Is MIDAS a Proper Predictor Model? What Iran's Agriculture Data Say?

Zeynab Omidvar[1] Reza Moghaddasi [1*] Amir Mohammadinejad[1]

Abstract

One of the most important sectors of the economy that is important to know how it will work in the future is the agricultural sector. Today, it is important to anticipate macro-indicators for the agricultural sector for planners and policymakers. For this purpose, the main purpose of this study is to estimate the macro indicators of the agricultural sector by the regression model with mixed data (Midas), which is very different due to the nature of agricultural data and the different pattern of agricultural data reporting and different frequency for them. It is useful and important. The period under study in this study is from 1392 to the end of 1397. The data set for agricultural value added, agricultural exports and agricultural imports in this research is monthly and the variables of inflation and exchange rate have annual data and seasonal temperature and precipitation will be considered. Finally, after fitting the Midas regression models, it is concluded that the exchange rate and inflation variables have a significant effect on all equations, and the temperature has a significant effect on value added and exports, and the amount of precipitation in any of the estimates. The study does not have a significant effect.

Keywords: MIDAS regression; Forecasting; Agriculture; Iran

1. Introduction

There is hardly any economy of the world that has not been challenged by inflation in one time or the other. This made inflation a global issue both for developed and developing economies like Nigeria. At global level as reported by Commodity Research Bureau (2009), the overall and food inflation rates stand at 16.5 and 30.2 percent respectively by November, 2007. Its effect particularly on agricultural products cannot be over emphasized as economists argued that it is the less productivity in agriculture sector and "so called" shortage of goods and services used in the production of agriculture sector that are considered responsible for inflation. This is made worst by the rise in prices in economy resulting from supply shocks of specific food items and to oil market in the world (Chaudhry, Ayyoub and Imran, 2013)

Input price inflation creates cash flow problems for farmers and increases the necessity of a high level of operational management and conservative financial strategies. Individual farmers can possibly counteract the effect of input price inflation through increases in productivity and economizing on costs. Present competitive structures may however possibly result in accelerated input price inflation if increases in productivity and economizing on costs occur for agriculture in aggregate. The exchange rate between two currencies specifies how much one currency is worth in terms of the other. The Canadian exchange rate impacts the competitiveness of the agriculture sector by affecting prices of agriculture products and inputs and, therefore, farms' profits.

[1] Department of Agricultural Economics, Extension and Education, Science and Research Branch, Islamic Azad University, Tehran, Iran.
*Corresponding author: r.moghaddasi@srbiau.ac.ir

The agricultural sector for reasons such as providing food for society, generating income, producing raw materials needed by other economic sectors, creating fast and widespread employment, creating a balance in the labor market and capital, the country's comparative and natural advantages in producing some agricultural products. The lack of need for very complex technology and expertise, the need for small foreign exchange capital, the short time of return on investment and many other issues are of great importance in the Iranian economy (Sepehrdoost et al., 2015).

Mixed data sampling (MIDAS) regressions are now commonly used to deal with time series data sampled at different frequencies. This chapter focuses on single-equation MIDAS regression models involving stationary processes with the dependent variable observed at a lower frequency than the explanatory ones. We discuss in detail nonlinear and semiparametric MIDAS regression models, topics not covered in prior work. Moreover, fitting the theme of the handbook, we also elaborate on the R package midasr associated with the regression models using simulated and empirical examples. In the theory part, a stylized model is introduced in order to discuss specific issues relevant to the construction of MIDAS models, such as the use or nonuse of functional constraints on parameters, the types of constraints and their choice, and the selection of the lag order.

For proper long-term planning in the economy, forecasting macroeconomic variables is of particular importance, and one of the most important sectors of the economy, which is important to know how it will function in the future, is the agricultural sector. Undoubtedly, an economy that is productive will be resilient. Iran's agricultural sector is of special importance due to its role and impact on production and employment, as well as its interrelationships with other economic sectors. For this reason, it is very important to know how this sector works in the Iranian economy.

This importance and position has led planners and policymakers to try to use more accurate and less risky methods and with proper modeling, in addition to identifying the factors affecting the growth of this sector, correctly predict the macro indicators of this sector and policies and programs. Plan what you need to do to improve your position.

Today, the quantity of variables and economic elements is an economic criterion that forms the basis of economic theories. In general, national income is the basis for the quantity of variables and economic elements, and the economic value and volume of any society is usually assessed by the national value of that society; because the outcome of economic activity in any society depends on the national development of that society. Calculating and measuring national income is one of the most important economic issues that economists have done a lot of research on. One of the common methods of calculating national income, which prevents the revaluation of the value of intermediate goods in the value of national income, is to calculate the national income through the value-added method. The value-added economic index is of particular importance among macroeconomic indicators because it is not only used as the most important indicator of economic performance in analysis and evaluation, but also one of the 31 most important indicators that It shows the economic power of countries.

Foreign trade is also one of the important components in economic development and a source of foreign exchange earnings for investment in new technology and increasing the productive capacity of the country's economy. In recent years, the existence of price fluctuations in the oil market has caused many changes in the country's foreign exchange earnings and has affected the country's economy, and this clearly shows the need to diversify export products and emphasize the importance of non-oil products. In the meantime, it is important to pay attention to the trade of the agricultural sector, considering the goals such as self-sufficiency and food security, and the possibility of high appreciation of this economic sector. Because it is necessary to form a capable agricultural sector, to adopt appropriate policies and these

policies cannot be adopted without identifying and identifying effective and important factors. (Ghysels et al 2019)

Studies show that the variables of exchange rate, inflation rate, interest rate as the most important economic factors and temperature and precipitation as climatic factors affecting value added, exports and imports in this sector. Therefore, considering the importance of the agricultural sector in the country's economy and the existence of different and uncontrollable influential factors, we try to use methods in forecasting through which estimation is close to reality and the error is very small to macroeconomic indicators. In the agricultural sector, including value added and trade, this sector should be properly predicted and the necessary policies and programs should be designed to improve the position of this sector.

There are many application series models that review regression at similar frequencies. For example, all the data in them is annual, monthly, etc. However, there are other time series in which this frequency equation is not observed. For example, while many macroeconomic variables, such as GDP, are reported annually, there are variables such as the price index, which may be seasonal, monthly, or even daily. A common method of simple averaging that aggregates High-frequency data leads to the loss of potentially useful information that could be used to better identify relationships between target variables. In other words, the standard approach to using this information to predict is to evaluate the average high-frequency agricultural data in order to adapt regression to seasonal data. However, this method may not be optimal, for example, if newer data has more information. In this case, the latest data should weigh more than the previous data. A simple linear regression using any daily value of the predictor variable as a fitter requires estimating a large number of parameters, thus leading to high uncertainty.

Inconsistencies in data frequencies prompted researchers to think of ways to increase the accuracy of macroeconomic variables. Overcoming this problem is a significant issue in recent years. The MIDAS regression model is one of the methods first proposed by (Ghysels et al., 2004). Making a pattern based on this has two major advantages. First, placing more variable variables next to low-frequency variables in a regression makes it possible to accurately predict the dependent variable for the near future. The second obvious sense of these patterns is that when new information about radiation variables is obtained, it can be reconsidered in a previous prediction for the dependent variable of the pattern frequency. Therefore, it can be seen that with the help of such models, macroeconomic variables can be predicted and the future state of the economy can be monitored.

The MIDAS model has the ability to combine recent information to improve predictions. To understand this, suppose that the added value of agriculture in the last quarter should be predicted. If this month is April, January, or November, we will have about 21 working days (1 month) of daily data to predict the growth of quarterly agricultural value added. Using up-to-date information to predict the next value of a variable is called short-term forecasting (Gomez et al, 2017).

John P.Laborde, et al. (2020) in a study entitled Identifying the pioneers and predicting the results of agricultural conservation worldwide (in order to maintain sustainable economic growth) stated that due to the importance of the impact of agricultural sub-indicators in production and The economy of different countries, in order to maintain and continue to increase the economic growth of countries, it is necessary for the agricultural sector to move forward through soil and water protection and programs to prevent global warming in order to stabilize and increase efficiency.

Moses et al. (2019) in a study on the ability to predict inflation by agricultural indicators stated that we use the main components approach to create a composite index for all agricultural goods and the performance of the forecasting model significantly Individual farms are significantly improved, especially

when it comes to food inflation. These results are consistent for sample and non-sample predictions and are strong alternatives to predictive performance, multiple prediction horizons, and different data frequencies.

Gomez and Ibarra (2017) in an article entitled "Are Daily Financial Data Suitable for Predicting GDP?" They examined the possibility of using financial data in the forecast of GDP and stated that in this article, the use of financial data is used at high frequencies to improve the short-term forecast of GDP quarterly in Mexico will be evaluated. Specifically, the MIDAS mixed sampling regression model is used to combine both daily and monthly frequencies. A data set containing 392 daily financial sets is used to observe the existing information, factor analysis and predicted techniques to summarize the available information. The findings of this study show that the regression model of mixed data sampling, which includes daily financial data, leads to improved quarterly forecasts of macroeconomic variables compared to traditional models that are based only on economic data. They rely on quarterly or average daily financial information. In addition, the ability of the mixed data sampling model to provide updated forecasts for macro-agricultural variables is assessed appropriately.

Ayyoub and Chaudhry (2013), in an article entitled" Does Inflation Matter for Sectoral Growth in Pakistan? An Empirical Analysis" say that the present study makes vigorous attempt to analyze empirically the impact of inflation on sectoral growth of Pakistan. Three major sectors (i.e. agriculture, manufacturing and services) have been selected for analysis and study employed annual time series data started from year 1972 to 2010. It is found that impact of inflation on sectoral output differs substantially according to the nature of the sector. Prevailing inflation is harmful to the manufacturing sector growth; whereas, the effect of inflation on services sector growth is in sharp contrast with the manufacturing sector growth results. The statistically significant positive impact of inflation was found to encourage the services sector growth. It is observed that inflation and agriculture sector growth is positively and significantly related. It is suggested to restrict the inflation in a single-digit zone; so that it may put forth its positive impact on sectoral growth. Moreover, it is also concluded that the very low level of inflation in the economy may not be beneficial to the growth of agriculture and services sectors in Pakistan.

The variables used in this research will include data on agricultural commodity price indices, atmospheric indices, exchange rates, interest rates, value added of the agricultural sector, exports and imports of agricultural goods. One of the unknown aspects of this research is the selection of suitable markets in Iran that can be suitable for predicting macroeconomic variables. Another unknown aspect is the methodological need of this research, which has a lot of complexity and the researcher will extract its complexities during the research.

2. Materials and Methods

The variables studied in this study are as follows:
A) Independent variables:
Inflation, exchange rates, interest rates, temperature and precipitation, exports and imports
B) Dependent variables:
Agricultural value added, agricultural exports, agricultural imports

The period under study in this study is from 1392 to the end of 1397. The frequency of the data is different and therefore the number of observations for each of the variables studied is different. The table below shows the variables studied.

Table 1: Variables studied

TYPE	Frequency	NAME
Dependent	Monthly	VALUE
Dependent	Monthly	EXPORT
Dependent	Monthly	IMPORT
Independent	Yearly	EXCHANGE
Independent	Yearly	INFLATION
Independent	Seasonal	TEMP
Independent	Seasonal	PER

Therefore, regression equations are presented as follows.

$VALUE = \alpha + \beta_1 . EXCHANGE + \beta_2 . INFLATION + \beta_3 . TEMP + \beta_4 . PER + \varepsilon$

$EXPORT = \alpha + \beta_1 . EXCHANGE + \beta_2 . INFLATION + \beta_3 . TEMP + \beta_4 . PER + \varepsilon$

$IMPORT = \alpha + \beta_1 . EXCHANGE + \beta_2 . INFLATION + \beta_3 . TEMP + \beta_4 . PER + \varepsilon$

In these models, it is observed that the added value of agriculture, agricultural exports and agricultural imports are three dependent variables that are placed on the left side of the equation in three regression models. In these equations, it is clear that the effect of macroeconomic variables (exchange rate and inflation) along with the effect of temperature and precipitation on these three variables is examined.

To fit the regression model, the correlation between the variables is first examined:

Table 2: Correlation of research variables

	Export	Inflation	Exchange rate	Temperature	rain	import	Value added
Export	1/000						

Inflation	0/21	1/000					
	0/06	----					
Exchange	0/85	0/39	1/000				
rate	0/000	0/000	----				
Temperature	-0/18	0/06	0/003	1/000			
	0/12	0/57	0/97	----			
rain	0/07	-0/06	-0/03	-0/78	1/000		
	0/50	0/61	0/75	0/000	----		
import	0/90	0/21	0/87	-0/05	-0/02	1/000	
	0/000	0/06	0/000	0/62	0/83	----	
Value added	0/97	0/22	0/88	-0/12	0/02	0/97	1/000
	0/000	0/05	0/000	0/29	0/81	0/000	----

The null hypothesis in the correlation test is based on the significant non-correlation between the studied variables and the hypotheses can be written as follows:

H0: There is no significant correlation between the studied variables.

H1: There is a significant correlation between the studied variables.

To reject the null hypothesis and confirm the significance of correlation, the significance level must be less than 0.05.

The table above shows the degree of correlation in the first line and the significant correlation in the second line. If the significance is less than 0.05, the correlation is statistically significant. As can be seen, in some cases the correlations are significant, but the intensity of correlations between the independent variables is less than the probability that there is a correlation in the model.

The strong correlation between dependent and independent variables does not interfere with models. For example, in the table above, it can be seen that there is a very strong correlation between the exchange rate and exports of 0.85. The connection between the exchange rate and exports is logical on the one hand, and on the other hand, because exports are on the left side of the equation as a dependent variable and the exchange rate is on the right side of the equation as an independent variable, there is no statistical disruption. What is considered in the table above is the low correlation between the independent variables, which seems to be the maximum of the not-so-strong correlation between inflation and the exchange rate, which is equal to 0.39. Therefore, it is safe to say that there is no possibility of a correlation in the regression model.

In the following, the gross models are adjusted in order:

A) The first model examines the factors affecting agricultural value added

$$VALUE = \alpha + \beta_1 . EXCHANGE + \beta_2 . INFLATION + \beta_3 . TEMP + \beta_4 . PER + \varepsilon$$

Table 3: The first model estimation result

Dependent variable: agricultural value added			
Independent variables	coef	t-stat	prob
Constant equation (α)	83594700	7/64	0/000
exchange rate	-516275	-2/55	0/01
Inflation	7632/60	16/70	0/000
Temperature	-615656	-2/34	0/02
Rain	-98459/5	-1/19	0/23
F-stat = 77.47			
D-W = 0.73	R-Sq = 0.82		

In the table above, it is clear that the effect of exchange rate inflation and temperature on agricultural value added is significant, and due to low rainfall in Iran, rainfall cannot have a significant effect on agricultural value added. The negative effect of the exchange rate on the value added of agriculture and the positive effect of this effect on inflation is due to the fact that in this study, nominal numbers have been used for the added value of agriculture.

B) The second model examines the factors affecting agricultural exports

$$EXPORT = \alpha + \beta_1 . EXCHANGE + \beta_2 . INFLATION + \beta_3 . TEMP + \beta_4 . PER + \varepsilon$$

Table 4: The second model estimation result

Dependent variable: Agricultural Export			
Independent variables	coef	t-stat	prob
Constant equation (α)	21717855	5/58	0/000
exchange rate	-143711	-2/04	0/04

Inflation	2265/96	14/28	0/000
Temperature	-245849	-2/65	0/009
Rain	-27805/5	-0/97	0/33
F -Stat= 58.35	R-Sq= 0.85		
D-W= 0.55			

In the case of agricultural exports, the results are similar to those of agricultural value added. In the table above, it is clear that the effect of the exchange rate on inflation and temperature on the export of agricultural products is significant, and due to low rainfall in Iran, rainfall can't have a significant impact on agricultural value added. The negative effect of the exchange rate on the value added of agriculture and the positive effect of this effect on inflation is due to the fact that in this study, nominal numbers have been used for agricultural exports such as agricultural value added. Regarding the positive effect of temperature on export value, it can be said that in tropical areas where it is possible to cultivate agriculture, most of the country's agricultural exports are done and in the years when more heat prevails in the provinces that are agricultural hubs, production growth and exports Increases.

C) The third model examines the factors affecting agricultural imports

$$IMPORT = \alpha + \beta_1 . EXCHANGE + \beta_2 . INFLATION + \beta_3 . TEMP + \beta_4 . PER + \varepsilon$$

Table 5: The third model estimation results

Dependent variable : Agricultural import			
Independent variables	coef	t-stat	prob
Constant equation (α)	26563343	7/72	0/000
exchange rate	-156155	-2/51	0/01
Inflation	-2170/81	15/47	0/000
Temperature	-121136	-1/48	0/14
Rain	-29292/9	-1/16	0/24
F-stat = 19.65			
D-W =0. 91	R-Sq = 0.79		

In the table above, the most important difference between agricultural imports and exports and added value is that the effect of temperature on agricultural imports is not significant. This is due to the fact that Iran's temperature has no effect on agricultural imports, and this component should be sought in the impact on exports of countries that export agricultural products to Iran.

3. Conclusion

Variables of exchange rate and inflation have a significant effect on all equations, and temperature has a significant effect on value added and exports, and the amount of precipitation has no significant effect on any of the studied equations. The reason why the amount of rainfall is not significant is due to the low rainfall in Iran in general. Only the Northern Provinces and a small part of the western provinces of the country can produce rainfed under the influence of rainfall and in other regions of the country, regardless of rainfall. Years of cultivation of agricultural products are carried out with successive irrigations. Lower exchange rates improve exports and imports, and ultimately agricultural value added, so the impact of the

exchange rate on the three indicators examined is negative. Inflation also has a significant and positive effect on value added and exports and imports. This is justified because the figures used in this study are nominal and are influenced by inflation. Finally, it can be stated that the significant exchange rate and inflation for all three equations is an indicator of the impact of macroeconomic variables in the agricultural sector.

Government inflation data is presented in terms of core and headline inflation. Core inflation comes from price levels of a basket of goods, not including food and energy. These two items are considered volatile, so they are not included in core inflation, since it is a metric used for cost-of-living adjustments, and Social Security and pension increases.

Understanding exchange rate and its basic application is important for agricultural producers. Exchange rates impact agricultural commodity prices and farmers' margins. Most international agricultural transactions are in USD. Agricultural businesses need to recognize the impact of fluctuating currency on their business and consider ways of managing this risk.

References

Ayyoub M, Chaudhry I , DOES INFLATION MATTER FOR SECTORAL GROWTH IN PAKISTAN? An Empirical Analysis, July 2013

Barkchian, Seyed Mehdi and Rezaei, Mohammad Hossein (2016), A Study of the Performance of Regression of Combined Data with Different Frequencies in Predicting Seasonal Inflation in Iran, Quarterly Journal of Economics and Modeling, Shahid Beheshti University, Spring 2016.[in persian]

Sayadi, Fatemeh and Moghaddasi, Reza (2015), The effect of energy price on grain price using regression patterns with mixed data, Iranian Journal of Applied Economic Studies, Vol. 15, pp. 149-160. [in persian]

Nofarasti, Mohammad and Javaherdehi, Samaneh (1396), a model to show the perspective of the country's trade balance by regression of combined data with different frequency, Quarterly Journal of Financial Economics, Eleventh Year, No. 39, pp. 101-123. [in persian]

Sepehrdost, Hamid; Vahideh Shams Elahi and Dariush Sarhadi, 2015, Investment Opportunities and Challenges in Agriculture, Comprehensive and International Conference on Resistance Economics, Babolsar, Taroud Shomal Sanati Research Company. [in persian]

Espinoza, R., Fornari, F., and Lombardi, M. J. (2012). The Role of Financial Variables in Predicting Economic Activity. Journal of Forecasting, 31(1), 15-46.

Forni, M., Hallin, M., Lippi, M., and Reichlin, L. (2003). Do Financial Variables Help Forecasting Inflation and Real Activity in the Euro Area? Journal of Monetary Economics, 50(6), 1243-1255

Giannone, Domenico; Reichlin, Lucrezia; Small, David (May 2008). "Nowcasting: The real-time informational content of macroeconomic data". Journal of Monetary Economics. Elsevier. 55 (4): 665–676.

Ghysels, E.; Santa-Clara, P. and Valkanov, R. (2004); The MIDAS touch: Mixed Data Sampling regression models, mimeo, Chapel Hill, N.C.

Ghysels, E , Kvedaras V, Zemlys V , Mixed data sampling (MIDAS) regression models, DOI: 10.1016/bs.host.2019.01.005

Luis M. Gomez-Zamudio, Raul Ibarra, Are daily financial data useful for forecasting GDP? Evidence from Mexico , Documentos de Investigación Banco de México Working Papers N° 2017-17

Stock, J. H., and Watson, M. W. (2002a). Forecasting Using Principal Components From a Large Number of Predictors, Journal of the American Statistical Association, 97(460), 1167–1179.

RohitChakraborty SaurabhDas SoumyajyotiJana AnimeshMaitra (2014), Nowcasting of rain events using multi-frequency radiometric observations , Journal of Hydrology , Volume 513, 26 May 2014, Pages 467-474

Shi-ZhuanHan,Wen-TsaoPan,Ying-YingZhou,Zong-LiLiu, Construct the prediction model for China agricultural output value based on the optimization neural network of fruit fly optimization algorithm, Future Generation Computer Systems , Volume 86, September 2018, Pages 663-669