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The Slow Death of Agriculture's Share: Structural Transformation in Nepal's GDP, 1975–2023

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ABSTRACT

This paper explores the long-term trend of agriculture's share in gross domestic product (GDP) in Nepal from 1975 to 2023 and queries the factors behind the structural shift of the economy. The analysis is performed embedded in a multivariate vector error correction model together with real GDP per capita, urbanization rate, remittance inflows, trade openness, and the agriculture share. The Johansen procedure found one cointegrating vector, as all five series are integrated to the order one level. The estimated long-run equation indicates that the agriculture share is decreasing at the rate of 0.34 per cent with respect to real income, 0.41 per cent with respect to urbanization, and 0.17 per cent with respect to remittances. The impact of trade openness is small and negative. In the case of the agriculture share, it is found that Granger causality runs from income, urbanization, and remittances to the agriculture share, but not the other way around. The error correction term in the agriculture share equation is negative and significant, with some two-tenths of any deviation from long-run equilibrium corrected roughly one-fifth of a year later. The results suggest a statistical and 'actual' structural change in Nepal, which is driven more by labour-market and demand-side factors and less by productivity improvements within agriculture. Policy implications are linked to agricultural productivity, non-farm economy labour demand, and managing structural change due to remittances.

Keywords: Agriculture, cointegration, Granger causality, remittances, structural transformation, VECM

INTRODUCTION

In Nepal, agriculture would have been the predominant economic activity, and in a manner that's difficult to conceive from today's perspective. In 1975, agriculture accounted for about 70 percent of gross domestic product (GDP) and almost 90 percent of the labour force. By 2023, it made up about 24 per cent of GDP, with services comprising more than half and industry (including construction) taking up the pronounced, dramatic and sustained in few macroeconomic time series, anywhere in the world. The title "slow death" is not a light one to use. It reflects the ongoing gradual, decade by decade decline in the size of a sector which supports the largest share of households in rural areas and has a decreasing share of measured output.

This is a familiar aspect of development called "structural transformation". It has been documented by Kuznets (1973) in the now developed

economies. It is the work of Chenery and Syrquin (1975), who followed typical patterns in a wide cross-section. The canonical theoretical explanation of the shift of labour from traditional agriculture (where there is surplus labour) to the modern non-agricultural sector was provided by Lewis (1954). Timmer (1988) gave emphasis to the importance of agricultural productivity to both the transition and its hindrance. Later work by Herrendorf et al. (2014) and McMillan et al. (2014) has been able to make this analysis more precise, within the context of the modern growth literature. This empirical regularity is evident in all these strands: as economies grow, the share of agriculture in output declines, urbanisation increases, and labour moves from agriculture to industry and services.

The mechanism is the part that is not common to the Nepali case. The textbook version is that the transition is a result of gains in productivity in agriculture, leading to labour being released and the relative price of food falling, and industrial absorption of labour. In Nepal, agricultural productivity growth has been modest, industrialisation has been limited, and out-migration from agriculture has been in substantial part to the construction sector and to low-end service jobs and to foreign labour markets in the Gulf states, Malaysia, and India (NRB, 2022; Sharma, 2014). Remittance inflows have surged into rural economies to approximately 22-25 percent of GDP and have transformed the rural economy from afar (World Bank, 2023). The Nepali transformation, that is, is thus structural and not classical.

There are three objectives of this paper. The first is to empirically identify the long-run relationship between agriculture's share of GDP and the classic factors of structural change – which are income, urbanisation, remittances and trade openness – and employ almost half a century of annual data. The second one is to examine the Granger causality flow direction of these variables with the agriculture share. The third is to learn policy lessons from the empirical pattern in terms of a country where the transformation is driven not by productivity within the sector, which is contracting, but by external labour markets and demand-side influences. The rest of the paper is in the IMRaD format.

METHODS

Theoretical framework and literature

There are three pillars of the theory underlying the study of the decline of agriculture's share. The first is the income elasticity of the demand for food. According to Engel's law, the proportion of food expenditure decreases as the level of income increases, and consequently, the relative importance of agriculture diminishes. The other one is the Lewis (1954) two-sector model, in which the labour flows from a low-productivity traditional sector to the modern sector, where it has a higher productivity as wages are higher in the modern sector, which draws the labour across the sectoral boundary. The third is the more general development perspective of Chenery and Syrquin (1975), which assumes that structural change is a complex process of production, employment, demand, and trade at the same time.

Despite the small number of studies on structural change in Nepal, the number of studies is increasing. The lack of an industrial middle class in the country's transformation was the argument put forth by Sharma (2014), who attended to the fact that labour has mostly shifted from agriculture to the service industry and foreign labour markets. Bhattarai (2014) analyzed the sectoral growth and found that manufacturing has been lagging behind the rest of the sectors. The role of remittances in the role of labour withdrawal from agriculture and enhancing consumption was reported by Sapkota (2013) and Karki Nepal (2016). Adhikari (2015) has applied a time-series approach to analyze the sectoral shares, but failed to include the agriculture share in a multivariate cointegrating framework with the standard structural transformation drivers. The present study attempts to address this issue and bring the canonical drivers together in a single VECM, and therefore asks what the data do say about the long-run relationships and the direction of causality.

Data and variables

The number of observations is 49, which is the annual data from 1975 to 2023. There are 5 variables that enter into the system. The percentage of Agriculture's contribution to GDP (AGR) is sourced from the Central Bureau of Statistics (CBS, 2023) and verified with World Development Indicators (World Bank, 2023). The income channel is captured by real GDP

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per capita (GDPPC) (in constant 2015 USD). Urbanisation (URBAN): Percent of population residing in cities. Remittance inflows (REM) are personal remittances received as a per cent of GDP. Trade openness (TRADE) is the percentage of total trade (goods & services) to GDP. The last four variables are from the World Development Indicators. All variables are in natural logs and are called "lnAGR", "lnGDPPC", "lnURBAN", "lnREM", and "lnTRADE," respectively.

The variables are related to the theoretical framework. Income exhibits the demand-side compression of agriculture and Engel's law. Urbanisation is a direct measure of structural change and a good proxy for the non-agricultural labour demand. Remittance inflows occur for Nepal-specific reasons, but are shared in other labour-exporting economies: these draw labour away from agriculture, underpin rural consumption and influence rural production choices. Trade openness reflects the integration with the global economy, which may be squeezing domestic agriculture by low-cost imports or enlarging it by export opportunities. The 49-year window encompasses the entire post-1975 period, including the long-drawn-out monopoly rule, the 1990 multi-party transition, the period of the Maoist conflict, the post-2006 political reconstruction, and the 2015 earthquake, among other factors.

Econometric strategy

The analysis is carried out in the usual order that is applied in the practical work of time series. The order of integration of each series is first determined by the Augmented Dickey-Fuller (Dickey & Fuller, 1979) and Phillips-Perron (Phillips & Perron, 1988) unit root tests. The Schwarz information criterion is used to select the lag length in the specification of the ADF. In case the order of integration is the same for all the series, the cointegration procedure outlined by Johansen (1988, 1991) is implemented, and the test statistics trace and max-eigenvalue are presented.

Once the cointegration is determined, a vector error correction model is used to jointly estimate the long-run relationship and the short-run dynamics. Then the Granger causality is tested in the framework of the VECM. Wald tests are used for testing short-run causality on the lagged differenced terms. The statistical significance (p-value) of the error correction term in each equation is used to investigate the matter of long-run causality. If the ECT in the agriculture share equation is negative and significant and the ECTs in the remaining equations are insignificant, this would indicate long-run causality from the drivers towards the agriculture share.

All the estimation is performed using EViews 12 software. The Akaike and Schwarz criteria are used to choose the lag length in the VECM. Diagnostic tests include tests for serial correlation, heteroskedasticity, normality of the residuals and stability of the parameters using CUSUM and CUSUM of squares plots.

RESULTS

Descriptive Statistics

Table 1 provides a summary of the simple characteristics of the five variables when they are logged. The share of agriculture in GDP was 71.6 percent in 1975 and 23.9 percent in 2023. The real GDP per capita has about tripled. Urbanization has increased from less than 5 to more than 21 per cent. The remittance share of GDP was less than 1 per cent in the mid-1970s before increasing to more than 22 per cent towards the end of the sample period. Openness to trade increased significantly over the years, though with large fluctuations associated with political and external shocks.

Table 1
Descriptive statistics (variables in natural logarithms)

Statistic	lnAGR	lnGDPPC	lnURBAN	lnREM	lnTRADE
Mean	3.78	6.31	2.42	1.94	3.42
Median	3.81	6.28	2.46	1.71	3.46
Maximum	4.27	6.92	3.05	3.18	3.81
Minimum	3.17	5.84	1.61	-0.34	2.91
Std. Dev.	0.34	0.32	0.43	1.18	0.25
Skewness	-0.21	0.18	-0.27	-0.14	-0.32
Kurtosis	1.94	1.83	1.92	1.87	2.18
Jarque-Bera	2.71	2.94	2.83	2.61	1.74
Probability	0.258	0.230	0.243	0.271	0.419

Standard deviations are highest for lnREM, since the distribution of remittance receipts is extremely dispersed, and lowest for lnTRADE. Skewness values

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are moderate, with kurtosis values remaining near 2, which is common for trended series and slightly platykurtic. The Jarque-Bera test statistic is not significant at 5 per cent for any.

Unit toot tests

Table 2 provides the ADF and PP statistics for the five variables both in levels and first differences.

Table 2

Augmented Dickey-Fuller and Phillips-Perron Unit Root Test Results

Variable	ADF (Intercept)	ADF (Intercept + Trend)	PP (Intercept)	PP (Intercept + Trend)	Order
lnAGR	-0.81	-1.74	-0.94	-1.81	I(1)
lnGDPPC	-0.62	-1.58	-0.78	-1.69	I(1)
lnURBAN	-1.05	-1.92	-1.18	-2.01	I(1)
lnREM	-1.27	-2.06	-1.34	-2.13	I(1)
lnTRADE	-1.41	-2.21	-1.49	-2.27	I(1)
ΔlnAGR	-5.18***	-5.31***	-5.24***	-5.39***	—
ΔlnGDPPC	-4.92***	-5.04***	-4.97***	-5.11***	—
ΔlnURBAN	-4.46***	-4.58***	-4.51***	-4.63***	—
ΔlnREM	-4.87***	-4.98***	-4.82***	-4.94***	—
lnTRADE	-5.04***	-5.16***	-5.09***	-5.21***	—
5% critical value	-2.93	-3.51	-2.93	-3.51	—

Note. *** denotes rejection of the null of a unit root at the 1% significance level. Δ is the first-difference operator.

The unit root null is not rejected in any of the five series at levels. All variables are rejected at the one per cent level using ADF and PP statistics after first differencing. All five variables are thus I(1), which is the assumption of the cointegration test.

Lag length and cointegration test

Table 3 presents the selection criteria for lag lengths obtained from the unrestricted VAR. The Schwarz and Hannan-Quinn criteria indicate that there are two lags, and the Akaike criterion indicates there are three. Since the sample size is small, and it is important to keep the model as simple as possible, the VECM has only two lags.

Table 3

VAR Lag Length Selection Criteria

Lag	LogL	AIC	SC	HQ
0	-41.62	2.027	2.229	2.103
1	184.71	-6.487	-5.273	-6.034
2	218.94	-6.713	-4.483*	-5.842*
3	238.41	-6.821*	-3.575	-5.534
4	247.62	-6.486	-2.224	-4.781

Note. Asterisks indicate the lag length chosen by the respective criterion.

Table 4 provides the Johansen trace and maximum eigenvalue statistics for the five variable system for which the intercept was included in the cointegrating equation and VAR.

Table 4

Johansen Cointegration Test Results

Null Hypothesis	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
r = 0	94.27***	69.82	42.18***	33.88
r ≤ 1	52.09	47.86	23.74	27.58
r ≤ 2	28.35	29.80	14.62	21.13
r ≤ 3	13.73	15.49	8.91	14.26
r ≤ 4	4.82	3.84	4.82	3.84

Note. *** denotes rejection of the null at the 1% level. r denotes the number of cointegrating vectors.

The trace statistic for the null of no cointegrating vector is 94.27, which is much higher than the 5% critical value of 69.82 and hence this null is rejected. In the case of at most one cointegrating vector it is below the critical value in the trace test, and the maximum eigenvalue test is supportive. One cointegrating vector is found and this can be understood as the long-run structural transformation

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relationship.

Table 5

Normalised Long-Run Cointegrating Equation (dependent variable: lnAGR

Variable	Coefficient	Standard Error	t-statistic	p-value
lnGDPPC	-0.34	0.067	-5.07***	0.000
lnURBAN	-0.41	0.084	-4.88***	0.000
lnREM	-0.17	0.041	-4.15***	0.000
lnTRADE	-0.09	0.038	-2.37**	0.022
Constant	8.94	0.612	14.61***	0.000

Note. ***, ** denote significance at the 1% and 5% levels. Equation normalised on lnAGR.

The long-run equation reads lnAGR = 8.94 - 0.34 lnGDPPC - 0.41 lnURBAN - 0.17 lnREM - 0.09 lnTRADE. All four explanatory variables have negative signs, which is in line with the theory. In the long run, a 10% increase in real GDP per capita cuts the share of agriculture by approximately 3.4%, a comfortable range of income elasticities found in cross-country analyses of structural change. Urbanisation has the highest coefficient of -0.41, which indicates that urbanisation is the most important correlate of the decrease in agriculture in Nepal. Economically, the -0.17 remittance elasticity is significant and is indicative of the pattern of labour market pullouts from farming by foreign labour markets. Trade openness has a small but statistically significant negative effect, which is in line with the compression of domestic agriculture due to low prices for imported food, but the effect is not large.

Vector Error Correction Model

The VECM is estimated with two lags in the differenced terms, when one cointegrating vector has been given. Each equation has an error correction term shown in Table 6.

Table 6

Error Correction Term Estimates from the VECM

Equation (dependent variable)	ECT Coefficient	Standard Error	t-statistic	p-value
ΔlnAGR	-0.22	0.061	-3.61***	0.001
ΔlnGDPPC	-0.04	0.052	-0.77	0.446
ΔlnURBAN	0.02	0.018	1.11	0.273
ΔlnREM	0.13	0.124	1.05	0.300
ΔlnTRADE	0.06	0.071	0.85	0.401

Note. *** denotes significance at the 1% level. The ECT is the lagged residual from the cointegrating equation in Table 5.

The agriculture share equation has an error correction term equal to -0.22 and significant at the one per cent level. Approximately 22% of the change from the LR equilibrium is corrected in 1 year. This adjustment speed is moderate and is appropriate for a structural variable that is slow to react to changes in the underlying drivers. In the equation for GDP per capita, as well as for urbanisation, remittances, and trade openness, the ECTs are small and statistically not significant. The agriculture share is the only one that must adjust to restore the long-run equilibrium, and the four drivers act as if they were exogenous in the long run. This is the trend one would expect if the structural transformation is driven by forces of income, demography, and labour markets rather than by changes in the agricultural sector as such.

Granger Causality

Wald restrictions on the differenced lagged terms are used to test for short-run Granger causality. The significance of the ECT is read to determine the long-run causality. The major directions of interest are indicated in Table 7.

Table 7

Granger Causality Test Results from the VECM

Direction of Causality	Chi-square (Short Run)	p-value	ECT (Long Run)	Conclusion
ΔlnGDPPC → ΔlnAGR	13.62***	0.001	-0.22***	Causality
ΔlnURBAN → ΔlnAGR	16.41***	0.000	-0.22***	Causality
ΔlnREM → ΔlnAGR	8.74**	0.013	-0.22***	Causality
ΔlnTRADE → ΔlnAGR	3.21	0.201	-0.22***	Long-run only
ΔlnAGR → ΔlnGDPPC	2.18	0.336	-0.04	No causality
ΔlnAGR → ΔlnURBAN	1.62	0.445	0.02	No causality

Direction of Causality	Chi-square (Short Run)	p-value	ECT (Long Run)	Conclusion
ΔlnAGR → ΔlnREM	1.81	0.405	0.13	No causality

Note. ***, ** denote significance at the 1% and 5% levels. → reads as "Granger-causes".

The null hypothesis that GDP per capita does not Granger-cause the agriculture share is rejected at the one per cent level. Urbanisation has a Granger cause on the agriculture share with a chi-square value of 16.41. Remittances do so at the 5 percent level. The agriculture share is influenced by trade openness only by the long-run cointegrating relationship, which indicates that the compressive impact is a long-term phenomenon. All of the reverse directions are not statistically significant. It is a picture of unidirectional (pure) causality from the structural change drivers to the agriculture share, and no feedback from the agriculture share to the overall economy in this empirical setting. This is in line with the diagnosis that Nepal's structural transformation is not an outcome of agricultural transformation, but has been pulled by external forces, especially labour markets and remittances.

Diagnostic Checks

Table 8 presents residual diagnostics for the estimated VECM.

Table 8
Diagnostic Tests on the VECM Residuals

Test	Statistic	p-value	Conclusion
Breusch-Godfrey LM (serial correlation)	28.91	0.371	No autocorrelation
White (heteroskedasticity)	192.74	0.298	Homoskedastic
Jarque-Bera (multivariate normality)	10.42	0.404	Normal residuals
CUSUM (stability)	Within bounds	—	Stable
CUSUM of squares (stability)	Within bounds	—	Stable

Note. All tests at the 5% significance level. LM and JB tests are multivariate versions appropriate for the five-equation system.

There is no evidence of serial correlation, heteroskedasticity or non-normality for the residuals. Both CUSUM and CUSUM of squares plots are within the five percent confidence limits throughout the sample, even in the politically volatile late-1990s and early-2000s. The model is well specified and the inference of the previous sub-sections can be considered reliable.

DISCUSSION

The main result is that the loss of agriculture's relative contribution to GDP in Nepal can be statistically attributed to a tidy list of long-run forces: the growth of income per capita, urbanisation, remittance inflows and to a lesser extent trade openness. The cointegrating equation provides the anticipated negative sign for all four drivers and all four are statistically significant, while Granger causality goes from the drivers to the agriculture share and not the other way. The error correction term indicates that about 22 percent of all deviations from the long-run equilibrium is corrected within a year, providing the relationship with empirical force even in the short run.

The descriptive data suggest rather than prove a story that the size of the coefficients tells. The strongest correlation with the agricultural decline is urbanisation with elasticity of -0.41. This is logical in a country where the proportion of people living in urban areas is more than quadruple the sample and where urbanisation in Nepal frequently leads to low-end service and construction jobs for people who come from rural areas rather than to jobs in manufacturing. Income has a classical Engel-curve elasticity of -0.34. Economically significant remittances, which have an elasticity of -0.17, are a uniquely Nepali channel through which the structural transformation has been pulled along.

What is noteworthy in this empirical setting is that there is no impact of agriculture on the rest of the economy. The classical Lewis-Timmer story is that increases in productivity in the agricultural sector free up labour, reduce the price of food, and generate the surplus to fuel industrialisation. That is not evident in the Nepali data. The other variables do not seem to be influenced by the agriculture share, while agricultural transformation has an impact on them.

Some authors have termed this a "premature" structural transformation, in which the agricultural sector's share will be reduced without a productivity basis to ensure its sustainability (Sharma, 2014). The labour that has abandoned farming has not been picked up, for the most part, by a vibrant industrial economy. It has largely dispersed to other countries, and the remittances it remits have also hastened rural out-migration.

The policy implications are unpleasant, but it's important to be forthright. For one, the farm industry cannot be allowed to die a quiet death. The sector's relative decline would be slowed by investment in productivity-raising activities such as irrigation, seed systems, agricultural extension, and post-harvest infrastructure and, more importantly, make the sector more resilient for the rural households that are still reliant upon it. Second, there is a need to consider the absorptive capacity of the non-farm economy seriously. If labour continues to go out of farming and neither domestic industry nor productive services can absorb it, the only way to get rid of an individual problem is to resort to foreign migration, which solves an individual problem at the cost of national long-run capacity. Third, remittance-led structural change – while a reality – is precarious. The impacts highlighted here are contingent on the perpetuation of labour migration and regular flows. Either one or the other, such as a change in destination country policy or a global shock, would reveal the extent of a transformation that has been pulled.

There are several caveats to note. The model assumes the structural environment to be relatively constant, as is corroborated by CUSUM tests, but does not completely explain the discrete political and institutional changes the country has undergone during the period. The agriculture share is a residual in the sense that the share of agriculture is a product of changes in other sectoral shares; thus, part of the dynamics being captured here is mechanical compositional change. Some potentially important variables like agricultural productivity, foreign direct investment, and the real exchange rate are not included in the model, either to avoid the loss of degrees of freedom or because long series data are not available before the mid-1990s. Future research could incorporate these variables when more and longer time series become available, analyze sub-sectoral dynamics in agriculture, and integrate the time-series evidence with household-level panel data.

CONCLUSION

The primary aim of this study was to explore the gradual downfall of agriculture in Nepal's GDP from 1975 to 2023 and understand the driving factors behind this trend. The results achieved with the 5-variable VECM (agriculture share, real GDP per capita, urbanisation, remittances, and trade openness) show that all variables are integrated of order one and all variables belong to a single cointegrating relationship. The long-run equation indicates that all variables, namely income, urbanisation, remittances, and trade openness, significantly contribute to reducing the agriculture share, with urbanisation having the highest coefficient. The results of Granger causality are unidirectional from drivers to agriculture share, and there is no significant reverse feedback.

The interpretation of the real but unconventional structural transformation in Nepal can be understood in the light of the empirical pattern. The compression of agriculture is not due to a productivity-induced out-migration from agriculture but due to a pull of migration, whether it be to urban service jobs or foreign labour markets, and the demand effects of the rising income and remittances. The transformation is statistically well-founded but has weak bases. The message for the policy makers is that the gradual demise of the agriculture share cannot by itself be construed as a successful development. The important question is whether the work that has abandoned farming is being used in productive pursuits at home, and there, the figures are not as cheerful as the totals would indicate.

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