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ARTICLE

Agricultural Economic Growth in Immediate Regions of Mato Grosso, Brazil: The Impact of Institutional Changes since the Military Regime

Daves Cordova [1], Diego Procópio [2], Alexandro Ribeiro [3], Leonardo de Souza [3], Arturo Zavala [3]*

[1] *State Court of Accounts of Mato Grosso, Cuiabá 78049-915, Brazil*

[2] *Department of Animal Science and Rural Extension, Federal University of Mato Grosso, Cuiabá 78060-900, Brazil*

[3] *Faculty of Economics, Federal University of Mato Grosso, Cuiabá 78060-900, Brazil*

ABSTRACT

This article examines the reason why growth in Mato Grosso's Immediate Regions has been diverging since the 1960s. The hypothesis is that difference came from the institutional changes, which were initiated during the Military Regime (1964–1985). This theoretical framework applies New Institutional Economics with an augmented Solow growth model, to investigate how the preexisting extractive institutions were replaced by inclusive ones, namely Land Market and Transports, to modify the path of regional development. The methodology applies an estimation by Two-Stage Least Squares (2SLS) regression and a Spatial Durbin Model (SDM) with Agricultural Census data, from 1975 to the 2006. The findings reveal a significant regional division driven by these two institutions. Regions integrated into new infrastructure hubs and marked by the effects of Land Market, such as Sorriso along BR-163 and Primavera do Leste along BR-070, exhibited increasing returns to scale and reduced transaction costs. This institutional quality led to the division, which marks the emergence of a new institution, Rural Enterprise, which is the synthesis of the previous two. Conversely, regions with former institutions, remnants of the colonial era, such as Cáceres, experienced stagnation. Therefore, the study empirically validates the Seven Theses on the Brazilian Rural World, demonstrating a structural shift from land-

*CORRESPONDING AUTHOR:
Daves Cordova, State Court of Accounts of Mato Grosso, Cuiabá 78049-915, Brazil; Email: daves.cordova@gmail.com

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expansion-based growth to a model driven by technological intensification and capital accumulation in the 21st century. Ultimately, the research concludes that specific institutional reforms fostered Schumpeterian creative destruction, establishing a new, technologically intensive capitalist agriculture that defined the state's economic trajectory.

Keywords: Agricultural Production; Extractive Institutions; Inclusive Institutions; Land Market; Rural Enterprise

1. Introduction

Mato Grosso's development mirrors Brazil's historical trajectory of raw products, given its status as a leading global supplier of agricultural products [1,2]. However, this comparison is not accurate when considering the institutional changes that occurred within the state during the second half of the twentieth century.

In the first half of the 20th century, economic institutions in Mato Grosso were marked by raw products, concentration of activities, a deficient labour market, and a relative lack of dynamism (p. 26) [3]. Following the Green Revolution, from the 1970s in Brazil, these extractive institutions were replaced by potentially inclusive ones.

Driven by institutional changes in the 1960s that brought the Green Revolution to the state, the Military Regime (1964–1985) transformed the Mato Grosso economy into a sophisticated Rural Enterprise.

To understand this outcome, it is necessary to turn to New Institutional Economics. Institutions are the rules of the game in a society, providing mechanisms that guide economic behaviour.

By establishing formal and informal rules, they decrease uncertainty and reduce transaction and production costs. The lower the costs, the higher the growth, as productivity increases, because property rights are clear and secured.

A framework for classifying the type of institutions that may have shaped Mato Grosso's path is provided by Acemoglu and Robinson. As they conclude, inclusive or extractive institutions are the fundamental cause of long-term economic divergence (pp. 96–100) [4].

They define inclusive institutions as being both sufficiently centralised and pluralistic, while arguing that this fosters sustainable growth. Without either of these characteristics, they tend to be extractive, limiting broad-based development.

With this framework, it is possible to use a national-level theory to explain the development of regional portions of a nation, Brazil, in a sector marked by structural heterogeneity. It is possible to explain why agricultural modern regions maintain borders with stagnating ones. This gap in the literature of growth can be addressed while the gap in the compatibilization of New Institutional Economics with Econometrics is addressed.

The aim is to understand how subsequent reforms in the Land Market and Transport infrastructure facilitated a new capitalist mode of production, epitomized by the Rural Enterprise. This new institutional framework was a synthesis that overcame key challenges to Mato Grosso's economy, enabling a surge in high-technology agricultural production starting in the 1960s.

Furthermore, the outcomes observed in this period provide empirical validation for the *Seven Theses on the Brazilian Rural World*. Specifically, they validate the establishment of new productive dynamics, competing interests, and structural heterogeneity. They also highlight the marginalisation of social concerns and the state's role in shaping the rural landscape.

A production function will be estimated to measure the growth divergence between regions operating under legacy institutions and those that transitioned to the new model. Such a function connects institutions to growth, as the response of labour productivity depends on the institutional setting, which in turn affects rates of return and economic expansion. This quantitative analysis will also assess the changed importance of land relative to technology in driving growth from the 20th to the 21st century.

The study concludes that the institutional reforms of the late twentieth century established the Rural Enterprise. This inclusive institution enables Schumpeterian creative destruction. It also highlights the importance of technology in advancing agriculture in the current century.

2. Materials and Methods

The impact of institutional changes can be measured by integrating them into the production function of Mato Grosso. As they occur in specific regions, it is possible to incorporate them by their location, which results in higher coefficients for the regions with institutional changes.

For this reason, the Solow neoclassical model of growth [5] is the analytical instrument to derive the production function. This model provides a framework for quantifying the relationship between production factors and production itself. In the context of Mato Grosso, land is the essential factor, not machinery; therefore, the key metric becomes how responsive output is to an increase in land per worker.

The model is enhanced by considering two further elements: technological progress and human capital. Technological progress is measured as Total-Factor Productivity (TFP), which Acemoglu and Johnson define as growth caused by technological innovations and increases in efficiency (p. 241) [6]. While the movement of human capital also helps to explain production increases, for the purposes of this model, its effects are encompassed within the broader labour variable [7].

However, the Solow model must be updated with the presence or the absence of inclusive institutions. The work of Jones and Romer [8] provides these connections. Their updated stylised facts of economic growth provide a lens to understand the interplay of population, productivity, and institutions. This framework explains the drivers behind the growth spurt in the Mato Grosso.

Their third fact, that growth rates vary with distance from the technological frontier, describes the presence of the sector's structural heterogeneity in Brazilian agriculture. It reflects a conflict between new, inclusive institutions and older, extractive ones inherited from the colonial era.

Their fourth underscore that input inefficiency hinders growth in developing economies, which describes the heterogeneity from the high-level productivity areas with the inclusive institutions to those with extractive ones. The fifth provides that capital per worker is rising globally, which can be described in the 21st century agricultural economy of Mato Grosso.

As the distance of the technological frontier diminishes from these areas of inclusive institutions, as the growth arises from the high-level productivity areas, and as the capital becomes prominent in the 21st century, institutional changes matter to growth. Such changes can foster a virtuous circle between population growth and the generation of innovative ideas, a dynamic driven by the extent of the market (Jones and Romer's first fact).

As the population grows, labour productivity (A_t) is expected to increase, but this is contingent on institutional conditions, represented by the variable γ. This relationship is shown in the growth condition in Equations (1) and (2):

$$\frac{dA_t}{dt} = \gamma L_0 e_t^n \tag{1}$$

$$\frac{dA_t}{dt} = \gamma \frac{dL_t}{dt} \tag{2}$$

Legend:

- $\frac{dA_t}{dt}$: Derived Labour productivity in relation to time
- γ: Institution
- L_0: Initial population
- n: Populational rate of increase
- L_t: Labour

Exogenous shocks to γ (institutional changes) and n (population growth) explain historical critical junctures. The Black Death, for example, fundamentally altered the labour market in Europe. In Western Europe, it improved conditions for the populace, whereas in the East, where landlords held greater power, it led to the erosion of labourers' freedoms. This differentiation in power dynamics is captured by the γ variable.

Shifting to Mato Grosso, its total agricultural output is the sum of production from its constituent cities, as presented in the Equation (3):

$$Y_t = \sum_{1}^{j} A_{jt} K_{jt}^{\alpha} L_{jt}^{1-\alpha} \tag{3}$$

Legend:

- Y_t: Total production
- A_t: Labour productivity
- K_t: Capital
- L_t: labour
- α: Coefficient
- j: Cities in Mato Grosso

For long-run stability, the population growth rate, n_j, must converge to zero in all cities. Local growth is therefore driven by this growth and local institutions (γ_j). This implies that TFP changes can result from exogenous institutional shocks or shifts in population growth.

With positive γ variables, it represents that inclusive institutions matter to growth, after the control of production factors. In the Solow model, through the lens of Jones and Romer, these institutions functioned as exogenous shocks that created different rates of return on savings. Therefore, they reinforced production growth channelled through the creative destruction of prior institutions. The contrast between these new inclusive institutions and the remnant of the colonial era helps to account for the structural heterogeneity of Brazilian agriculture.

Therefore, the Solow model explains *how* growth was achieved, while the New Institutional Economy explains *why* the paths of the Immediate Regions diverged. This framework uses the neoclassical model as a measurement tool. It posits that the exogenously defined γ variable causes the efficiency of capital and labour to differ between regions. Consequently, this approach rejects the model's underlying assumption of institutional irrelevance.

To estimate the production function, the data were organised into a panel for the Immediate Regions of Mato Grosso with corresponding geographical dummy variables. These are the aggregation of cities, which are structured from close urban centres to satisfy people's immediate needs. Hence, the metropolitan network is the principal element [9].

The data for this panel were taken from the Agro and Cattle Censuses for the years 1975, 1980, 1985, 1995, and 2006. Capital Stock data, which were missing from the 1995 Census, were constructed by taking the difference between the total value of agricultural goods and the value of land, 'Valor dos Bens Agropecuária total' and 'Valor dos bens terra' in the Census. WAP was constructed by interpolating an exponential function between the Demographic Census years of 1970, 1980, 1991, and 2010 to create annual estimates. Total Tillage is the total land area, which were calculated as the sum of the values from 'Utilização das terras – lavouras temporárias' and 'Utilização das terras – lavouras permanentes' variables, in hectares, which corresponds to 2.47 acres. Total Production corresponds to the total of produced goods in the agricultural sector, which corresponds to the variable 'valor da produção total'. TFP is calculated based on the difference between the rates of increase in production and the rates of increase in the supply of inputs [10]. They were described in **Table 1** below:

Table 1. Yearly Descriptive Statistics of Data.

Variable	Descriptive Statistics	Year				
		1975	1980	1985	1995	2006
Production	min	2122.54	1150.34	1499.6	334.43	394.52
(in 2010 Brazilian Reais R$)	max	354,378.4	369,928.1	422,731.7	486,277.6	794,159.4
	std	85,441.69	75,685.15	74,727.67	68961.1	140,401.3
	mean	52,571.44	61,990.49	68,244.57	37,754.05	75,162.3
	median	12,876.17	34,275.8	43,350.6	12,819.89	15,956.9

Table 1. *Cont.*

Variable	Descriptive Statistics	Year				
		1975	**1980**	**1985**	**1995**	**2006**
WAP	min	837.22	803	801.39	801.3	808.31
(in total number)	max	64,634.39	121,241	139,632	25,9822.7	336,018.2
	std	12,912.93	17,324.21	19,958.77	29,315.22	33,822.44
	mean	9675.11	11,278.09	12,174.9	13,194.34	13,311
	median	5423.69	6848	6972.44	6432.22	6311.58
Total Tillage	min	774.59	2107.8	1049.89	98.08	201
(in hectares)	max	72,930.8	142,826.4	293,779.1	437,035.4	500,481
	std	17,549.99	27,980.57	46,750.6	53,444.41	75,221.89
	mean	14,743.16	28,240.9	36,714.55	25,228.59	44,458.16
	median	8174.32	16,044.29	21,872.32	6715.57	12,078
Annual Investment	min	420.5	2958.18	1797.75	429.55	482.29
(in 2010 Brazilian Reais R$)	max	430,031.5	263,206.9	209,680.9	70,084.14	72,958.5
	std	75,806.19	42,076.89	45,522.19	10,872.21	11,331.83
	mean	36,811.95	44,895.77	54,986.47	11,104.66	12,062.68
	median	15,842.17	37,270.85	47,416.84	7167.06	8803.73
Capital Stock	min	21,424.01	28,892.1	42,411.42		−1.35
(in 2010 Brazilian Reais R$)	max	1,170,306	1,021,126	10,511,038		214,811.1
	std	274,221.9	209,657	1,370,113		25,313.73
	mean	236,478.2	289,150.8	724,952.8		17,753.85
	median	117,895.4	235,797	449,121.4		8073.57
TFP	min	−71,152.1	−169,172	−119,790	−253,265	−333,977
(Rates of increase in Production minus the rates of the other variables)	max	241,083.3	291,168.7	127,514.3	132,571.6	491,081.3
	std	64,554.16	59,856.41	40,773.64	34,957.65	81,490.36
	mean	28153.17	2639.05	16098.91	1709.81	19124.51
	median	5443.72	−4829	5259.04	−107.81	7.21

Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

This study analyses the data using a geographic panel organized according to the Immediate Regions of Mato Grosso. As shown in **Figure 1** below, these regions represent the areas of influence of urban centres, structured to meet the immediate needs of the population:

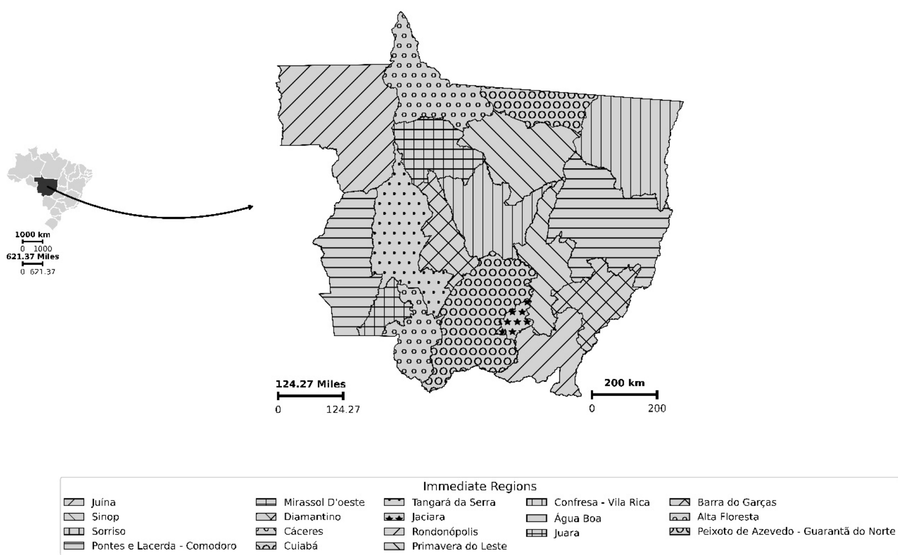

Figure 1. Map of the Immediate Regions of Mato Grosso and their Location in Brazil.

Source: IBGE [17]; Elaborated by the authors.

A model using Total Tillage as the sole independent variable would align with the literature on the Green Revolution in Brazil [18]. However, it would fail to explain the geographical distribution of agricultural growth. To address this, a 2SLS regression was employed. We used the full set of explanatory variables as instruments to generate predicted values for Total Tillage, which were then used as the final explanatory variable.

A two-stage least squares (2SLS) regression was employed to address potential endogeneity. A simpler regression could be misleading because reaching the land frontier is influenced by the extent of labour, investment, and technological means. The 2SLS method helps to isolate the true impact of factors like TFP and capital on production.

In the first stage, the potentially endogenous variable, Total Tillage, was regressed on the instrumental variables: Total Factor Productivity (TFP), Working-Age Population (WAP), Annual Investment, and Capital Stock. In the second stage, the predicted values of Total Tillage from the first stage were regressed against the dependent variable, Production.

First, to decide between a fixed-effects and a random-effects model, a Hausman test was performed. The null hypothesis of the Hausman test is that the random-effects model is appropriate because the unique errors are not correlated with the regressors. The alternative hypothesis is that the fixed-effects model is appropriate because such a correlation exists. If the test yields a statistically significant *p*-value, $p < 0.05$, the null hypothesis is rejected in favour of the fixed-effects model. Conversely, a non-significant *p*-value suggests that the random-effects model is more efficient and should be used.

The resulting model was then evaluated for heteroskedasticity under the null hypothesis of constant error variance (homoskedasticity). This procedure involves regressing the squared residuals from the initial model on the original independent variables. A *p*-value for the F-statistic below 0.05 leads to the conclusion that the model suffers from heteroskedasticity.

The model will also be evaluated for first-order autocorrelation against the null hypothesis that the errors are not correlated across time periods. To do this, the residuals from the initial regression are lagged by one period. The correlation coefficient between the original residuals and their lagged values is then computed. A statistically significant correlation coefficient leads to the conclusion that the model suffers from autocorrelation.

To see the potential spillover effects from the neighbours, a spatial model will be constructed to analyse if the coefficient of spatial interaction differs from zero.

As the panel is unbalanced, due to unavailable data for the cities in all the Censuses, an inverse distance matrix will be settled, to capture the economic influence which decays over the distance. It will be made using the geometric centroids of the boundaries, converted to a coordinate system. The threshold will be equal to three times the average nearest neighbour distance, to prevent islands, and finally, the matrix will be row standardized.

The testing method was to use a Spatial Durbin Model (SDM), which encompasses the spatial lag of the dependent variable, , and the independent ones, . Its implementation was based on the Elhorst procedure (pp. 39, 64) [19], which describes that adding the spatial error leads to weak identification of the parameters, as using the General Nesting Model (p. 23) [19].

The random model will be preferred, because the matter of interest is to maintain the effects, as explained for the non-spatial model. For this reason, a , parameter approaching 1 indicates that the model successfully captures the spatial heterogeneity of the regions, which is preferable to the non-spatial model.

If this is achieved, it is necessary to determine the regions' intercepts in a Geographically Weighted Regression with the spatial lagged coefficients, which are significant. If it is achieved, the data will be better described than the non-spatial model.

The data, code, and materials that support the findings of this study are openly available in the following GitHub repository: https://github.com/Econometric-data/Paths-agricultural-growth.

3. Results

In **Table 2**, the first stage of the regression analysis revealed that instrumental variables were statistically significant, and the strong F-statistic indicated that the chosen instruments were adequate:

Although the annual dummy for 1995 was omitted due to collinearity caused by missing capital stock data, the other time dummies are significant. The lack of statistical significance for geographical dummies can be attributed to the staggered emancipation of new municipalities, which creates an unbalanced panel. Nevertheless, most regional dummies achieve a *p*-value of at least 0.1.

A random-effects model was selected over a fixed-effects model to retain these crucial geographical variables. This decision is supported by a Hausman test result of 0.0501.

To ensure the reliability of the standard errors, the model was evaluated for heteroskedasticity and serial correlation. Firstly, a *p*-value for the F-statistic of 0.9445 in the regression of the squared residuals against the regressors indicates that there is no heteroskedasticity. However, the second test did not perform well due to the unbalanced panel. For this reason, it was assumed that the absence of heteroskedasticity is masked by the absence of data for all the periods, and the Huber-White estimators, as the Cluster method and Baltagi-Chang performed equally.

Table 2. Multiple OLS Regression to Logarithmic Total Tillage with Random Effects.

Dependent Variable		Total Tillage	
Independent variables			
lTFP	0.370^{***} (0.0438)	Peixoto de Azevedo—Guarantã do Norte (0.351)	−0.522
lWAP	0.267^{**} (0.108)	Juara (0.342)	0.841^{**}
lAnnual Investment	0.205^{***} (0.0638)	Barra do Garças (0.376)	0.878^{**}
lCapital Stock	0.182^{***} (0.0627)	Confresa—Vila Rica (0.369)	−0.238
Tangará da Serra	0.888^{**} (0.350)	Água Boa (0.505)	1.374^{***}
Diamantino	0.622 (0.435)	Rondonópolis (0.271)	0.676^{**}
Cáceres	−0.0716 (0.258)	Primavera do Leste (0.565)	1.441^{**}
Pontes e Lacerda—Comodoro	0.932 (0.582)	Jaciara (0.289)	0.578^{**}
Mirassol D’oeste	-1.186^{***} (0.452)	year1980 (0.198)	0.594^{***}
Sinop	0.422 (0.819)	year1985 (0.207)	0.460^{**}
Sorriso	1.750^{***} (0.326)	year1995 (.)	0
Juína	-0.455^{*} (0.249)	year2006 (0.254)	1.435^{***}
Alta Floresta	−1.323 (0.918)	Constant −1.063	−1.329
Wald chi2(24) = 7865.89		Prob > chi2 = 0.0000	
N		126	

Note: “l” before a variable’s name indicates logarithm of it, for example lTFP indicates logarithm of Total Factor Production; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Prob > chi2 = 0.0000.
Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

The second stage of the regression confirms that the Solow model, augmented with TFP, effectively explains growth in Mato Grosso. The high overall R-squared value (0.8619) indicates that production is significantly influenced by capital per worker, which is represented by land in this context. This stage is presented in **Table 3**:

Table 3. Generalized 2SLS to Logarithm of Production with Random Effects.

Dependent Variable	lProduction
Independent variables	
lTotal Tillage	0.850^{***}
	(25.65)
Constant	2.487^{***}
	(7.38)
N	126

Note: "l" before a variable's name indicates logarithm of it, for example lTFP indicates logarithm of Total Factor Production; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Prob > chi2 = 0.0000.
Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

As a regression of Production against Total Tillage explained more than three-quarters of the variance, instruments were not needed to explain production. However, they can explain the differences in the productivity of land, representing technology, capital stock, investments, years, but especially for the purposes of this paper, inclusive institutions. For this reason, a Hausman test for endogeneity is not the most appropriate, because a single equation describes the situation, but the Kleibergen-Paap test demonstrates that the instruments matter to describe Total Tillage and Production, as it reaches a *p*-value of 0.0423.

Furthermore, the panel is unbalanced, because the data were obtained through the cities, which become independent over the years. Merging them in the Immediate Regions to maintain the degrees of freedom according to the observations could not erase the missing data. Besides addressing problems with the instruments, it cannot be authorised to describe regional dependence, because the weights matrix could not be defined over the years.

The geographical coefficients reveal the impact of institutional changes in **Table 4**:

Table 4. Coefficients of Geographical Production Function in **Table 2** multiplied by **Table 4.**

Immediate Regions	Coefficient (Table 2)	Total Increment (Table 2 × Table 4)
Tangará da Serra	0.888^{*}	0.7548
Diamantino	0.622	0.5287
Cáceres	−0.0716	−0.06086
Pontes e Lacerda e Comodoro	0.932	0.7922
Mirassol D'oeste	-1.186^{**}	−1.0081
Sinop	0.422	0.3587
Sorriso	1.750^{***}	1.4875
Juína	−0.455	−0.38675
Alta Floresta	−1.323	−1.12455
Peixoto de Azevedo e Guarantã do Norte	−0.522	−0.4437
Juara	0.841^{*}	0.71485
Barra do Garças	0.878^{*}	0.7463
Confresa-Vila Rica	−0.238	−0.2023
Água Boa	1.374^{**}	1.1679
Rondonópolis	0.676^{*}	0.5746
Primavera do Leste	1.441^{*}	1.22485
Jaciara	0.578^{*}	0.4913

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Prob > chi2 = 0.0000.
Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

The regions of Sorriso (BR-163 hub), Primavera do Leste (BR-070 axis), and Água Boa (BR-158 axis) all benefited from new Land Market and Transportation institutions. Consequently, they exhibit production function coefficients of 1.4875, 1.22485, and 1.1679, respectively. These indicate increasing returns to scale relative to the control region of Cuiabá.

These regions, which half a century ago were not part of the agricultural sector, achieved production levels surpassing older, established regions. In fact, they achieve such a growth that shifts the growth inward into the state through these hubs and axes.

Conversely, regions without these changes, such as Cáceres and Mirassol D'Oeste, show lower or even negative coefficients. Therefore, those regions that were important to growth in times of Portuguese America and at times of Brazilian consolidation of frontiers do not accompany the other regions.

Other regions like Rondonópolis and Tangará da Serra show positive but smaller gains, reflecting partial exposure to these new institutions, such as proximity to a transport hub without being a centre of the new Land Market. The middle situation is in these regions which are sufficiently exposed to inclusive institutions to have gains but not sufficiently marked by those to have higher returns than the control region.

Applying the SDM model, it is possible to go further on the analysis, because it goes beyond where the production is high, as in the previous code. It describes that there are technological and labour spillovers, as the spatial lagged variables become significant on these (**Table 5**):

Table 5. SDM model for Logarithmic Total Tillage with Random Effects.

Dependent Variable	**lProduction**
Independent Variables	
CONSTANT	−0.3789
	(0.2103)
lTotalTillage	0.5228***
	(0.0624)
lTFP	0.2403***
	(0.0161)
lWAP	0.0950***
	(0.0174)
lAnnual Investment	0.2911***
	(0.0646)
lCapital Stock	−0.0805**
	(0.0262)
W_lTotal Tillage	0.0025
	(0.1271)
W_lTFP	0.0843*
	(0.0428)
W_lWAP	0.0882
	(0.0475)
W_lAnnual Investment	0.0090
	(0.1270)
W_lCapital Stock	0.0114
	(0.0310)
W_lProduction	−0.0191
	(0.0327)
phi	1.0000***
	(0.0633)
Observations	690
Pseudo R2	0.9190
Log Likelihood	−1232.3089

Note: "l" before a variable's name indicates logarithm of it, for example lTFP indicates logarithm of Total Factor Production; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

The lack of significance of other spatially lagged variables indicates that only TFP and WAP have spillover effects. Therefore, it provides significance for a cluster insight of production, in which technology and labour will be determinant.

For this reason, it can be moved to an SLX, Spatial Lag of X model, as the dependent variable is not significant, with only spatial lags for those significant explaining variables. Furthermore, it can be made a Geographically Weighted Regression to know the intercepts for each Immediate Region.

Despite the possibilities, the unbalanced panel pays a penalty to calculate the weights. The regions of Diamantino, Tangará da Serra, and Água Boa reach a zero division, and the others do not achieve significance except for the spatial lag of WAP in Cáceres and Confresa-Vila Rica and for TFP in Mirassol D'oeste, as demonstrated in the Frame (**Table 6**):

Table 6. SLX Geographically Weighted Regression with Random Effects.

Dependent Variable				lProduction						
Immediate Region	R^2	Obs	Cities	lTotal Tillage	lTFP	lWAP	lAnnual Investment	lCapital Stock	W_lTFP	W_lWAP
Cuiabá	0.911098	65	13	0.5747***	0.2265***	0.1735***	0.2219	−0.0443	0.0896	0.1112
				(0.1645)	(0.0381)	(0.0487)	(0.1663)	(0.0390)	(0.1316)	(0.1232)
Alta Floresta	0.890809	25	5	0.6530	0.3820*	0.1797	−0.0503	−0.1416	0.1509	0.4109
				(0.8134)	(0.1550)	(0.1713)	(0.8551)	(0.1320)	(0.3345)	(0.2123)
Rondonópolis	0.968843	50	10	0.4210***	0.1246***	0.0600	0.5127***	−0.0354	0.0554	0.1050
				(0.0808)	(0.0285)	(0.0407)	(0.0936)	(0.0281)	(0.0772)	(0.1131)
Confresa-Vila Rica	0.95284	65	13	0.1438	0.2053***	0.0294	0.6262**	−0.0027	0.3491*	0.0317
				(0.1834)	(0.0543)	(0.0423)	(0.1822)	(0.0655)	(0.1538)	(0.1054)
Barra do Garças	0.919783	45	9	0.5319**	0.2679***	0.3081***	0.0608	0.0312	0.0681	0.1996
				(0.1941)	(0.0600)	(0.0744)	(0.1992)	(0.0667)	(0.2029)	(0.1372)
Mirassol D’oeste	0.888851	45	9	0.5623	0.6203***	0.2620*	−0.2384	−0.0936	0.1892	0.4755**
				(0.3153)	(0.0963)	(0.1073)	(0.3305)	(0.0750)	(0.1837)	(0.1549)
Juína	0.99661	35	7	0.4909***	0.1623***	0.0558	0.4876***	−0.0631**	0.0135	0.0165
				(0.1221)	(0.0266)	(0.0317)	(0.1266)	(0.0188)	(0.0343)	(0.0222)
Pontes e Lacerda-Comodoro	0.949234	35	7	0.8173*	0.5093***	−0.0198	0.0228	−0.2408**	−0.1011	0.1352
				(0.3451)	(0.0894)	(0.0851)	(0.3496)	(0.0820)	(0.1516)	(0.1336)
Sinop	0.904672	60	12	1.0171***	0.3078**	0.0767	−0.3130	−0.1438	0.5927	0.1840
				(0.2829)	(0.0923)	(0.0785)	(0.2676)	(0.0774)	(0.3195)	(0.1314)
Cáceres	0.917702	25	5	0.7802	0.4517***	0.3869**	−0.1489	−0.1983	0.6186*	−0.0407
				(1.1292)	(0.1047)	(0.1004)	(1.0617)	(0.1102)	(0.2588)	(0.2224)
Jaciara	0.913348	20	4	1.3185*	0.4901**	0.1412	−0.7466	−0.0583	0.7702	−0.5929
				(0.5125)	(0.1486)	(0.1940)	(0.4974)	(0.1144)	(0.4336)	(0.4726)
Peixoto de Azevedo-Guarantã do Norte	0.999496	20	4	0.8352***	0.0534**	0.0250*	0.1784**	0.0294	−0.0862	−0.0021
				(0.0560)	(0.0141)	(0.0102)	(0.0567)	(0.0171)	(0.0460)	(0.0263)
Sorriso	0.998886	45	9	1.0642***	0.1258***	0.0297*	−0.2083	0.0424**	−0.0370	0.0162
				(0.1090)	(0.0187)	(0.0119)	(0.1414)	(0.0146)	(0.0339)	(0.0247)
Juara	0.992957	20	4	0.7966**	0.0625	0.0001	0.2410	0.0054	0.1185	−0.0446
				(0.1991)	(0.0605)	(0.0746)	(0.2134)	(0.0618)	(0.1460)	(0.1167)
Primavera do Leste	0.890648	15	3	1.1871	0.4473	−0.0938	−0.6193	−0.0061	0.1118	−0.0814
				(1.9031)	(0.6496)	(0.4042)	(1.7224)	(0.3205)	(0.7685)	(0.8611)

Note: “l” before a variable’s name indicates logarithm of it, for example lTFP indicates logarithm of Total Factor Production; W before a variable’s name indicates is spatial lagged value; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

Therefore, the SDM model explains why production is higher, due to TFP and WAP, while the IV model explains where it is higher. For this reason, both are significant, but for different purposes. The SDM model demonstrates that production is increased through the spatial lag of these variables, while the IV one demonstrates that this expansion was directed to specific regions, especially Sorriso, Primavera do Leste, and Água Boa.

For these reasons, the regional coefficients of the IV regress represent the estimations of the different institutional qualities (γj) for each Immediate Region (pp. 224–225) [8]. This is consistent with the findings of

Wuepper et al. (pp. 1, 26) [20] who describe that a better position of institutional quality represents an increase in yields. Specifically, an increment of ten points in the Fraser Index represents 2.2% more yield. On the other hand, Zhan et al. (p. 14) [21] reach a significant conclusion that land certification increases credit accessibility by a coefficient of 0.420. For this reason, the institution of the Land Market had the potential to increase agricultural production.

The superior performance of regions with new institutions demonstrates that these changes were important for agricultural growth. Furthermore, it represents a shift in Mato Grosso's agricultural focus, which spreads via the new institutions of Land Market and Transport to be synthesized in the newer one, the Rural Enterprise, which will be seen in the upcoming chapter. The emergence of this synthesis institution is represented in the SDM model through the spatial lag of TFP.

This analysis acknowledges a potential selection bias, as institutional changes may have been targeted at areas with favourable rainfall, relief, and soil. However, since the study's goal is to explain the divergence between high-growth and stagnant regions, this bias does not invalidate the conclusion that institutions were the key differentiating factor.

Chow tests were performed to detect two potential structural breaks in the IV regressions. The first test confirms that the Kandir Law [22] induced a significant structural break in the production function, creating the conditions for a subsequent boom in growth by lowering transaction costs for exports, in **Table 7**:

Table 7. Chow Test Made for Structural Break in the Production Function of Mato Grosso.

Regressions	Chow Test							Economic Conclusion
	n	SSR	DF-numerator	DF-denominator	Chow statistics	F tabled	p-value	
All years	387	216.1206918	22	343	0.253787885	0.554703946	0.00018983920	H0 rejected: Structural break reached Kandir Law modified production function
untill 1995	247	132.6288977						
only 2006	140	79.812138						
k+1	23	383						

Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

This aligns with the Jones and Romer framework, where an exogenous institutional shock (γ_j) alters the growth trajectory. The boom does not approximate the regions but accelerated its differentiation, providing the different returns of scale presented in the geographical coefficients of **Table 3** and being significant instruments, according to the Kleibergen-Paap test.

The second test reveals a structural break in TFP between the 1975–1985 period and 2006 in **Table 8**:

Table 8. Chow Test Made for Structural Break in the Coefficient of TFP.

Regressions	Chow Test							Economic Conclusion
	n	SSR	DF-numerator	DF-denominator	Chow statistics	F tabled	p-value	
All years	270	154.680624	23	216	0.34320257	0.559478151	0.001826	H0 rejected: Structural break reached TFP is not equal during 1975–1985 and in 2006
untill 1985	130	69.334694						
only 2006	140	79.812138						
k+1	24	270						

Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

Therefore, two things emerged in this test. First, it is consistent with the SDM model, which poses significance to the spatial expansion of TFP, while demonstrating that it is more prominent in the 21st century. Second, the fiscal consolidation of the central government directly affected total factor productivity (TFP) growth in Mato Grosso. This helps to explain why TFP gains were modest throughout the 1990s, only accelerating later. The withdrawal of the state also exacerbated problems for smaller producers who had settled in the 1970s and 1980s, leaving them vulnerable to the opportunistic behaviour of better-capitalised competitors.

This finding suggests that institutional quality functioned as a countermeasure to potential Dutch disease (p. 48) [23]. It is consistent with the development of the productive chain along the BR-163 [24] and points to a new phase where technology and capital—not just land expansion—became the primary drivers of wealth, confirming the 'Seven Theses of Brazilian Rural World'.

Furthermore, this study provides empirical evidence to explain the technological intensification of the nineties. It suggests that the factors that drove Mato Grosso's shift from land-intensive to technology-intensive agriculture can be used as a case study to understand Brazil's wider economic transformation. This transition was caused by the critical juncture that emerged through the exhaustion of the agricultural frontier. This occurred for two reasons: firstly, national fiscal consolidation resulted in reduced public support for land settlement; and secondly, stricter environmental regulations, such as the enforcement of the Forest Code, limited the availability of new land.

In conclusion, institutional changes, namely the Land Market and Transport infrastructure, drove differentiated economic growth in Mato Grosso, despite not being perfect. These institutions reduced uncertainty and transaction costs, facilitating the rise of the Rural Enterprise. This synthesis institution, which can be considered inclusive in the sense of Acemoglu and Robinson, fostered the creative destruction necessary to erode the remnants of colonial-era extractive systems and establish a new, dynamic capitalist agriculture.

4. Discussions

These results stem from institutional changes in the Brazilian Amazon and Cerrado economies that began in the 1960s. As described in the theoretical framework, these new institutions, represented by the γ variable in Equations (1) and (2), place labour productivity on a higher growth path. The coefficients for the Immediate Regions shown in **Table 3** reflect this, demonstrating how these institutional changes now affect their respective growth conditions.

Therefore, an exogenous shock was applied to the institutional variable, γ_j, for the cities, which were grouped into their Immediate Regions for the regression analysis in **Tables 1–3**. The impetus for these changes was not solely economic; it was also driven by the National Security Doctrine (DSN), which promoted Western and Christian values and used economic integration to pre-empt social unrest and neutralize foreign interests.

A key influence on this policy was the geopolitical vision of Brazil as an archipelago, rather than a continuous territory, by de Barros (p. 88) [25]. He identified a central nucleus comprising Rio de Janeiro, Brasília, and São Paulo, alongside three adjacent peninsulas in the Northeast, South, and Centre-West. In contrast, he described a vast, disconnected Amazon Island. This area was characterised by precarious infrastructure and a low population density. This perceived emptiness was viewed as a strategic vulnerability that could attract foreign powers.

The settlement of these areas was therefore also presented as a means of alleviating social tensions in the Northeast and South since agricultural modernisation could absorb surplus labour and counter revolutionary movements. In the context of the DSN, Amazon represented both a challenge to national progress and a risk to national security.

To address this question, a set of general policies was established. The National System of Rural Credit (SNCR), established in 1965, directed significant funding towards the agricultural sector. Designed to stimulate backward and forward linkages in line with import substitution industrialisation, it consolidated the agro-industrial complex.

In 1973, the Brazilian Agricultural Research Corporation (Embrapa) was established to lead research efforts, contributing to Brazil's future dominance in grains, fibres, and oilseeds [1]. In 1975, the Brazilian Company for Technical Assistance and Rural Extension (Embrater) was established to transfer modern technologies to rural producers.

These national policies were accompanied by region-specific initiatives. In Mato Grosso, a notable example was the Bureau for the Development of the Centre-West (SUDECO), established in 1967. Its purpose was to implement regional development programmes, which primarily took the form of expanding the agricultural frontier.

The National Integration Programme (PIN) of 1970 and the Land Redistribution and Agro-Industry Stimulation Programme (Proterra) of 1971 were the key initiatives undertaken by SUDECO. These programmes aimed to resolve land-related social issues, most prominently through the construction of major highways like the Transamazônica and the Cuiabá–Santarém (p. 27) [3].

These policies were subsequently integrated into the National Development Plans (1972–1979) and drove a significant expansion of the agricultural frontier into the Centre-West, especially during the 1980s. This expansion was fuelled by productivity gains from technological innovation [1], which derived from the investment in rural assistance through research and development. This can be traced as the distinguished factor between long-term productivity growth, as Fuglie and Wang [26], which is remarkable to Latin America, according to Tovilode and Moon (p. 45) [27].

The rationale behind state-led rural extension services such as Embrater can be understood through the lens of New Institutional Economics. Since farmers act with limited rationality and imperfect information, state assistance can mitigate uncertainty and reduce transaction costs. However, the fiscal consolidation of the 1980s and the subsequent abolition of Embrater in 1991 meant that direct state support became increasingly scarce, as shown in **Figure 2**:

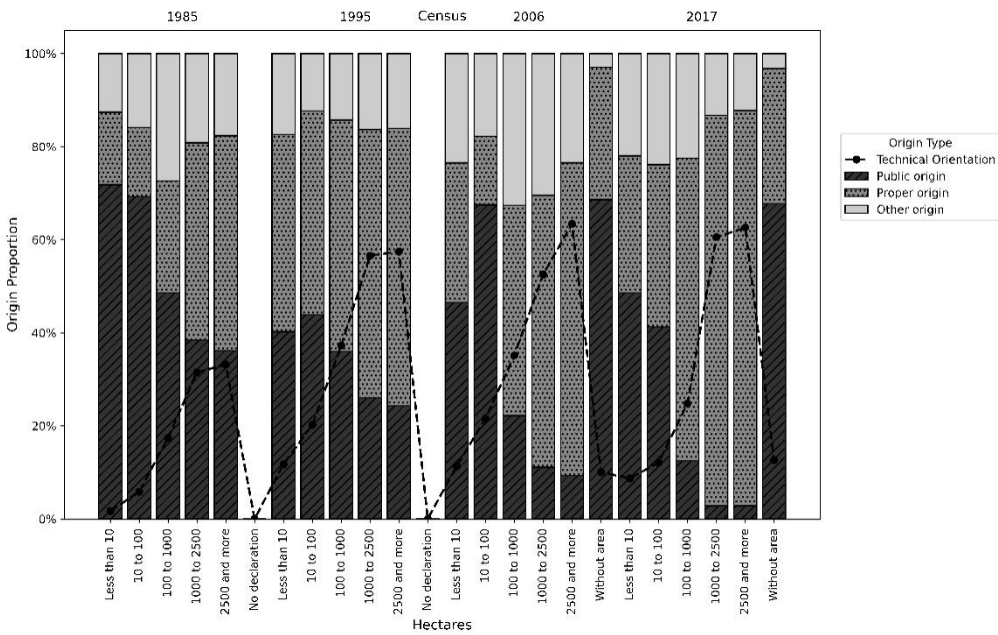

Figure 2. Technical Assistance: Coverture and Origin Proportions per Land Area (Agriculture/Cattle Census).
Source: IBGE, 1979–2006. Agro and Cattle Censuses: 1975 [11], 1980 [12], 1985 [13], 1995–1996 [14], 2006 [15] and Ipeadata Database [16].

The 1970, 1975 and 1980 did not have a question about these variables, hence the first time in which it appears is in 1985 Census. From this to 1995–1996, there is no tabulated data in Sidra, therefore the data will be taken from the published versions. Furthermore, they were aggregated into classes: Less than 10; 10 to 100; 100 to 1000; 1000 to 10,000; and 10,000 and more. As 2006 Census have its aggregation made in 1000 to 2500 and 2500 and more, linear interpolation was made with the other Census to adapt the data.

This reduction in public assistance did not affect all producers equally. As the Census data reveals, larger farms received more assistance from other sources, including private suppliers, and were less dependent on public aid. The proportion of private assistance increased with farm size in each census, and by the 2017

Census, it had become the sole source for the largest landholders.

These events represent a critical juncture, as described by Acemoglu and Robinson (p. 106) [4]. Motivated by geopolitical concerns, the central government sent federal agencies and introduced new legislation to these sparsely populated regions. This intervention disrupted the existing economic equilibrium, facilitating the subsequent rise of a new class of high-productivity farmers over the following decades.

However, this new institutional framework had mixed results. On the one hand, the centralisation of power by the state created a dynamic market in the new colonisation zones, fostering a form of pluralism where land could be acquired and developed. On the other hand, this system only benefited those with sufficient capital to purchase land and technology. While the new economic rules reduced uncertainty for these well-positioned individuals, the withdrawal of state support increased uncertainty for original settlers and led to displacement.

This transformation was built upon two main institutional pillars: the creation of a formal Land Market and the development of transport infrastructure. Therefore, it provided exogenous shocks to the reaching cities, which modified their growth condition, by altering its γ_j, or the institutions that rule their labour productivity, as in Equations (1) and (2).

The legal basis for the new Land Market was the 1964 Land Statute [28]. This federal initiative was possible because the Central Government was driven by its National Security Doctrine. As a result, it was in a much stronger position to implement its agenda than the state's traditional oligarchies were to resist it. The creation of this market had two objectives: to stimulate the colonisation of the frontier by establishing a formal mechanism for land transactions, and to alleviate social pressures in southern Brazil by providing an outlet for surplus labour [3].

For this reason, property rights secured by the Land Market could represent a source of agricultural productivity, as Chen et al. [29] demonstrated for Ethiopia. It functions as promoting incentives for investment as well as more efficient technologies, as A. J. Tovilode and W. Moon (p. 38) [27].

The primary manifestation of this policy was a series of state-sponsored colonisation projects that took place from the seventies through the late eighties. The influx of migrants, bringing with them their agricultural experience ('learning by doing'), led to an increase in production driven by population growth—a phenomenon linked to an increase in the working-age population (WAP).

Despite these intentions, the government's reliance on the Land Market as its central tool proved deeply problematic. For the market to function, a full suite of supporting factors was required: capital, effective public governance, rural extension, and credit (p. 23) [30]. These were often missing. From the outset, the effectiveness of the Land Market was constrained by fiscal limitations and a weak state presence.

Individuals were often drawn to colonisation projects by promises of production support and living infrastructure that frequently went unfulfilled. This reality is well-documented in academic research [30] and vividly portrayed in the 1984 documentary 'Os Homens do Presidente'. Filmed during the colonisation years, the documentary captures the riot that ensued when the government failed to honour its promise to purchase the colonists' rice harvest — a remarkable event during an undemocratic period.

These failures demonstrate that the Land Market alone could not regulate interactions and minimise transaction costs. The governance structure intended to manage this process can be seen as trilateral, involving the colonists, the colonising companies, and the state. However, with one pillar—the government—weakened by the limited capacity of the state of Mato Grosso and the fiscal consolidation of the central government, a space for opportunistic action arose. These foundational institutional changes did not function as intended.

The institution of the Land Market faced another critical juncture in 2012 with the enactment of the new Forest Code [31]. Article 12 of the Code stipulated that significant legal reserves be established on private property within the Legal Amazon, an area that encompasses Mato Grosso. The requirements were set at: 80 per cent of the property in forested areas; 35 per cent in the *cerrado*; and 20 per cent in other vegetation types.

This shift corresponds to the dynamic described by Becker (pp. 24–29) [32], concerning the Brazilian 'Heartland'. Following the exhaustion of the previous national development model after 1985, a combination of state crisis, social resistance, and international pressure generated a new 'techno-ecological' vector. This prompted a transition from a purely physical land frontier, governed by the original Land Market, to a new socio-environmental frontier governed by regulations like the Forest Code.

This trend reinforces the central thesis that rural development in Mato Grosso is entering a new phase. Capital investment and technology are becoming increasingly important for generating wealth in agriculture, which could reduce the importance of land ownership itself (pp. 1167–1169) [33].

Alongside the formation of the Land Market, the development of transportation infrastructure represented another pivotal institutional change in Mato Grosso. Highways provided crucial connections between regions, enabling the replacement of traditional economic practices with modern capitalistic ones. This process eroded the profound isolation that had historically challenged the state's economy through the eras of Portuguese America, the Brazilian Empire, and the First Republic. Following a policy direction initiated during the Juscelino Kubitschek years, the Military Regime prioritized road construction to connect Mato Grosso with the rest of the nation, as illustrated in **Figure 3**:

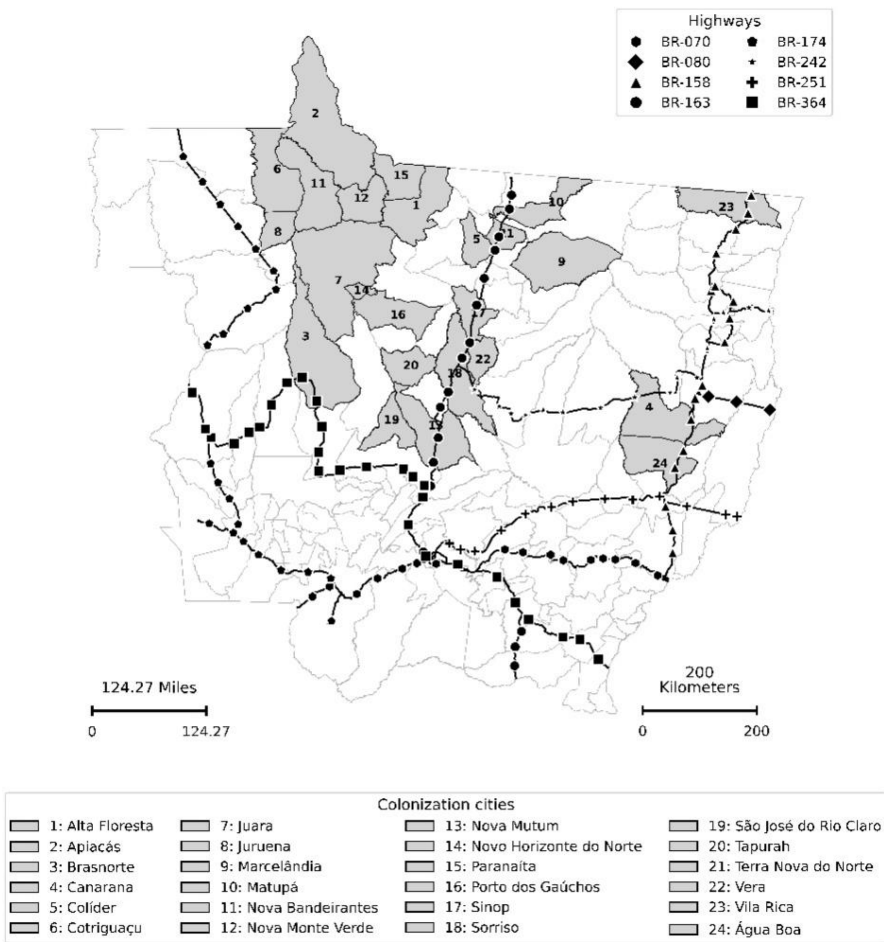

Figure 3. Projects of colonisation with federal highways in Mato Grosso (highways on a 2024 basis and projects by their cities on a 2024 basis).

Source: IBGE [17]; National Department of Transport Infrastructure [34]; Elaborated by the authors.

Highways can be understood as institutions because they establish new rules of engagement by reducing transaction costs and facilitating coordination. Data for Mato Grosso specifically supports this role for two key routes. The first, BR-163, functioned as a primary engine of change alongside the Land Market, particularly in the regions north of the capital. This highway transformed the outflow of grains by significantly reducing transportation costs and time (p. 18) [35]. In turn, it enabled the opening of new lands with soils suitable for mechanized agriculture.

The institutional impact of the second highway, BR-070, was more limited because the highway was never completed, and its route partly followed a colonial-era path. Such historical differences can trigger divergent outcomes at critical junctures (p. 106) [6]. Consequently, BR-070 did not uniformly reduce transaction costs across its entire length. Its transformative effects were confined to areas where it intersected with other institutional changes, such as the Land Market in Primavera do Leste, while having a negligible impact in places like Cáceres.

An analysis of Mato Grosso's federal highway network reveals a clear hierarchy. BR-163 functions as the state's central transportation hub, a primary north-south corridor that intersects with multiple other federal highways. BR-070, a major east-west axis, is complementary to BR-163, which it connects to. A secondary hub is emerging around BR-158 in the northeast, providing vital external connectivity for agricultural projects in municipalities like Água Boa and Canarana. Other routes like BR-364, BR-251, and BR-242 primarily serve to reinforce the dominance of the BR-163 hub and the BR-070 axis. In contrast, routes such as BR-174 and BR-080 are constrained by paving deficiencies or limited connections, restricting their impact [36]. This network structure means that colonisation projects in the state's northwestern quadrant, which lack direct federal highway access, face higher production and transaction costs. The superior connectivity offered by BR-163, and to a lesser extent BR-158, provides colonisation projects along their corridors a greater potential for economic growth.

In Mato Grosso do Sul, a state divided in 1977 from Mato Grosso [37], highway development received less intensive focus from the Military Regime. The state's main axis, BR-262, can be seen as subsidiary to BR-163 and does not offer direct connections to São Paulo.

Although the PROSUL programme was created to boost food production and agro-industries, its goals and financing were modest. In contrast, Mato Grosso's counterpart programme, PROMAT, was more extensively implemented, driven by both economic goals and the strategic geopolitical concerns of the National Security Doctrine (DSN). This discrepancy is detailed in **Table 9**:

Table 9. Performance PROMAT and PROSUL (1979–1984) in Cr$ 1.000 (one thousand 'Cruzeiros')/US$ 1,000.

Programmes	PROMAT		PROSUL	
Subprogrammes	Cr$	US$	Cr$	US$
Transport	2.104.529	1,661.03	1.511.811	1,193.22
Energy	691.545	545.81	373.589	294.86
Rural Development	1.487.079	1,173.70	129.000	101.81
Industrial Development	502.021	396.22	-	-
Telecommunications	177.300	139.93	245.144	193.48
Urban Development	1.376.264	1,086.23	147.000	116.02
Social Development	2.069.554	1,633.42	150.000	118.39
Public Edification	599.708	473.32	512.000	404.1
TOTAL	9.008.000	7,109.70	3.068.544	2421.89

Note: This table was prepared based on the average dollar value for March 1984 = 1267.00, according to information contained in its source.

Source: Abreu [38].

Consequently, Mato Grosso, which had a fragile economic base inherited from colonial-era extractive institutions, received significantly more funding for transformative development. In contrast, Mato Grosso do Sul, whose development had begun earlier in the twentieth century with infrastructure such as a railway, did not experience the same scale of change. This historical divergence helps to explain why the economic growth gap between the two states narrowed at the turn of the twenty-first century (**Figure 4**):

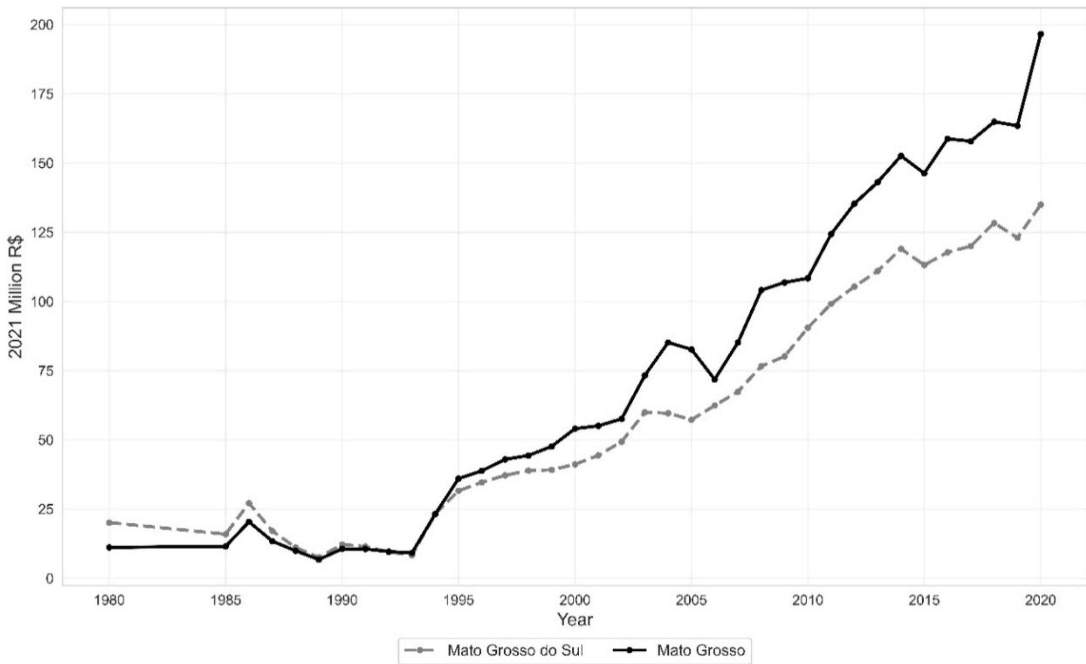

Figure 4. Mato Grosso and Mato Grosso do Sul GDP in 2021 million R$.

Source: Ipeadata, 1980–2021 [16]; Elaborated by the authors.

Transportation infrastructure plays a crucial role in economic development. By reducing transaction and production costs and facilitating coordination among economic agents, it helps to foster shared expectations (pp. 13–17) [39]. These very attributes are the defining characteristics of effective institutions.

Therefore, the presence of Transports and a Land Market result in higher regional production, a finding reflected in the larger geographical coefficients in **Table 3**. The particularly high coefficients for the regions of Sorriso, Água Boa, and Primavera do Leste support this conclusion. In fact, these results demonstrate that a new synthesis institution, the Rural Enterprise, has emerged in these areas.

The Rural Enterprise: A Synthetical Capitalistic Institution

This analysis connects the institutions of the Land Market and Transport in Mato Grosso to the theoretical frameworks of Acemoglu and Robinson and Jones and Romer. In Mato Grosso, creating the institutions of Land Market and Transport reduced geographical isolation and lowered transaction costs. This mechanism served to erode pre-existing extractive institutions, creating a new dynamic for labour productivity that corresponds to different values of the γ variable, from Equations (1) and (2), depending on the reach of these institutions.

Consequently, growth was channelled into a new institutional synthesis that Moreno termed the Rural Enterprise (pp. 286–288) [40]. Unlike regions that retained informal rules, areas with the Rural Enterprise fostered more formalized, capitalistic modes of coordination and greater economic dynamism. This outcome is reflected in the empirical results: regions with these improved institutions exhibit larger geographical coefficients in the first-stage regression, **Table 1**, which in turn lead to higher overall production, as shown in **Table 3**.

Even if the Rural Enterprise existed in a centralised, but extractive, environment, growth could still occur as elites allocated resources to high-productivity activities like commodity exportation. The situation is analogous to the *commendatore* of Venice, where elites permitted new institutions that facilitated creative destruction (pp. 152–157) [4].

This process of creative destruction in Mato Grosso can be understood through Rogers's innovation-decision model, which he categorises as optional, collective, or authority-based (p. 37) [41]. Within the Rural Enterprise—a system sharing features with Rogers's concept of an organisation—decision-making was rarely optional.

The inherent pressures for productivity, coupled with opportunistic behaviour, meant that few influential actors often guided technological adoption and adaptation (p. 248) [41]. This dynamic fosters a process of creative destruction, marginalising those who fail to keep pace with evolving standards. Such internal transformations, which drive out less productive systems, are a hallmark of the evolutionary process of capitalism described by Schumpeter (p. 83) [42].

This outcome resembles what Buainain et al. named Argentinisation of development, where agrarian progress is characterised by the dominance of large-scale, technologically efficient agriculture achieved alongside demographic depletion in rural areas (pp. 1179–1180) [33]. In this uncertain environment, opportunistic actions can flourish, leading to the consolidation of many smaller farms into fewer, larger ones.

In the Immediate Regions experiencing these institutional changes, the Rural Enterprise could therefore install a highly productive sector [43] with greater specialisation than in regions of older colonisation, a dynamism that is spreading to other sectors. In other Immediate Regions, the lack of centralisation and pluralism inherited from Portuguese America and the Republic persisted, maintaining stagnation.

The synthesis institution of the Rural Enterprise confirms the Seven Theses of the Brazilian Rural World [33]. The rise of this model is linked to groups of agricultural producers who emerged after the 1960s and, importantly, did not belong to the old, established oligarchy. This aligns with the trajectory of technological transformation that has since defined Brazilian agriculture. While the historical timeline is established, Buainain et al. note that the specific producers driving this change, and the details of the 1990s technological intensification [44], are not fully understood (pp. 1164–1165) [33]. Applying the framework of inclusive institutions and analysing the institutional changes from the Military Regime helps clarify the specific development path of Mato Grosso.

The Rural Enterprise serves as a point of confluence for the Seven Theses:

1. the foundation for a new productive dynamic was laid in the 1960s.
2. the process of technological diffusion was met with challenges from competing interests.
3. a duality of productive concentration and selectivity emerged, which data in this article addresses by highlighting structural heterogeneity.
4. certain social concerns were sidelined. This article focuses on economic growth but acknowledges the significant social implications of this heterogeneity.
5. the state's role, especially in providing technical assistance to smaller producers, diminished, reinforcing a concentrated, market-driven model.
6. a perverse tendency is noted where the children of rural workers migrate permanently to urban centres.

   The data in this study, however, diverges from the Sixth Thesis, as the Working-Age Population (WAP) shows a positive relationship with production. However, issues of income concentration and opportunistic behaviour were not researched.
7. the large-scale, technologically intensive model can lead to a demographic emptying of the countryside.

For these reasons, the Rural Enterprise serves as an empirical validation of the Seven Theses. However, the inclusiveness of this new system is constrained by opportunistic behaviour, which limits its capacity for genuine external market orientation.

While the emergence of a new productive chain along the BR-163 corridor helps to overcome prior deficiencies and add economic complexity, fundamental concerns remain (p. 19) [45]. The state's economy is still largely export-oriented and functions as a price-taker in global markets. This leads to the conclusion that another form of the Colony-Capitalist institution has emerged—one that is, however, more capable of overcoming the state's historical challenges.

The rise of the Rural Enterprise embodies the process described in the theses and reflects a fundamental shift in the region's economic institutions. As an inclusive institution, the Rural Enterprise alters the growth condition by increasing the value of γ, fostering the Schumpeterian creative destruction that drives regional differentiation. The resulting large-scale, technologically intensive model can lead to a demographic emptying of the countryside, which is the hallmark of the Seventh Thesis: the path toward an Argentinian model of development. The Rural Enterprise thus serves as a powerful framework for understanding how new institutions reshape growth conditions and empirically validate the Seven Theses in modern Brazilian agriculture.

5. Conclusions

The agricultural economic growth of Mato Grosso has been boosted by institutional changes since the 1960s. Despite imperfections arising from opportunistic actions, these changes differentiated the economic trajectories of the state's immediate regions by significantly reducing transaction costs, minimizing uncertainty, and enhancing coordination. Consequently, these reforms altered the institutional parameter, , governing growth in Mato Grosso. Therefore, this study serves as a powerful case study validating the structural transformations of the Brazilian rural landscape, as presented in the Seven Theses.

The Land Market and transportation networks were the foundational institutions that facilitated the emergence of the Rural Enterprise during the Military Regime (1964–1985). As a result, a dynamic economic center emerged along the BR-163 corridor, featuring three primary hubs: Rondonópolis, Sinop, and Sorriso. Other locations, such as Primavera do Leste, on the BR-070 axis, and Água Boa, on the BR-158 axis, are gaining prominence.

However, in the 21st century, technology became more determinant of growth than simple land expansion. This aligns with the first thesis of Buainain et al., describing a structural shift in the accumulation pattern from land to capital. The explosive growth in Total Factor Productivity (TFP) in dynamic regions, confirmed by the structural breaks identified in the Chow tests and the significant spatial spillovers (W_TFP) in the Spatial Durbin Model, sustains this modification.

The establishment of the Land Market and Transport networks enabled this transition, culminating in the Rural Enterprise. This synthesis institution, which consolidated between the 1990s and the 21st century, prioritizes capitalistic management and technological innovation. This new institutional arrangement represents a higher value of γ fundamentally changing the growth conditions for the regions where it took hold.

Its emergence also derives from Brazilian fiscal consolidation, which created an opportunistic space. Incorporating Mato Grosso into the agricultural frontier involved complexity, uncertainty, and asset specificity. In this environment, the necessary trilateral governance structures became less feasible due to the state's fiscal retrenchment.

As rural assistance diminished, the number of small farmers decreased. This dynamic confirms the fifth thesis, wherein the state's diminishing role in agricultural assistance prevented the new inclusive institutions from reaching their full potential for all actors.

Yet, even at this critical juncture, signs of institutional pluralism emerged. The centralization driven by the federal government in the late 20th century was accompanied by incentives for secure and profitable private property. This model created conditions to erode the vestiges of previous extractive institutions.

A key innovation of this study is its analysis of the regional economy through the modern New Institutional Economic framework developed by Acemoglu and Robinson. This approach is applied to a state historically marginalized in classical Brazilian social thought by connecting contemporary economic theory with historical explanations. It demonstrates how institutional changes altered the underlying growth conditions of Mato Grosso's diverse regions. This alteration is evidenced by their specific coefficients in the production function.

A second key innovation is the integration of this New Institutional framework with the Solow model through the lens of Jones and Romer. This combination culminated in the empirical validation of the Seven Theses. Specifically, it demonstrates the emergence of a new, high-technology growth pattern.

This transformation allowed the state to overcome structural challenges like isolation and dependence on São Paulo. Nevertheless, the state still exhibits the Colony-Capitalist duality, particularly regarding its orientation towards external markets and its status as a price-taker. Therefore, future research must monitor how this growth model evolves, particularly regarding the extent of social inclusion it can achieve.

Author Contributions

Conceptualization, D.C., D.P. and A.R.; methodology, D.C.; software, D.C.; validation, L.d.S. and A.Z.; formal analysis, D.C. and A.Z.; investigation, D.C.; resources, D.C.; data curation, D.C.; writing—original draft preparation, D.C.; writing—review and editing, D.P., A.R., L.d.S. and A.Z.; visualization, D.C.; supervision, D.P., A.R., L.d.S. and A.Z.; project administration, D.C. All authors have read and agreed to the published version of the manuscript.

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All data and code used in this analysis are available in an online repository: https://github.com/Econometric-data/Paths-agricultural-growth.

Conflicts of Interest

The authors declare no conflict of interest.

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