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Empirical Analysis of the Effect of Foreign Direct Investment Inflows on Agricultural Production in Developing Countries : Evidence from Nigeria

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ABSTRACT

As the world economy has opened up and borders have become less of a barrier to trade, there has been a growing trend of spreading investments into different nations around the world. This diffusion of investments is often directed toward developing nations where inputs such as labor and raw materials tend to be less expensive than they are in the developed world. This movement to developing nations has sparked a considerable amount of debate on the impacts that it has on labor, the environment, and a number of other areas in the receiving nations. The particular movement of investment that is the focus of this study is foreign direct investment (FDI). FDI is any investment by a firm from one country in the actual productive capacity of another country. This can take the form of a physical investment such as a foreign firm building a factory in a country or it can be when a firm invests money in a foreign firm and is granted part ownership or some other amount of control in the foreign firm.

Keywords: FDI, IFAD, UNCTAD, BT, ARDL, VECM, LAGDP, LEX, LFDI, FAO, CBN, OECD, WDI

I. INTRODUCTION

FDI has been shown to play an important role in promoting economic growth, raising a country's technological level, and creating new employment in developing countries (Blomström and Kokko, 2003; Klein, Aaron, and Hadjimichael, 2003; Borenzstein, De Gregorio, and Lee. 1998). It has also been shown that FDI works as a means of integrating developing countries into the global market place and increasing the capital available for investment, thus leading to increased economic growth needed to reduce poverty and raise living standards (Rutihinda, 2007; Dollar and Kraay, 2000; Dupasquier and Osakwe, 2005).

According to the World Bank.s .World Development Report., in 2000 over 1.1 billion people were subsisting on less than US$1 a day and around 2.1 billion people on less than US$2 a day of whom between two-thirds to three-quarters live in rural areas. In Sub-Saharan Africa (SSA), where about 43 percent of its population is living below the international poverty line, the incidence of poverty is the highest among smallholder farmers residing in rural areas. Thus, if the war on poverty is to be won, developing countries need to place more emphasis on the agricultural sector (Mangisoni, 2006; IFAD, 2002).

Growth in agriculture and its productivity are considered essential in achieving sustainable growth and significant reduction in poverty in developing countries. Both developmental and agricultural economists view productivity growth in the agricultural sector as critical if agricultural output is to increase at a sufficiently rapid rate to tackle poverty (Rao, Coelli and Alauddin, 2004). In view of the declining arable land per capita, high production costs, combined with rapid population growth and the resulting need for human settlement, and rising urbanization, significant improvements are required in productivity growth in agriculture in order to increase agricultural output through technological innovations and efficiency. Limited development and adoption of new production technologies essential for improving productivity by the poor are mostly due to limited income and sources of credit.

The intense competition for foreign direct investment (FDI) inflow among developing economies in recent years is premised upon the perceived growth multiplier effects of multinational enterprises (MNEs) in their host countries. In order to provide conducive environment for FDI inflow and therefore benefit from these advantages, most developing countries have made changes to their investment regulatory framework. For instance, evidence provided by United Nations Conference on Trade and Development (UNCTAD) (2003), indicates that during the period 1991 to 2002, around 95% of the changes to worldwide laws governing FDI were made favorable to multinational firms activities. According to this report, establishment of investment promotion agencies, provision of fiscal incentives, inflation and exchange rates control have characterized these efforts. As a corollary, the share of net FDI inflow in middle income countries rose from 0.74% in the 1970s to 1.08% between 1985 and 1994, and subsequently to 2.85% between 1995 and 2005 (Sayek, 2009).

In Nigeria, agriculture remain the mainstay of the economy Okuneye (2002) described agriculture as the main source of food for most of Nigeria's population while Ayinde et al.,(2007) opined that it was until oil discovery Nigeria's highest foreign exchange earner. From these views and definitions, the expectation would be that the agriculture sector receives the highest attention from government and private enterprises especially concerning funding. Conversely, Mogues et al., (2007) publicized that public spending in the sector is "astronomically" low. Less than 2 percent of total federal expenditure was allotted to agriculture during 2001 to 2005; far lower than spending in other key sectors such as education, health, and water contrasting dramatically with the sector's importance in Nigeria's economy and the policy emphasis on diversifying away from oil, an allotment far below the 10 percent goal set by African leaders in the 2003 Maputo agreement.

The involvement of private enterprises also leaves much to cheer; Ogbanje et al., (2010) revealed that in terms of foreign direct investment (FDI), the sector suffers heavy marginalization in spite of its relevance to Nigeria as a major provider of employment, foreign exchange, and economic sustenance. Even Fasinmirin and Braga (2009) called our attention on recourse to modern agriculture; they claim that virtually all facets of human endeavor rely primarily on agricultural products or its by-products. Provision of funds is a key area to address because it would help return the agriculture in Nigeria to its place of pride and introduce modern practices and system. Ogbanje et al., (2010) defined the lack of capital as the major sustenance of the vicious circle of poverty; this provokes the need for adequate funding since the agricultural sector is important to alleviate poverty.

II. METHODS AND MATERIAL

Following the theory of production, it is hpothesised in this study that the agricultural production in Nigeria is a function of capital stock, rural population which serves as proxy for agricultural labour, foreign direct investment , exchange rate and expenditure on agriculture. Empirically, the model is stated as:

$$LAGDP = \alpha + \delta_1 LEX_t + \delta_2 LCa_t + \delta_3 LLBa_t + \delta_4 LFDI_t + \delta_5 LEXPD + \delta_6 T + \varepsilon_t \quad .... (1)$$

where $LAGDP$ is the natural logarithm of agricultural labour, LEX is the real exchange rate, $LFDI$ is the natural log of foreign direct investment inflow into the agricultural sector in Nigeria, $LLBa$ is the natural log of rural population which serves as the proxy for agricultural labour in Nigeria, $LEXPD$ is the governments expenditure on agriculture, LCa represents the capital stock in agricultural production while T, the time trend variable, which represents technology was included in the model to capture the effects of variables which are inherent in time T, which represents technology and represented by the time variable serving as a proxy for the impact of technology change on agricultural production in Nigeria over time, i.e. to capture technical progress, productivity, high-yielding varieties, etc. Theoretically, it is expected that $\delta_1 \geq 0,\ \delta_2 \geq 0, \delta_3 \geq 0,\ \delta_4 \geq 0, \delta_5, and\ \delta_6 \geq 0.$

A. ARDL Model Specification

This study adopted Bounds Test developed by Pesaran et al. (2001). They have proposed the Autoregressive Distributed Lags modeling approach to cointegration also known as the Bounds Test (BT) procedure for the investigation of a long-run equilibrium among a number of time-series variables. The most important advantage of the ARDL approach to cointegration is that it is applicable irrespective of whether the model's regressors are purely I(0), purely I(1) or cointegrated. Another important advantage of the BT procedure is that estimation is possible even when the explanatory variables are endogenous. Pesaran and Shin (1995) demonstrate that valid asymptotic inferences on short- and long-run parameters can be made under least squares estimates of an ARDL model, provided the order of the ARDL model is appropriately augmented to allow for contemporaneous correlation between the stochastic components of the data generating processes included in estimation. Hence, ARDL estimation is applicable even where the explanatory variables are I(0) or I(1). (Barumshah et al, 2004)

The procedure is adopted for the following three reasons. Firstly, the bounds test procedure is simple. As opposed to other multivariate cointegration techniques such as Johansen and Juselius (1990), it allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, the Bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots unlike other techniques such as the Johansen approach. It is applicable irrespective of whether the regressors in the model are purely I (0) purely I (1) or mutually cointegrated. Thirdly, the test is relatively more efficient in small or finite sample data sizes as is the case in this study. The procedure will however crash in the presence of I (2) series. Following Pesaran *et al* (2001), we apply the bounds test procedure by modelling the long-run equation (6) as a general vector autoregressive (VAR) model of order *p*, in

$$z_t = c_o + \beta t + \sum_{i=1}^{p} \phi_i z_{t-i} + \varepsilon_t \,,$$

t = 1,2,3,...,T .... (2)

with c_o representing a (*k+1*)-vector of intercepts (drift) and β denoting a (*k+1*)-vector of trend coefficients. Pesaran *et al* (2001) further derived the following vector equilibrium correction model (VECM) corresponding to (6)

$$\Delta z_t = c_0 + \beta t + \pi z_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta z_{t-i} + \varepsilon_t \,,$$

t = 1,2,3,...,T .... (3)

Where the (k+1)*(k+1) matrices $\prod = I_{k+1} + \sum_{i=1}^{p} \psi_i$

and $\Gamma_i = - \prod = \sum_{j=i+1}^{p} \psi_i$, $i = 1, 2,$ ...,p-1

contain the long-run multipliers and short-run dynamic coefficients of the VECM. Z_t is the vector of variables y_t and x_t respectively. y_t is an I(1) dependent variable defined as $LAGDP_t$ and

$LAGDP_t = (LEX, LEXDP, LCa, LFDI, LLBa)$ is a vector matrix of 'forcing' I(0) and I(1) regressors as already defined with a multivariate identically and independently distributed (*i.i.d*) zero mean error vector $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})$ and a homoskedastic process. Further assuming that a unique long-run relationship exists among the variables, the conditional VECM can now becomes:

$$\Delta y_t = C_{yo}\ \beta_t + \delta_{yy} y_{t-1} + \delta_{xx} x_{t-1} + \sum_{i=1}^{p-1} \lambda_i \Delta y_{t-1} + \sum_{i=0}^{p-1} \xi \Delta x_{t-1} + \varepsilon_{yt},\ \ t = 1,2,...,T \qquad (4)$$

On the basis of equation (4) above, the conditional VECM of interest can now be specified as

$$\Delta LAGDP = \alpha + \delta_1 LAGDP_{t-1} + \delta_2 LEX_{t-1} + \delta_3 FDI_{t-1} + \delta_4 LEXPD_{t-1} + \delta_5 LCa_{Rt-1} + \delta_6 LLBa_{t-1} + \sum_{h=1}^{p} \eta \Delta LAGDP_{t-n} + \sum_{i=1}^{q} \phi l \Delta LEX_{t-d} + \sum_{j=1}^{q} w \Delta LEXPD_{t-z} + \sum_{k=1}^{q} \varphi \Delta LCa_{Rt-w} + \sum_{l=1}^{q} \ell \Delta LLBa_{t-g} \qquad (5)$$

Where δ are the long run multipliers, c_0 is the drift and ε_t are white noise errors and variables are as previously defined.

There are 3 steps in testing the co integration relationship between rice import demand and its explanatory variables. First, we estimated equation above by ordinary least square (OLS) technique. The presence of cointegration can be traced by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. That is, the null hypothesis

$H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ against the alternative.
Ha: δ_1 or δ_2 or δ_3 or δ_4 or $\delta_5 \neq 0$.
We denote the test which normalize on M by $AGDP = F_M\ (EX, FDI, EXPD, Ca, LBa)$. Two asymptotic critical values bounds provide a test for cointegration when the independent variables are I(d) (where 0≤ d ≤1): a lower value assuming the regressors are I(0) and an upper value assuming purely I(1) regressors. If the computed F- statistic is less than lower

bound critical value, then we do not reject the null hypothesis of no cointegration. Conversely, if the computed F- statistic is greater than upper bound critical value, then we reject the null hypothesis and conclude that there exists steady state equilibrium between the variables under study. However, if the computed F - value falls within lower and upper bound critical values, then the result is inconclusive. The appropriate critical values for the F-tests are obtained. Critical values for the I(0) series are referred to as the upper bound critical values while the critical values for the I(1) series are referred to as lower bound critical values.

For the second step, once the cointegration has been established consequent upon which a unique long run relationship exists among variables of interest, we specify a conditional ARDL (p, q_1, q_2, q_3,q_4, $q_{5,}$ $q_{6,}$) long run model for $LAGDP$ as

$$LAGDP = c + \sum_{h=1}^{p} \delta_1 LAGDP_{t-1} + \sum_{i=0}^{q} \delta_2 LEX_{t-i} + \sum_{m=0}^{q} \delta_3 FDI_{t-1} + \sum_{j=0}^{q} \delta_4 LEXPD_{t-1} + \sum_{k=0}^{q} \delta_5 LCa_{Rt-1} + \sum_{l=0}^{q} \delta_6 LLBa_{t-1} \quad \text{.............} (6)$$

The lags length in the ARDL model is selected based on Schwarz Bayesian criterion (SBC). For rice, a maximum of 2 lags was selected.

In the final step, we obtain the short-run dynamic elasticities by estimating an error correction model associated with the long run estimates. This is specified as follows:

$$\Delta LAGDP = C_0 + \sum_{h=1}^{p} \eta \Delta LAGDP_{t-n} + \sum_{i=1}^{q} \phi l \Delta LEX_{t-d} + \sum_{s=1}^{q} x \Delta LFDI_{t-m} + \sum_{j=1}^{q} w \Delta LEXPD_{t-z} + \sum_{k=1}^{q} \varphi \Delta LCa_{Rt-w} + \sum_{l=1}^{q} \ell \Delta LLBa_{t-g} + \lambda ECM_{t-1} \cdots\cdots\cdots\cdots\cdots\cdots (7)$$

The symbols $\eta, \phi, \omega, \varphi, x \; and \; \ell$ are the short-run dynamic elasticities of the model's convergence to long-run equilibrium and λ is the speed of adjustment. Δ represents the first difference operator and ECM_{t-1} is the one period lagged error correction term. The coefficient measures the speed of adjustment to obtain equilibrium in the event of shocks to the system. General – to – specific modeling technique of Hendry and Erricson (1991) is followed in selecting the preferred ECM. This procedure first estimate the ECM with different lag lengths for the difference terms and, then, simplify the representation by eliminating the lags with insignificant parameters. A correctly indicated ECM model has to pass a series of diagnostic tests. These include the Autoregressive LM (Lagrange multiplier) test and/or Durbin-Watson test for serial correlation in the residual, the Autoregressive LM test for normality distribution of the residuals in a regression model, the ARCH test for heteroscedasticity in errors. These tests were conducted to ensure reliability of results.

B. Data Source

The data for this study are primarily time series data at macro level spanning from 1981-2012. All the data were largely from Food and Agriculture Organization (FAO) statistical data base, Central Bank of Nigeria (CBN) statistical bulletin, PennWorld Data Table of the University of Pennsylvania, UNCTAD statistical database and OECD. Data on gross domestic product of agricultural production and government expenditure on agriculture in Nigeria were sourced from different editions of the CBN Statistical bulletin; data on rural population were sourced from the world development indicators (WDI) of the world band. The real exchange rate data were from the PennWorld data Table of the University of Pennsylvania, Capital stock data were sourced from FAO online statistical database.

III. RESULTS AND DISCUSSION

A. Result of Unit Root Test

As a precondition for the ARDL approach to cointegration, it is important that the unit root properties of all the variables to be brought into the cointegration space must be examined. This study therefore examined the unit root properties of the series to be considered in the analysis to ensure that none is I(2). The results of the unit root tests are shown in Table 1. The null hypothesis of the presence of a unit root (non-stationarity) was tested against the alternative hypothesis of the absence of a unit root (stationarity). of all the variable examined $LRAGDP$, $LLBa$, LEX and LCa have unit root properties and became stationary at 1st differencing hence have order of integration of 1 or are said to be I (1). However variables $LEXPD$ and $LFDI$ were stationary at level, with the order of integration of 0 or I (0). The data can now be used in the ARDL specification since none of them is I(2).

Table 1: ADF Unit Root Test Results for Selected Variables

Variables	t-statistics	t-statistics	
	Level	First	Order of

		difference	integration
LAGDP	-2.9003	-6.0403***	1
LFDI	-3.5316**	-8.6518***	0
LEX	-0.8997	-5.3352***	1
LLBa	-2.9288	-3.4142**	1
LEXPD	-3.9011**	-6.9176***	0
LCa	-1.5893	-5.3440**	1

*Source: Data Analysis, 2014. ***, ** and * indicates significant at 1%, 5%, and 10%respectively*

B. ARDL bounds test for co integration analysis for equation

The ARDL cointegration test was carried out for this study using E- Views 9 statistical software. With the software, it is no longer necessary to apply the steps enumerated above for the OLS regression in the first differences part of equation (1), since the software has generated the F- result for the test of the joint significance of the parameters of the lagged level variables when added to the first regression. The computed F-statistics from the Pesaran test is reported in table 2, according to the computed F-statistics, we can reject the null hypothesis of the no cointegration at 5% significance level for Agricultural production in Nigeria.

The computed F-statistics for $LAGDP = F_M\ (LAGDP / LEX, LFDI, LEXPD, LCa, LLBa)$ = 5.740 which is higher than the upper bound critical value of 4.329 at the 5% significance level. This indicates that the alternative hypothesis of the existence of a unique cointegration relationship between agricultural production and its determinants can be accepted for Nigeria in this case. The test statistics for the cointegration test was bases on the ARDL lag structure of (2,1,0,2,2,1) selected based on Schwarz Bayesian Criterion selection.

The result above has shown that agricultural production $(LAGDP)$, foreign direct investment (FDI) into the agricultural sector in Nigeria, exchange rate (LEX), capital stock (LCa), agricultural labour $(LLBa)$ and government expenditure on agricultural production $(LEXPD)$ bound together in the long -run (cointegrated) when the natural logarithm of agricultural production is made the dependent variable. The results of the solved static long- run equation for agricultural production in Nigeria as well as its short- run equation are given in the tables 2 below.

Table 2. ARDL bounds test for co integration analysis for equation

ARDL(2,1,0,2,2,1) selected based on Schwarz Bayesian

Critical values (F-Statistics) for the bounds test (Intercept and trend)						
1% level			5% level		10% level	
K	1 (0)	I (1)	I (0)	I (1)	I (0)	I (1)
5	4.011	5.331	3.189	4.329	2.782	3.827
$F_{AGDP}\ (LAGDP / LEX, Ca, FDI, EXPD, LLBa)$ Computed F. Statistics = 5.74***						

Source: Data analysis, 2014

Notes – Critical values are extracted from Pesaran et al (2001) Critical values for bounds test: case III. K is the number of regressors.

C. Static long – run, Short -run Error Correction Results and Diagnostics Tests results.

A number of diagnostic tests were carried out on the results of this analysis to test its reliability or otherwise. The diagnostic tests carried out include: the Autoregressive conditional heteroscedasticity (ARCH) test for testing heteroscedasticity in the error process, the Breusch-Godfrey serial correlation Lagrange Multiplier (LM) test for higher order – serial correlation and the Jacque – Bera X^2 statistic for testing the normality in the distribution in the error process. The results of these tests from table 3 show that the statistic of each of the test is statistically insignificant. From the battery of diagnostic tests this study concludes that the model is well estimated and that the observed data fits the model specification adequately, thus the residuals are expected to be distributed as white noise and the coefficient valid for policy discussions.

The error correction model estimate of effect of FDI inflow into the agricultural sector of Nigeria is given in the table below. The R^2 value of 0.810 for the model shows that 81% variation in agricultural productivity in Nigeria is explained by the variables in the specified model.

Agricultural productivity in the immediate past year $(LAGDP(-1))$ significantly increases production in the current year. A coefficient of 0.323 which is significant at 5% suggests that a unit increase in agricultural production in the immediate past year will significantly increases production in the current year. Farmers should be encouraged to significantly increase agricultural production since it significantly contributes to their gross revenue in the following year.

Real exchange rate (LEX) has a positive and significant coefficient of 0.034 in the long run while it has a coefficient of 0.029 (significant at one percent level) in the short run. These results suggest that devaluation of the currency, which was one of the major components of structural adjustment programme significantly, affected agricultural growth in Nigeria. Structural adjustment programme(SAP) was one of the major economic reform policies adopted by many of the sub- Saharan African countries in the early to late 1980's. It is expected that a fall in the exchange rate discourages import and encourage the purchase and use of locally made goods which include agricultural materials.

Foreign direct investment into the Nigerian agricultural sector in the long-run $(LFDI)$ has a coefficient of 0.061 in the long run and it is significant 1% level. In the short-run however, the coefficient is 0.037 and it is significant at 5% level. These results suggest in the long-run, a unit increase in the $LFDI$ inflow into the Nigerian agricultural sector will significantly increases agricultural production by 0.061 unit while in the short-run, a unit increase in $LFDI$ inflow into the nation's agricultural sector will increase agricultural production by 0.037 unit. From these results, it is apparent that $LFDI$ is playing a positive and significant role in the agricultural sector of the Nigerian economy. It is therefore important that the government of Nigeria encourages more foreign investment into the Nigerian agricultural sector and also creates a conducive investment climate for the foreign investors.

Capital investment in agriculture (LCa) has a coefficient of 5.563 in the long-run and it significant at 1% while it has a coefficient of -1.935 and it is significant at 10%. While the result in the long-run is in line with a-priori expectation, in the short-run it is not. The result increase the in the long-run suggest that a unit increase in the amount of capital stock invested in agricultural production will increase agricultural productivity by 5.563 units. This result suggests that capital stock invested into agricultural production is one of the most important determinants of agricultural production in Nigeria. The negative coefficient in the short-run may be as a result of low capital stock in the short-run or mismanagement of same.

Rural population $(LLBa)$, which is used as proxy for agricultural labour, has a positive coefficient of 5.562 and it is significant at 5% level in the long-run. In the short- run however, the coefficient of rural population is 142.68 and it is significant at 1%. These result in line with a-priori expectation. A unit increase in agricultural labour in Nigeria as the result suggests in the long – run will increase agricultural productivity by 5.562 while in the short – run, it increases agricultural productivity by 142.68 units. In the recent years, the government of Nigeria is making serious efforts at reducing the rural urban migration by coming up with programmes and policies that not only encourages agricultural production, but by also putting in place rural development programmes which are meant to improve the livelihood of the rural dwellers and also stem down the rate of rural urban migration which directly affects agricultural labour and hence agricultural productivity.

Meanwhile, government expenditure (LEXPD) into the agricultural sector has positive coefficients both in the long-run and in the short-run. The coefficients are 0.023 and 0.037 in the long-run and short-run respectively and both are significant at 5%. The results suggest that government expenditure significantly increases agricultural production in Nigeria. This is in line with a-priori expectation as we expect agricultural production to increase with the level of government funding especially in terms of provision of micro-credits and essential farm inputs.

Factors inherent in time such as infrastructural developments, expenditure on agricultural research and extension, applications of modern techniques, use of genetically modified seeds for cultivation which are all captured by time trend show a positve effect on agricultural production in Nigeria. The coefficient is 0.082 and 0.130 in the long and short-run respectively. Both are significant at 5%.

The coefficient of error correction term (ECM) carries the expected negative sign. The significance of the ECM supports cointegration and suggests the existence of long

– run steady state equilibrium between agricultural productivity and other determining factors in the specified model. The coefficient of -1.579 which is significant at 1% level indicates that the deviation of agricultural production from the long-run equilibrium level is corrected by about 159.7% in the current period.

Table 2 : Static long run and Short run Error Correction Modelling of Rice Imports in Nigeria

ARDL(2,1,0,2,2,1) *selected based on Schwarz Bayesian Criterion*

Dependent variable is LAGDP and 32 observations were used for estimation (1981 - 2012)

Static Long – run equation	Parsimonious Short – run equation
Constant -111.213(-2.314)**	ΔC -175.616(-2.280)**
LEX 0.034(1.892)*	$\Delta LAGDP(-1)$ 0.323(2.384)**
$LFDI$ 0.061(4.040)***	ΔLEX 0.029(3.604)***
LCa 5.563(2.083)**	$LEXPD$ 0.0365(2.550)**
$LEXPD$ 0.023(2.370)**	ΔLCa -1.935(-1.931)*
$LLBa$ 5.562(2.828)**	$\Delta LCa(-1)$ -2.755(-2.755)**
$Trend$ 0.082(2.636)**	$\Delta LLBa$ 142.680(3.613)**
	$\Delta LLBa(-1)$ -85.393(-2.285)**
	$LFDI$. 0.0366(2.260)**
	ΔT 0.130(2.084)**
	$ecm(-1)$ -1.579(-6.912)***
	R^2 = *0.81*
	AR LM F *(2, 22)* = *0.072 (0.9308)*
	ARCH *F(1, 22)* = *0.001 (0.9811)*
	Normality χ^2 = *0.194 (0.9075*
	Reset F = 0.490(0.492)

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