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The Analysis of the Impact of Monetary and Fiscal Policy on Private Investment in Agricultural Sector of Iran

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Abstract

Several factors including monetary and financial policy affect investments in the agricultural sector. Accurate estimation of the effect of the monetary and financial policy on investment in agricultural sector is important for proper use of these policies. This study aims to investigate the impact of monetary and fiscal policy on private investment in Iran's agriculture sector. Time series data during the years of 1967-2012 has been used in this study. Autoregressive Distributed Lag (ARDL) econometric model has been used for estimation. The results showed that government's investment as its fiscal policy in agriculture sector has a significant negative impact on private investment in agriculture sector and monetary policy has a significant positive impact by providing required liquidity of investors. The dummy variable of revolution years has negative and significant effect on the demand of the private investment in agriculture sector. The result of the error correction model showed that -0/282 of the lack of balance of each period is adjusted in the next period.

Keywords: *fiscal policy, monetary policy, private investment, Iran's agriculture sector, the form of ARDL correction model*

1. Introduction

Many economists believe that existence of a strong and advanced agriculture sector is one of the requirements of economic development and in any situation, development of agriculture sector is the prerequisite of country's economic development and if the barriers of this sector are not removed, other sectors won't achieve growth, development and thriving [11]. Agriculture sector is one of the main sectors of Iran's sector, so that it has allocated 14% of country's added value to itself [9]. Agriculture sector is very important in country's economy due to its significant abilities and potentials and it I considerable due to its role in providing people's food and raw material of some industries [12]. Meanwhile, the main mission of the agricultural sector as producer sector of food is providing dietary needs of the community.But with the development of production,in addition to providing enough food, this sector canparticipate to meet other economic needs. Thus, policy making in this sector should be done by taking a look at the macro policies of the country [5].Monetary and fiscal policies, as part of macro-economic policies, affect the demand side of the economy. Maybe it can be said that their effect on economic sectors is one of the most challenging issues in economy's literature that has allocated a main part of experimental researches to it [19]. Implementation of these policies is one of the most important policy instruments to achieve macroeconomic goals such as equitable distribution of income, the

increase in the rate of economic growth, employment level and price stability [10]. Government's fiscal policy are applied using current and administration costs, tax and nontax incomes and government's monetary policy through monetary and exchange variables [2].

Previous studies show that many variables depending on economic conditions of countries can have an effect on investment in the agricultural sector. Studies generally show the high effectiveness of monetary policy. Also, in recent external and internal studies,great emphasis has been put on assessment and analysisof the impact of public investment (fiscal policy). In this regard, the results of studies are not clear and often depend on the economic situation. In fact, public investment, depending on the type of investment (infrastructure or non-infrastructure) can supplement or replace private investment. In the context of the private investment in the agricultural sector, the impact of monetary and fiscal policies is individually investigated. With this interpretation, it has been attemptedto investigate the relationship between fiscal and monetary policy and private investment in agricultural sector of Iran by considering all the important variables and considering the integration of variables with respect to monetary and fiscal policy as key economic indicators, using the theoretical foundations of the neoclassical and adjustmentmodelsthat has been considered according to the economic conditions of developing countries.

2. Research background

Tada [21] measured the effect of agricultural and macroeconomic policies especially policies related to money supply, interest rate and exchange rate on Japanese agricultural sector and concluded that contractionary policy such as rise in interest rates and increase in the value of the national currency, leads to reduction of competitiveness in international markets.Hence, the earning of exporters of products, as compared to other manufacturers, reduces relatively. Doadus and Williams [16] studied the relationship between the general economy and agriculture.In their study, the effect of monetary policy on the agricultural sector in the United States during 1950-82 were reviewed, and they concluded that the expansionary monetary policy leads to increase of exports, prices and agricultural incomes and contractionary monetary policy has a negative impact on the agricultural economy. Lachal and Vumak [20] investigated the effect of macroeconomic policies on agriculture in Canada. The results showed that macroeconomic policies affect the relative prices of agriculture. The trade policies significantly affect the global competitiveness of Canadian agriculture.

Rahim Mahmoodgardi et al. [11] in an article entitled, investigating the effect of monetary and fiscal policy on private investment in the agricultural sector of Iranassessed the effectiveness of monetary and fiscal policy on private investment in the agricultural sector. In this respect, the investment results of the study showed that the government's investment (government's fiscal policy) in the agriculture sector has a negative impact; on the contrary monetary policy has a significant positive effect on private investment in the agricultural sector. The growth rate of agricultural prices and volatility index, respectively have positive and negative effects on private investment in agricultural sector.

The results of the research done by Azdi and Mohammadi [8] indicate the existence of a causal relationshipfrom government spending to the added value. This means that government spending has a positive impact on the agricultural sector in the short term. According to the results of this study, monetary and fiscal policy in the short term and long term has

significant positive effect on the agricultural sector.

Mohammad Hadi Hajian et al [4] investigated the impact of monetary and fiscal policies on the growth of added value of the agricultural sector and other variables in this section including prices, exports and investment. According to their study, the impact of monetary policy (liquidity) on the growth of added value of agricultural sector is positive and the effect of investment in this sector is negative. The impact offiscal policy (government spending in agricultural sector) on added value, the price and exports of agricultural sectoris positive and he effect of investment in this sector is negative.

In terms of private investment in agricultural sector,the study of Sameti and Faramarzpoor [7] suggests an algebraicalternative between public and private investment. The results of this study suggest a negative effect of granted credit on private investment in agricultural sector.

Moghaddasi and Yazdani [13] investigated the relationship between the main variables of agricultural sector and monetary and fiscal policy and concluded that in the short-term, the effects of monetary policy on the agricultural sector are greater than fiscal policy, but in the long term, fiscal policy was more effective than monetary policy.

Moghaddasi and Farhadi [12] investigated the effectiveness of monetary and fiscal policies on agricultural sector. Their results indicate that the effect of fiscal policy on growth of agricultural production is more than monetary policies; however, monetary policy in the long run has considerable effects on prices' level. Also, the volatility and instability in monetary and fiscal policies have inhibitory effects on investment, output and exports in the agricultural sector.

Studies of Nader Mehregan [14] showed that private investment in the agricultural sector considers the expected or permanent income and the current income is not much incentive to investors. Changes in agricultural sector's added value in the last 2-3 years had the most effect on the behavior of private sector's investors. In other words, if in the current yeareconomic recession (boom) is experienced in the agricultural sector, it is expected that in the next 2-3 years, investment in agriculture significantly decreases (increases). The experimental studies of Valadkhani [22] have shown that a 1% increase in inflation will lead to decrease of private investment to the same extent.

3. Theoretical framework of the function of private investment in agriculture sector

In this study, the model used by Jongwanish and Kohpaiboon[17] has been used. In this model, the foundations of the neoclassical model with adjustments according to the economic conditions in the developing countries have been considered. Neoclassical model of investment is based on the principle that firms minimize their production costs including labor and capital services as compared to their production function. As a result, the demand for capital as a factor of production is a derived function. In other words, manufacturers first specify the production function of firm and accordingly attempt to minimize production costs in order to produce the desired product (Ye).

The proposed production function proposed by Jongwanish and Kohpaiboon is Cobb-Douglas' function. The production function proposed by Cobb-Douglas is as follows:

$$y=ak^{\alpha}N^{1-\alpha} \quad (1)$$

Feature of this function is that the sum of squares of the production data in it is equal to the unit that actually shows constant return to scale. The final production factor of capital in Cobb-Douglas function is calculated as follows:

$$\frac{\partial y}{\partial K} = \frac{\alpha a K^{\alpha} N^{1-\alpha}}{K} = \frac{\alpha y}{K} \quad (2)$$

In the situation of balance in Cobb-Douglas function, the following equality will be formed:

$$\frac{\partial y}{\partial K} = \frac{\alpha y}{K} = \frac{C}{P} \quad (3)$$

With a few adjustments, the above relationship can be written as follows:

$$K^{E} = \frac{\alpha P y}{C} = \frac{\alpha y}{C/P} \quad (4)$$

This relationship indicates that with increase in (y), the equilibrium money supply increases and by increase in the real cost (C / P), money supply reduces. Then the index of (C) is used instead of (C / P). As it was explained, minimizing costs based on the desired level of production should be taken into account. In other words, instead of (y), the value of planned production (y_e) should be placed in the formula and based on this planned amount the optimal level of investment can be calculated.

$$K_t = \frac{\alpha y_t^e}{C_t} \quad (5)$$

Or more accurately:

$$K_t = \alpha y_t^e C_t^{-1} \quad (6)$$

The index of (t) represents the time period in question, and (α) is the parameter of distribution in Cobb-Douglas function.

Now, with the optimal balance of funds for planned production level, the factors affecting capital costs are investigated.

Capital cost is composed of three components.

The first element is the opportunity cost of using capital. This opportunity cost is the cost imposed to the investor that is required to pay for the use of capital goods and engaging capital in the manufacturing branches. The cost of capital opportunity is the cost of capital use. If it is thought that investor lend all his capital to someone else instead of using it in production, he can benefit from the use of his capital. The opportunity cost of capital can be obtained by multiplying the price of capital goods used in production (P_kt) in the nominal interest rate (r).

The second category is the rate of depreciation of capital goods in each period. If the useful life of capital goods used in production is estimated at 10 years, the rate of depreciation of the goods will be 10%. In other words, each year 10% of the total value of capital goods is decreased. The way of calculating the cost per period is equal to the result of multiplying the rate of depreciation (δ) in the price of capital goods (P_kt).

The third category is the losses or gains resulting from changes in the prices of capital goods. If the market price of a new car increases since the car was purchased by the firm over time, the price of the used car exceeds the difference between the purchase price and the amount of depreciation. In the case, capital goods will have benefits for their owners and if the price increase does not occur in capital goods or there is a price decrease, earning will be zero or negative. For

calculation, the expected rate soaring price changes in capital goods (π_t ^ e) should be multiplied by the price of capital goods (P_kt). The actual capital cost will be calculated as follows:

$$C_t = \frac{rP_{kt}}{p} + \frac{\delta P_{kt}}{p} + \frac{-\pi^e P_{kt}}{p}$$

(7)

$$C_t = \frac{r+\delta-\pi^e}{p} P_{kt}$$

(8)

Private investment function can be estimated as follows:

$$PI_t = \Delta K + \delta K_{t-1}$$

(9)

This relationship shows that the gross investment (PI_t) is extracted from the sum of net investment (Δ K) and alternative investments (δK_ (t-1)). Expanding the above formula and changing it into an interrupt function and the adjustment coefficient:

$$PI_t = (K_t - K_{t-1}) + \delta K_{t-1}$$

(10)

By applying interruption and adjustment factor, the formula is as follows:

$$PI_t = K_t + [\delta K_{t-1} - K_{t-1}] \quad (11)$$

$$PI_t = [1 - (1-\delta)L]\beta K_t + (1-\beta)PI_{t-1}$$

Where (β) is adjustment factor and (L) is the lag operator.

About lag operator, if time lag is one period, then:

$$LK_{i,t} = K_{i,t-1}$$

(12)

In the long term, good investment can be determined as follows from the lag changes in the desired stock of capital.

$$PI_t^* = \sum_{j=0}^{j} \beta_j \Delta k_{t-j}^*$$

(13)

It should be noted that in the above formula (k ^ *) is the optimal inventory of capital and (PI ^ *) is the desirable investment. By replacing the optimal inventory of capital from equation (6) in equation (13), private investment function can be obtained. The following formula shows the private investment that is a function of expected product, cost of capital and the adjustment coefficient.

$$PI_t^* = \sum_{j=0}^{j} \beta_j \Delta \alpha y_{t-j}^* C_{t-j}^{-1}$$

(14)

4. Research methodology

The method employed to gather resources and information was descriptive andfrom the library and using printed articles as well as the use of electronic resources and the Internet. The study is analytical and applied research. In the present study, the model estimation method is based on time series data using error correction form (ARDL).

Information needed to estimate the model including private investment in agricultural sector that was obtained after deducting public construction credits in agricultural sector from the total investment in the agricultural sector, public construction credits in agricultural sector as fiscal policy, monetary policy or actual liquidity, added value of agricultural sector and dummy variable of revolution years were gathered using statistical yearbook of the country during the years under study, national accounts statistics and economic studies and publications of the Central Bank of Iran [6].

5. The procedure of estimating the function of private investment in agriculture sector

1. After providing a consistent set of time series data, the level of sum of the each variable in the model was examined by adjusted Dicky-Fuller.
2. After being sure of the level of the sum of the variables involved in the equation, coefficients were tested by Engel and Granger in order to ensure the co-integration of variables of the equation. Otherwise, it is understood that there isn't a long-run equilibrium relationship among the variables so that the equation is specified.
3. After proving the existence of co-integration between the variables involved in the equation, in the next step, biases of estimated coefficients resulted from small samples are corrected. For this purpose, in order to achieve adjusted long-run equilibrium coefficients, the method proposed by Phillips (1988) is used. In this method, when for example, the co-integration equation is given as follows:

$$y = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_{2+} u_1$$
(15)

The long-term equilibrium relationship related to it, is estimated as follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_{2+} \beta_3 \Delta x_3 + \beta_4 \Delta x_4 + u_2$$
(16)

Where Δ is the difference of the first order and u is the residual sentence. The estimated coefficients of β_4 and β_3 are long-term unbiased coefficients of the variables of trivial x_1 and x_2 and have been considered only to eliminate bias of small samples in the equation. As a result, long-run equilibrium relationship is as follows.

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_{2+} \beta_3 \Delta x_3 + \beta_4 \Delta x_4 + u_3$$
(17)

4. In this step, the residual sentence of u_3 is calculated and the unit root test is done on it and if it lacks unit root or stationary root, long-run relationship can be trusted.

5. To illustrate the short-term dynamics, error correction model of equation is specified that is used from residual sentence of long-term adjusted correlation and is estimated using OLS.

6. After estimating coefficients of error correction model by OLS method, a series of diagnostic tests is used to evaluate the validity of the estimated relationship statistically.

6. Model estimation

6.1. Stability test

In this study, in order to distinguish the stable time series from unstable time series, adjusted Dicky- Fuller test (ADF) is used. The most important part of the adjusted Dicky- Fuller test is the selection of the optimal lag length in which residual sentences have the property of lack of serial autocorrelation. In order to select the optimal lag length, four criteria of Akaike, Hanan- Quick, Schwazer - Bizen and the log likelihood is presented. In samples with a volume of less than 100 observations (as in this study), it is recommended to use Shovazer-Bizen index so that not to miss the degrees of freedom [18].

Table 1: The results of adjusted Dicky-Fuller test (with intercept)

Variable	t-statistics (at level)	Critical value at 0/05 level	t-statistics (first level	Critical value at 0/05 level	Stability status

			difference)		
PIAS	0/7978	-2/929	-6/5666	-2/9314	PIAS~I(1)
GIAS	-2/5221	-2/9297	-6/7448	-2/9314	GIAS~I(1)
VAA	2/2022	-2/9411	-3/0798	-2/9411	VAA~I(1)
M2	9/5119	-2/9484	-	-	M2~I(0)

Table 2: The results of adjusted Dicky-Fuller test (with intercept and trend)

Variable	t-statistics (at level)	Critical value at 0/05 level	t-statistics (first level difference)	Critical value at 0/05 level	Stability status
PIAS	-0/6582	-3/5155	-6/8767	-3/5180	PIAS~I(1)
GIAS	-2/5186	-3/5155	-6/7228	-3/5180	GIAS~I(1)
VAA	-3/2845	-3/5155	-4/0393	-3/5330	VAA~I(1)
M2	9/7354	-3/5442	-	-	M2~I(0)

Comparing the quantity of statistical tests (ADF) of the variables with critical quantities presented in Tables 1 and 2, it is understood that variables of private investment in agricultural sector (PIAS), governmental developmental credits in agriculture (GIAS) and value added of Agricultural sector (VAA) have been stable in the first-order difference and variable of real liquidity (M2) has been stable at the level. Since that in the combination pattern, there are variables of I (0) and I (1), it is necessary to test co-integration of the pattern after the estimation of model.

6.2. Estimating the coefficients of long-term balance relationship of private investment in agriculture sector

The variables used in the model to estimate the coefficients of the long-run equilibrium relationship of private investment in the agricultural sector are as follows:

LPIAS: log of private investment in agricultural sector, LM2: logarithm of the actual volume of liquidity, LGIAS: log of governmental development credits in agricultural sector, LVAA: Log of value added in agriculture, DU: dummy variable of revolution years that takes number 1 for 1978 onwards and takes zero for other years. It should be noted that the variable of added value is used as a substitute for the income variable in this section.

$$LPIAS_t = \alpha_0 + \alpha_2 LM2_t + \alpha_1 LGIAS_t + \alpha_3 LVAA_t + DU + \varepsilon \qquad (18)$$

By considering a linear relationship between private investment in agricultural sector and other variables affecting it, the long-run equilibrium relationship of private investment in agricultural sector is estimated as follows with co-integration method using time series data of 1967-2012:

Table 3: The results of the estimation of long-term pattern

Variable	Coefficients	t-statistics	Standard deviation	Sig. level
C	27/27	5/3396	5/1084	0/0000
LM2	0/7121	6/8345	0/1041	0/0000
LGIAS	-0/079	-2/8012	0/5936	0/0002
LVAA	-2/4729	-4/1660	0/0285	0/0087
DU	-0/7787	-5/1250	0/1519	0/0000
R^2 = 0/87		$\overline{R^2}$ = 0/86		
F – 71/19 [prob=0/0000]		D.W = 2/21		

According to the estimation of long-run relationship of private investment in agricultural sector, long-term public investment ratio indicates a negative effect of public investment on private investment in the agricultural sector so that one percent increase in public investment in agriculture leads to a 0/07 percent decrease (less than one percent) in private investment in this sector. On the other hand, money supply in the long run has a positive and significant effect on private investment in the agricultural sector, so that one percent increase in the money supply results in 0/7121% increase in private investment in the agricultural sector. It should be noted that the monetary policy of the government during the study period coincided with an increase in the actual money supply with more emphasis on monitoring and dividing credits between economic sectors. The variable of added value has a significant negative effect on private investment in agricultural sector; negative effect of the added value on investments is not acceptable in the economic literature and it does not seem true logically; however, the coefficient of added value in the model is highly significant and has not been removed from the model. As can be seen, the estimated coefficient of determination of the equation is 0/87 that represents the good explanatory power of the model.

Also, as expected, the dummy variable of revolution years has a significant negative effect on the demand for private investment in agricultural sector. Negative and significant effect of the dummy variable of revolution years suggests that political stability and the stability of rules and regulations can be very important in attracting private capital in agricultural sector.

6.3. Co-integration test

In order to ensure the long-run equilibrium relationship, co-integration test between the variables of investment function in agricultural sector was conducted by adjusted Engel and Granger method; the reliability test results of residual sentence of long-term investment function in the agricultural sector (ERRORIA) is as follows:

Table 4: co-integration test

Co-integration test	t-statistic	Critical quantity	Test results
Angle-Grenjer test	-4/2704	-3/5885 at (0/01) level	ERRORIA~I(0)
		-2/9297 at (0/05) level	
		-2/6030 at (0/01) level	

As can be seen from Table (4), the test statistic of the residual of the long-term investment function in the agricultural sector was more negative than the critical value and the null hypothesis that there is a unit root for the error terms against the other hypothesis is rejected at error levels of (0/01, 0/05, 0/1), and long-term equilibrium relationship between investment in agricultural sector and its explanatory variables is confirmed.

6.4. Estimating the function of short-term private investment in agriculture sector

The co-integration between the variables of long-term investment function provides the opportunity to relate short-term fluctuations of private investment in the agricultural sector (PIAS) to long-run equilibrium values using error correction model (ECM).

$$\Delta LPIAS_t = \alpha_0 + \alpha_1 \Delta L\Delta M2_t + \alpha_2 \Delta LGIAS_t + ECM(-1) \qquad (19)$$

Based on the results of the model, the variable of added value does not have a significant effect on private investment in the agricultural sector in the short-term. However, Wald test was used to consider the zero constraint for the coefficient of added value. The results showed that the null hypothesis of omitting the added value is not rejected (table 5). So then, the final short-term model is estimated without the variable of added value.

Table 5: Elimination and zero constraint limitation tests for coefficient of VAA variable

Test / Variable	Wald test			
VAA	F-statistic	Possibility level	X^2 statistic	Possibility level
	0/7528	0/3910	0/7528	0/3656

Investigations indicate that the variables of the model except the M2 are all I (1). So, the first-order difference of all the variables will be I (0).Also, due to the reliability of the error term related to the function of long-term private investment, we can put the first order difference of the variables related to long-run equilibrium relationship of investment in the agricultural sector that all are I (0) with the variable of equilibrium error (ECM), which is I (0), in a regression and estimate its coefficients using OLS method. Under these conditions, the estimated coefficients are quite reliable, and F and t statistics are valid.

Table 6: The results of the estimation of short-term pattern

Variable	Coefficients	t-statistics	Standard deviation	Sig. level
C	-0/1282	-1/3907	0/0922	0/1722
DLM2	0/437	2/2355	0/3327	0/0312
DLGIAS	-0/1429	-4/3463	0/0328	0/0001
ECM((−1))	-0/2822	-1/8086	0/1560	0/0782
R^2 = 0/87		$\overline{R^2}$ = 0/86		

F – 71/19 [prob=0/0000]	D.W = 2/21

The results of the error correction model of factors affecting investment in agricultural sector are presented in Table (6).Based on the results of short-term pattern, it can be observed that the coefficients of public construction investment and money supply in the short term as well as their coefficients in the long term have significant positive and negative impact on private investment in the agricultural sector, respectively. About the short-term effect of money supply, short-term pattern results imply that monetary policy in the short term (the coefficient of money supply: 0/743) as compared to long term (coefficient of money supply: 0/7121) has more effect in increasing private investment in agricultural sector and about the short-term effect of public investment, fiscal policy in the long term (the coefficient of public investment: -0/1429) as compared to short term (coefficient of public investment: -0/079) has more effect in decreasing private investment in the agricultural sector. The error correction coefficient is equal to-0/2822 and is significant at the confidence level of 90%. In fact, - 0/2928 of imbalance of any of the courses is adjusted in the next course. This result emphasizes the performance of adjustment mechanisms toward making private investment close to its long-term path in the current model.

6.5. Detection tests

In the following section, statistic tests for the function of short-term dynamics of investment in the agricultural sector is presented, which shows the accuracy of all these tests and reliability of short-term function coefficients.

Table 7: Detection tests

Test type	Test statistics	Possibility test	Test results
Normality of the distribution of error terms using Jark-Bra method	0/4596	0/7946	Error terms have normal distribution.
Heteroscedasticity using White method	**F** = 0/4056 $\mathbf{X^2}$ = 4/2831	**P** = 0/9230 **P** = 0/8918	Error terms don't have Heteroscedasticity.
The correctness of specifying the model using codified method	**F** = 0/4854 $\mathbf{X^2}$ = 1/6488	**P** = 0/2304 **P** = 0/1991	Model has been specified correctly.

7. Conclusion

1. Based on the estimated long-term and short-term relationship in this study, the negative effect of public investment on private investment in agricultural sector has been verified. But the negative impact of public development investment on private investment in agricultural sector in the long term is greater than the short term, so that in the long run, a one percent increase in public development investment, private investment in agricultural sector decreases -0/1429 percent. The reason for the negative impact of public investment on private investment can be found in the fact that government deals with supporting issues such as price support (guarantee buying),

institutional support and other support (paying compensation of drought and crop insurance); therefore, it is recommended that the government on the one hand remove the negative effect of fiscal policy of government in agricultural sector by replacing improved seeds, newer, more fuel-efficient agricultural technologies (Mechanized) and on the other hand, create a proper condition for confidence and provide a safe environment for private sector investors.

2. Money supply in the long term and short term has positive and significant effect on private investment in the agricultural sector, so that in the long run, a one percent increase in the money supply leads to 0/7121 percent increase in private investment in agricultural sector; however, in the short term, a one percent increase in the money supply leads to an increase of 0/743 percent in private investment in the agricultural sector. The results indicate the effectiveness of monetary policy. Thus, expansionary monetary policy can have a significant impact on private investment in the agricultural sector by eliminating liquidity constraints of private investors in this sector.

3. Dummy variable of revolution years has significant and negative effect on the demand for private investment in agricultural sector.

4. The error correction coefficient is equal to 0/282 and is significant at 90% confidence level. In fact, -0/282 of imbalance in each period is adjusted in the postwar period. In other words, it takes up about 0/4 period to adjust error imbalances.

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