amounts have been removed and as in any prediction, any data contains important information, that ignoring it, information is lost, hence, the BK approach that loses some observations in prediction is not superior. CF filter predicts the potential value much lower than the actual value in most of subsectors during the period under review, since 2009 to 2010 and after this period and until the end of 2013 estimates potential value more than actual value; of course, the filter once again estimates the potential value lower than the actual value in the final months of the period under review; it is obvious that the estimation of the potential value by CF filter depends on the length of the period under review. Trend fluctuations are high in two filters of BK and CF; however, the most logical filter to clarify the potential value and display its difference with the actual value, is HP filter that show the potential value with little fluctuations and it is always in the middle of the actual value diagram. In most cases in the months under study, the potential value is more than actual value; although in some short periods, subsectors exports indicates high growth and its actual value is higher than the potential value. So in this study, HP filter is recommended as the most logical filter.

2.1 The Livestock and poultry sub-sector:

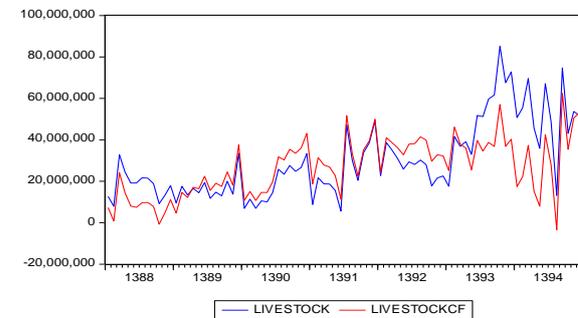
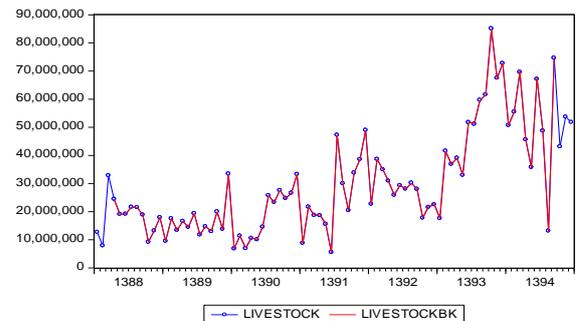
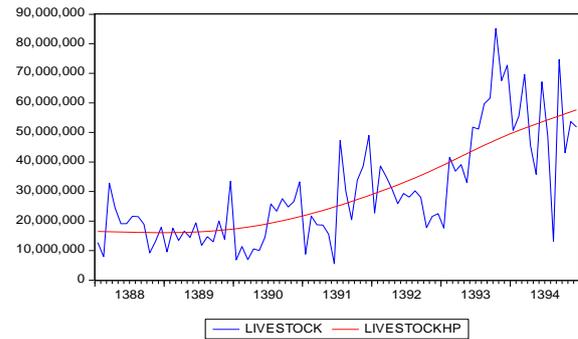
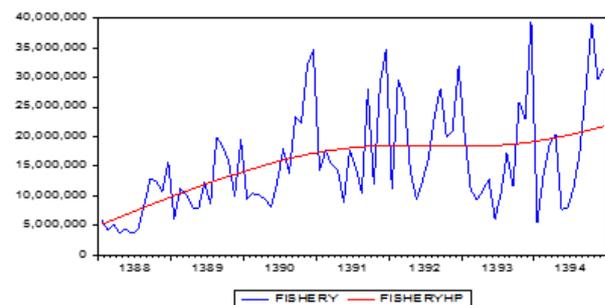


Fig.1. Comparison of actual and potential export value in Livestock and poultry sub-sector for the three filters

Most positive mutation in this subsection is in 2014 that the actual value is higher than the potential value. Trend series in the HP filter is much smoother than two other filters. In BK filter, the potential and actual value move very close to each other and have been matched in the chart; in CF filter, the actual amount is higher than the potential amount in the first and last months of the period.

2.2 The Fisheries subsector:



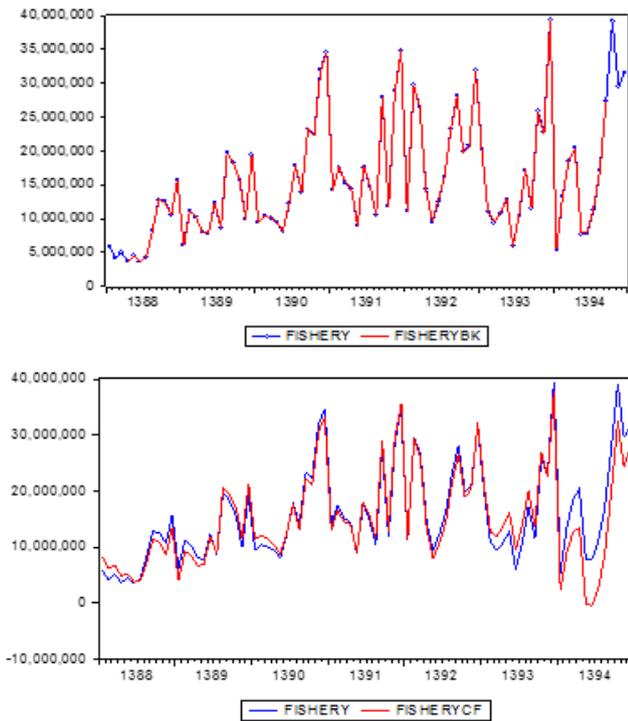


Fig.2.Comparison of actual and potential export value in fisheries products subsector for the three filters

The actual value of fisheries exports is far apart the potential amount in 2015 and it is more than its potential, which seems to be due to increased government support policies of fisheries subsector and its exports amount.

2.3 The Crops subsector:

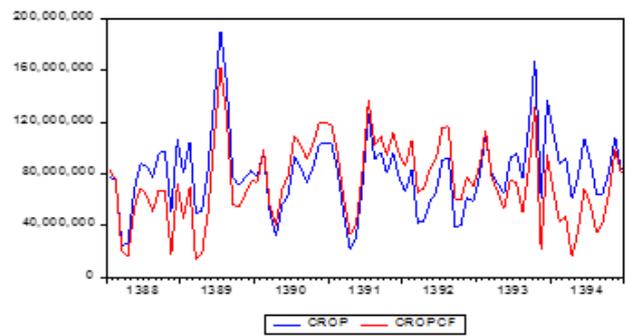
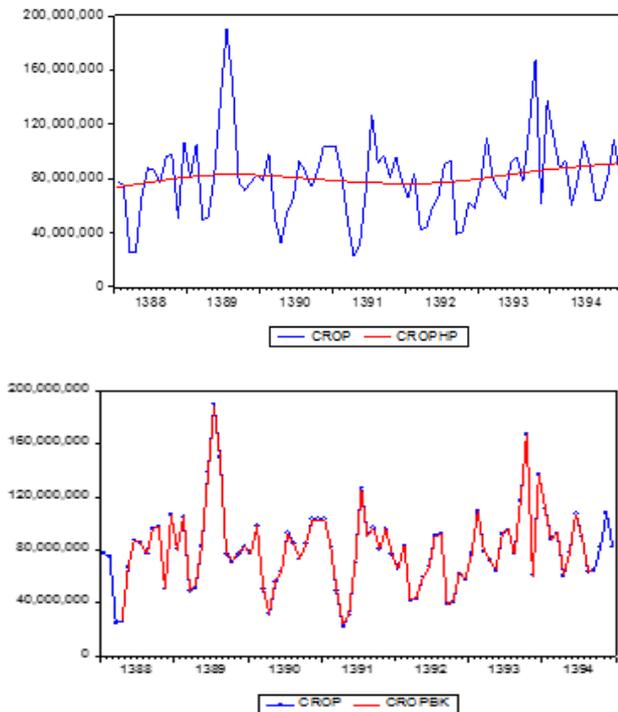


Fig.3.Comparison of actual and potential export value in crops products subsector for the three filters

At the end of the period, the actual value of crops export has distanced from potential values in 2015 and is lower than its potential amount; it seems that the government needs to pay more attention to the exports of this important sector of the agricultural section of the country.

2.4 The horticultural subsector:

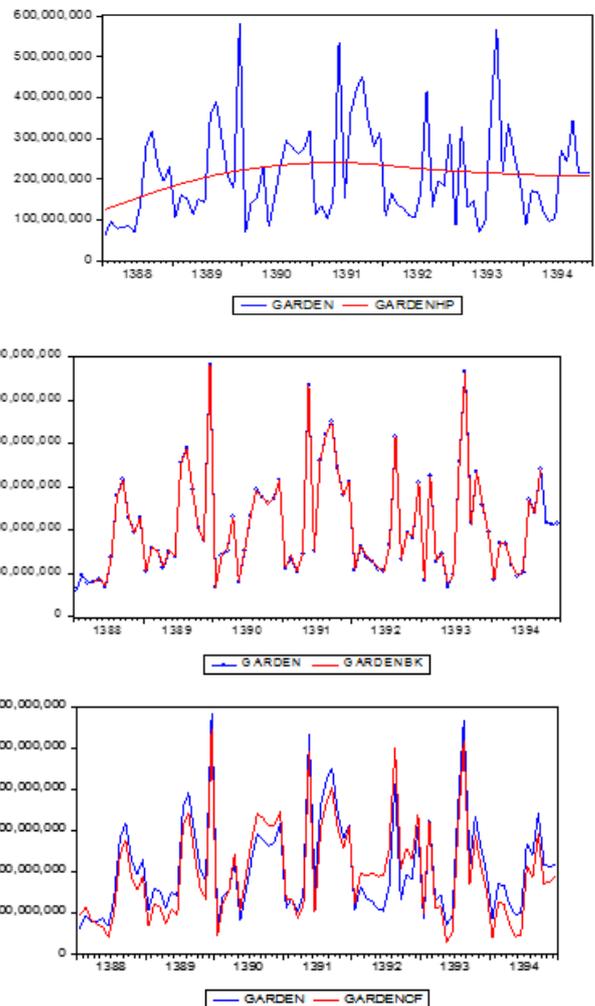


Fig.4.Comparison of actual and potential export value in horticultural products subsector for the three filters

About horticultural products, the actual amount is much greater than the potential value calculated by HP in some months under study that is because the weather conditions and good rainfall in some months of the investigation, which has taken somewhat sinusoidal mode.

2.5 The forest and rangeland subsector:

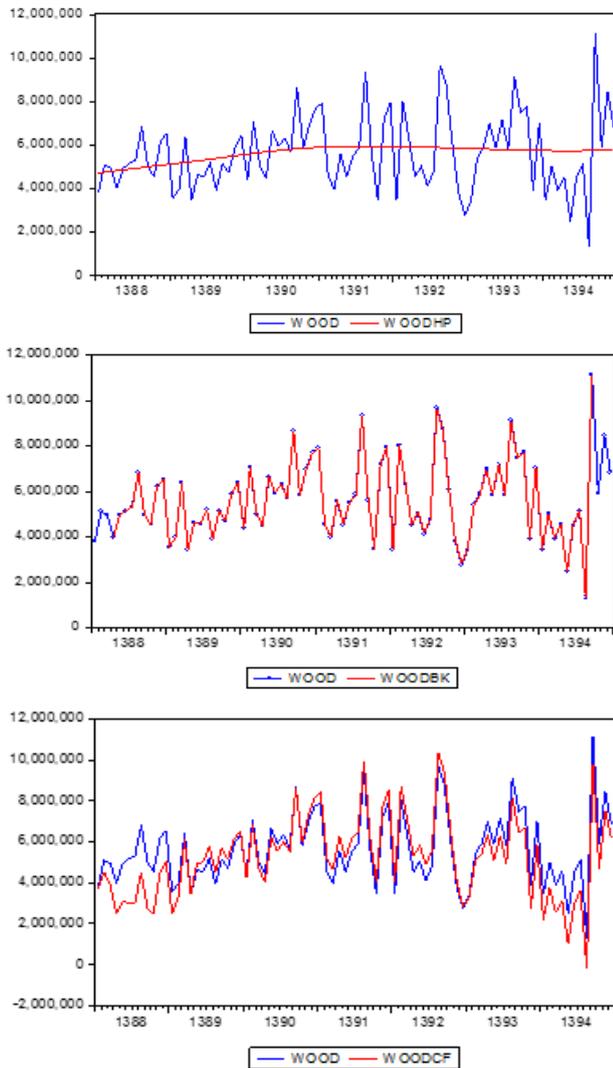


Fig. 5. Comparison of actual and potential export value in Forest and rangelands subsector for the three filters

The potential amount calculated by HP filter is greater than the actual amount in most cases in the reviewed months. Although, the value of the exports of forest and rangelands products has a significant growth in short periods and more licenses have been issued for the harvest of rangelands and forests in those months. In general, according to the climates of Iran, increase the exports of forest and rangelands products causes harm to the environment and natural ecosystems. So, in the long run, some export policies should be implemented to reduce exports and increase the stability of forests and rangelands in the country.

2.6 The food products subsector:

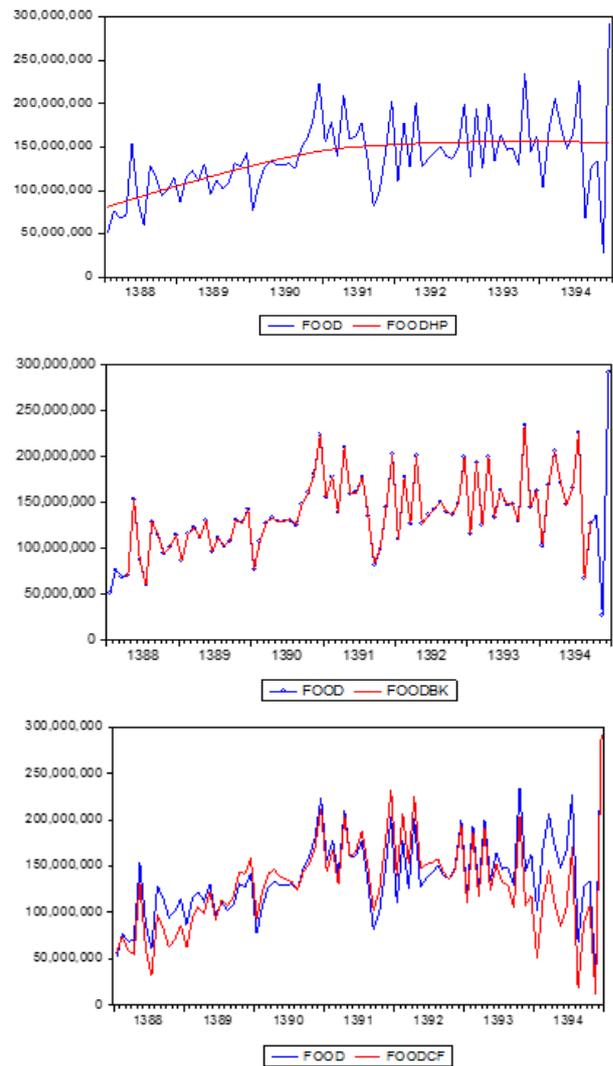


Fig.6.comparing the actual and potential amount of export value in the food sub-sector in three filters

High volatility in actual amount in the value of food exports is mostly due to the frequent changes in policies and lack of coordination between industrial sectors and agriculture policies in the country. In the final months of the period under review, exports value-added of food products has sharply risen due to the increased investment in this sector that if government support, it is hoped to progress due to the enormous interests in the production and export of food products in the country.

CONCLUSION

About the export value of various products under agricultural subsectors, it can be stated that the potential value which computed by the BK filter largely coincides with the actual value. The CF filter in most cases calculates the potential value below the actual value and in extreme cases the potential value is equal to the actual value.

Therefore, it can be stated that the CF filter calculates the potential value of most exports value of subsectors with an obscure view. The potential value which achieved by the CF for the value of exporting agricultural products, is always less than actual value which is not compatible with economic logic. But in this case, HP filter is also very reasonable and the long-term trend shows the potential value well. The potential value obtained by the HP filter is in most cases more than actual value, however in some months, the real value of the export value is greater than the potential value calculated by the HP filter. But in general, the increasing trend of the potential value that calculated by the HP filter is visible over time. Generally, agricultural policy changes with changes in government, climate change and the dry and semi-arid region of the world, have caused a lot of fluctuations in the export value of agricultural products in Iran and has made difficult the process of trend forecasting. Finally, the following results are presented:

- As expected, different techniques and methods provide different estimates of potential export value. This indicates that the estimation of the potential value of export has a relatively high level of sensitivity to the used method. Hence, it is suggested that to conduct applied research on economic policy setting, resting on the results of a single method should be used with caution.
- Given that the actual value of agricultural exports is heavily fluctuating in most months, the potential value is more than the actual one; we recommend that with long-term planning and by taking the most logical filters, such as HP in this study, the actual amount should be close to potential amount of HP filter and avoid it with the right policies.
- Setting appropriate incentives for each economic sector to restore the subsectors exports to the long-term trend in the agricultural sector.
- It is recommended that the government, with membership and more level of activity in international trade organizations such as WTO, and the acceptance of international obligations on manufacturing and export of agriculture, attempt to increase the inflow exchange and as a result, increase employment opportunities in the agricultural sector; since with membership in international trade organizations, it is hoped to increase the exports in subsectors where the country has comparative advantage.

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