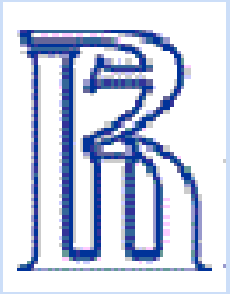

Non-parametric investigation of the Kuznets hypothesis for transitional countries

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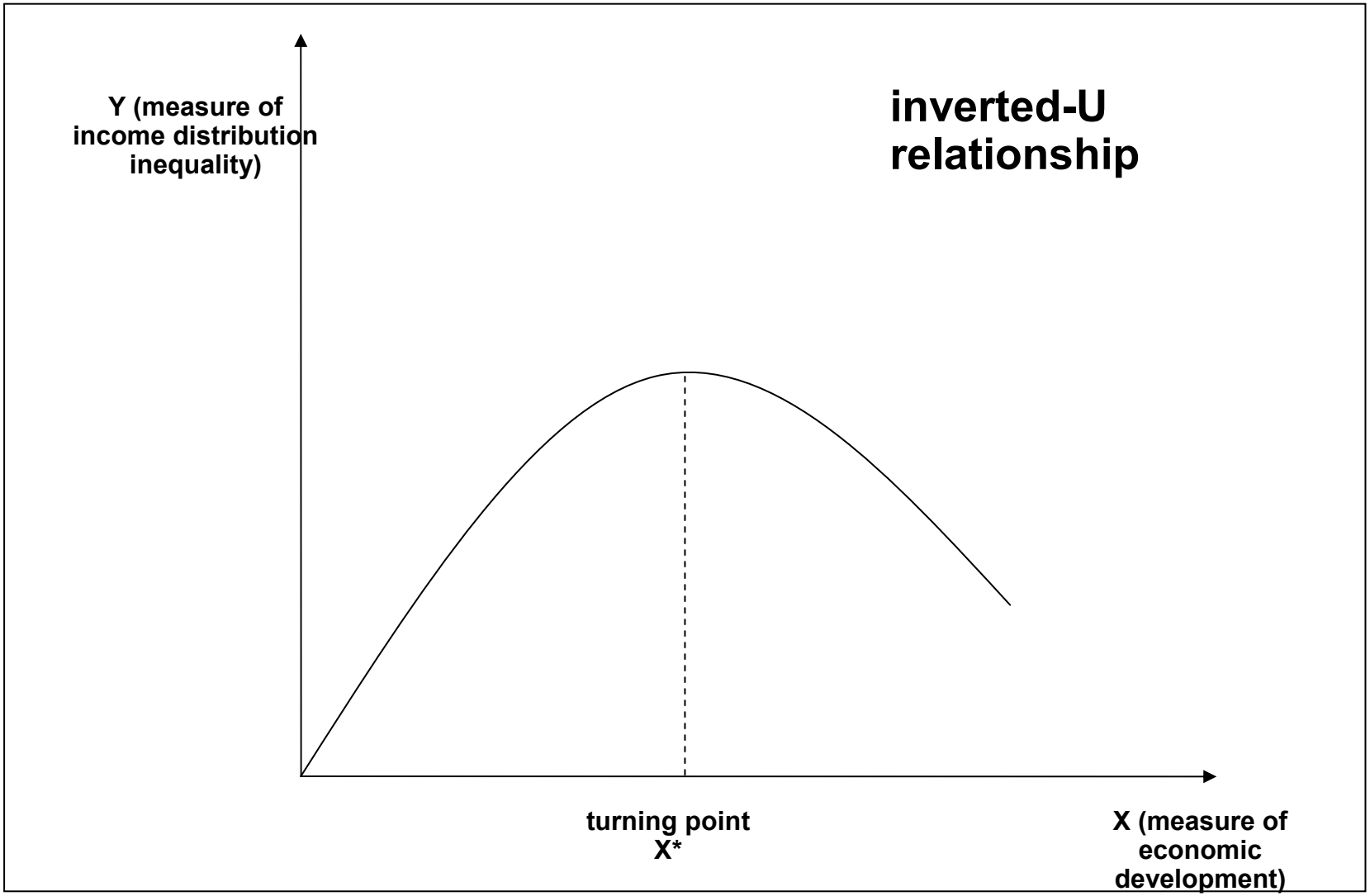
ECONOMIC GROWTH AND INCOME INEQUALITY*

By SIMON KUZNETS

The central theme of this paper is the character and causes of long-term changes in the personal distribution of income. Does inequality in the distribution of income increase or decrease in the course of a country's economic growth? What factors determine the secular level and trends of income inequalities?

The Kuznets hypothesis



Verification of the Kuznets hypothesis

- Ahluwalia M. (1976), “Income distribution and development”,
- Barro R. (2000), “Inequality and growth in a panel of countries”,
- Ho-Chuan River Huang (2004), “A flexible nonlinear inference to the Kuznets hypothesis”,
- Mushinski D.(2001), “Using non-parametrics to inform parametric tests of Kuznets’ hypothesis”,
- Papanek G. and Kyn O. (1986), “The effect on income distribution of development, the growth rate and economic strategy”,
- Savvides A. and Stengos T. (2000), “Income inequality and economic development: evidence from the threshold regression model”,
- Sukiassyan G. (2007), “Inequality and growth: What does the transition economy data say?”

Variables

Inequality measures:

- **Gini index**
- **Ratio of incomes richest 10% to poorest 10%**
- **Ratio of income incomes richest 20% to poorest 20%**

Measure of economic development:

- **GDP per capita PPP US$**
- **Growth rate of GDP**
- **Literacy rate**
- **Secondary school enrollment**

Objectives

- **To test the Kuznets hypothesis on the theoretical level,**
- **To determine the conditions on which the inverted-U dependence of the Gini index on the mean income might take place,**
- **To give an economic interpretation of the obtained mathematical results,**
- **To test whether the Kuznets hypothesis is valid for countries with transition economy.**

Theoretical approach

The Gini index is a function of n variables:

$$G = \left(1 - \frac{1}{n} - 2\frac{n-1}{n^2} \cdot \frac{X_1}{Z} - 2\frac{n-2}{n^2} \cdot \frac{X_2}{Z} - \ldots - \frac{2}{n^2} \cdot \frac{X_{n-1}}{Z}\right) \cdot 100\,\%$$

n – quantity of income groups,

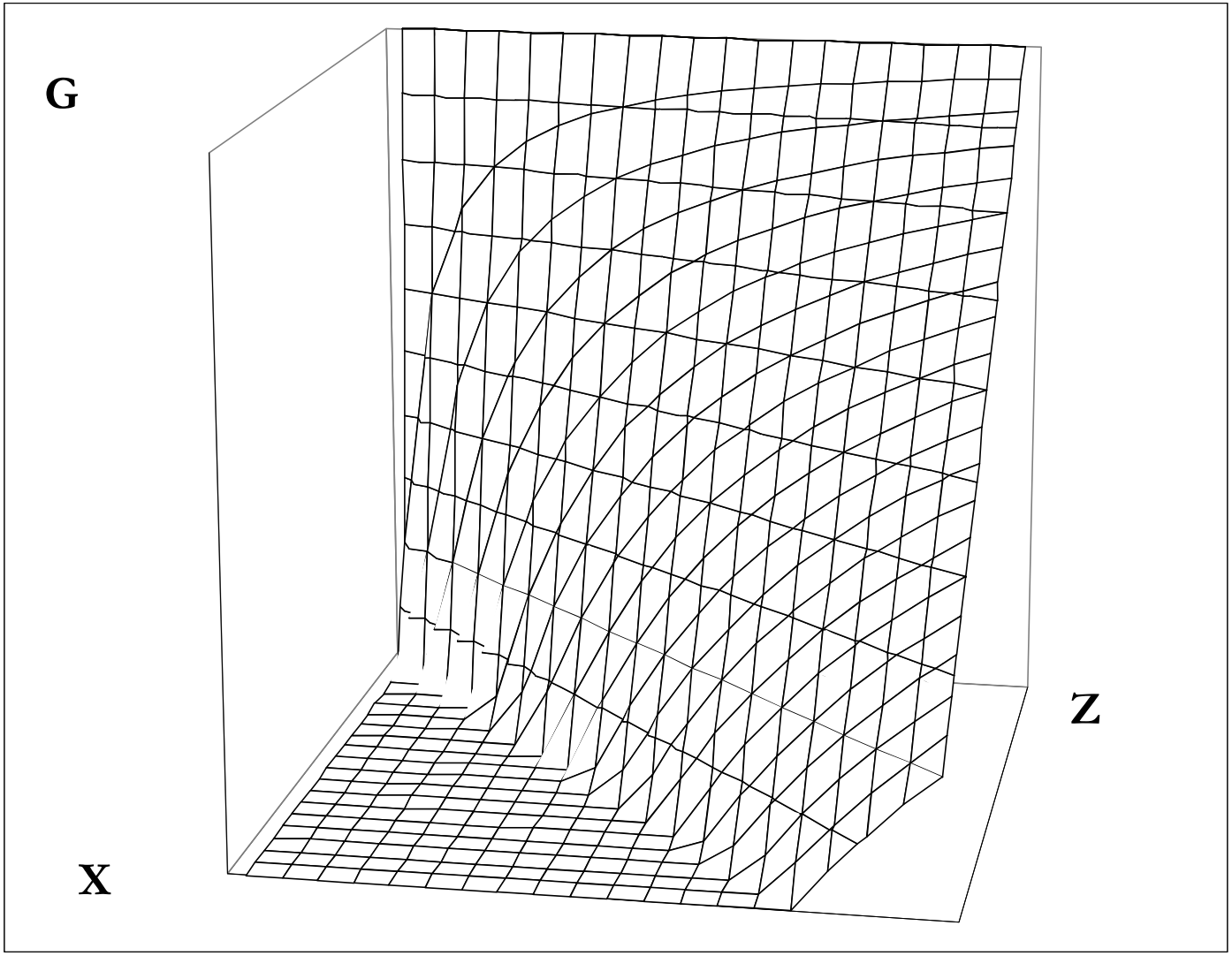
G – the Gini index,

X_1 - the income of the poorest group,

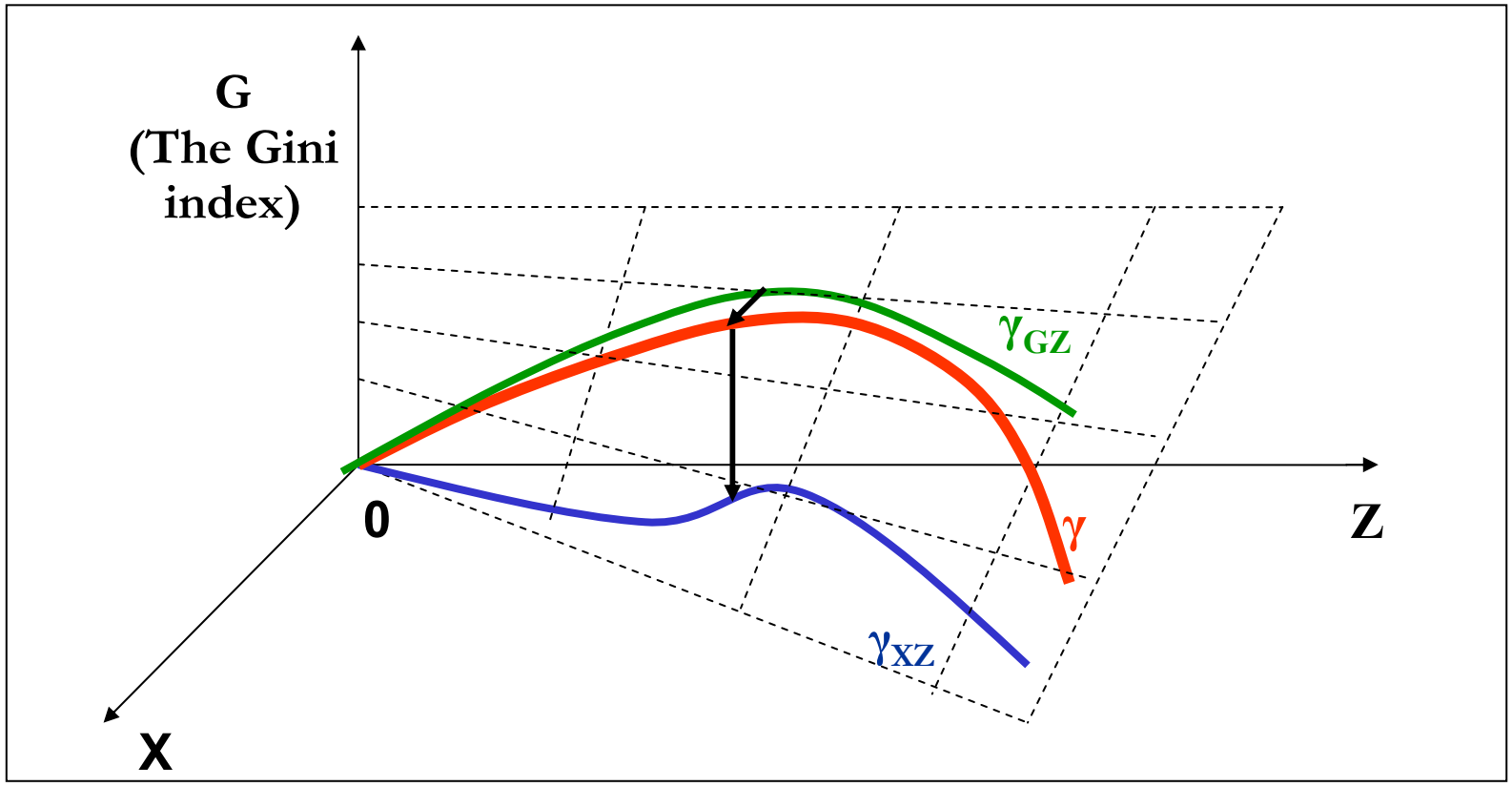
X_n - the income of the richest group,

Z - the mean income

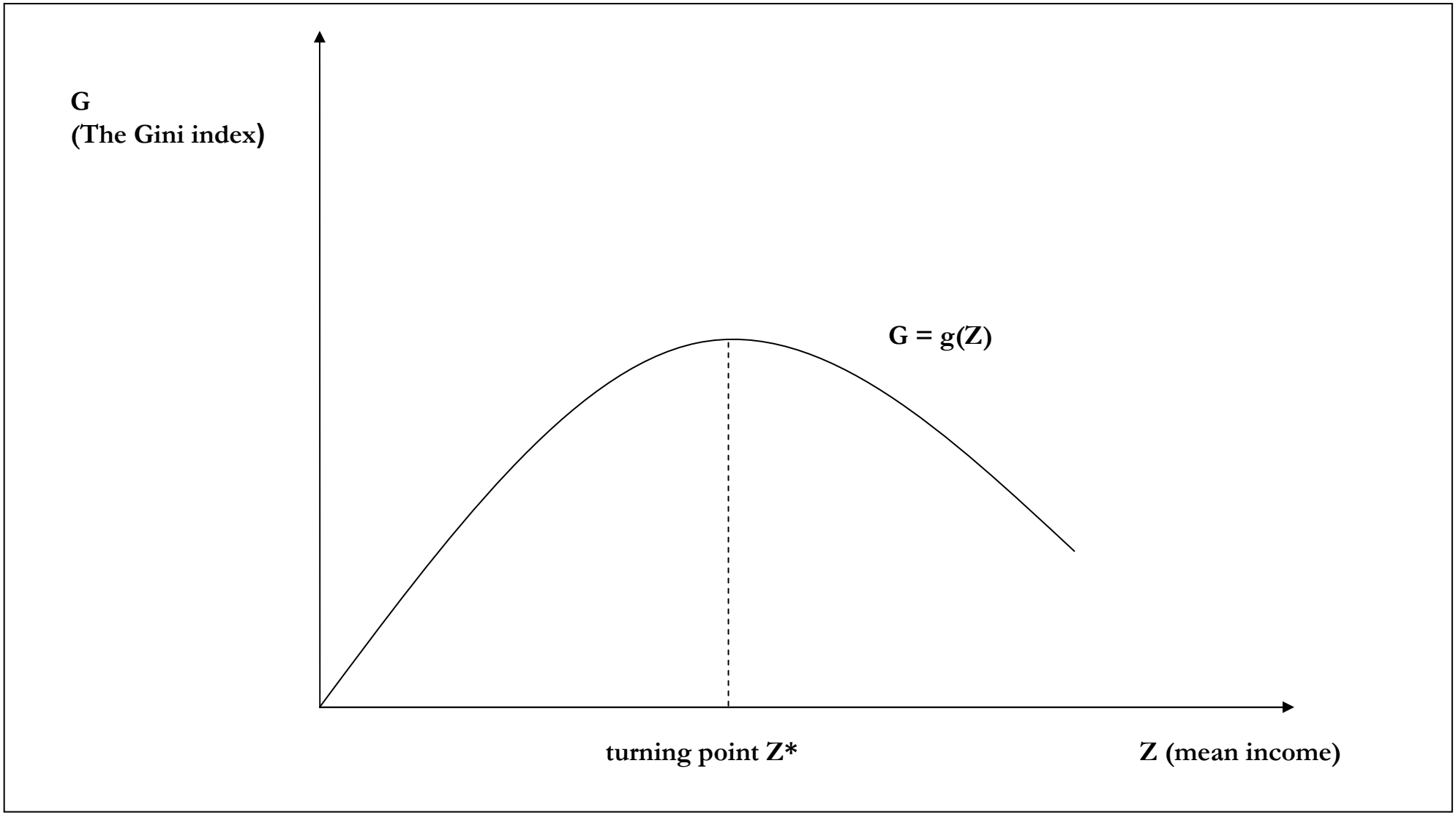
Manifold



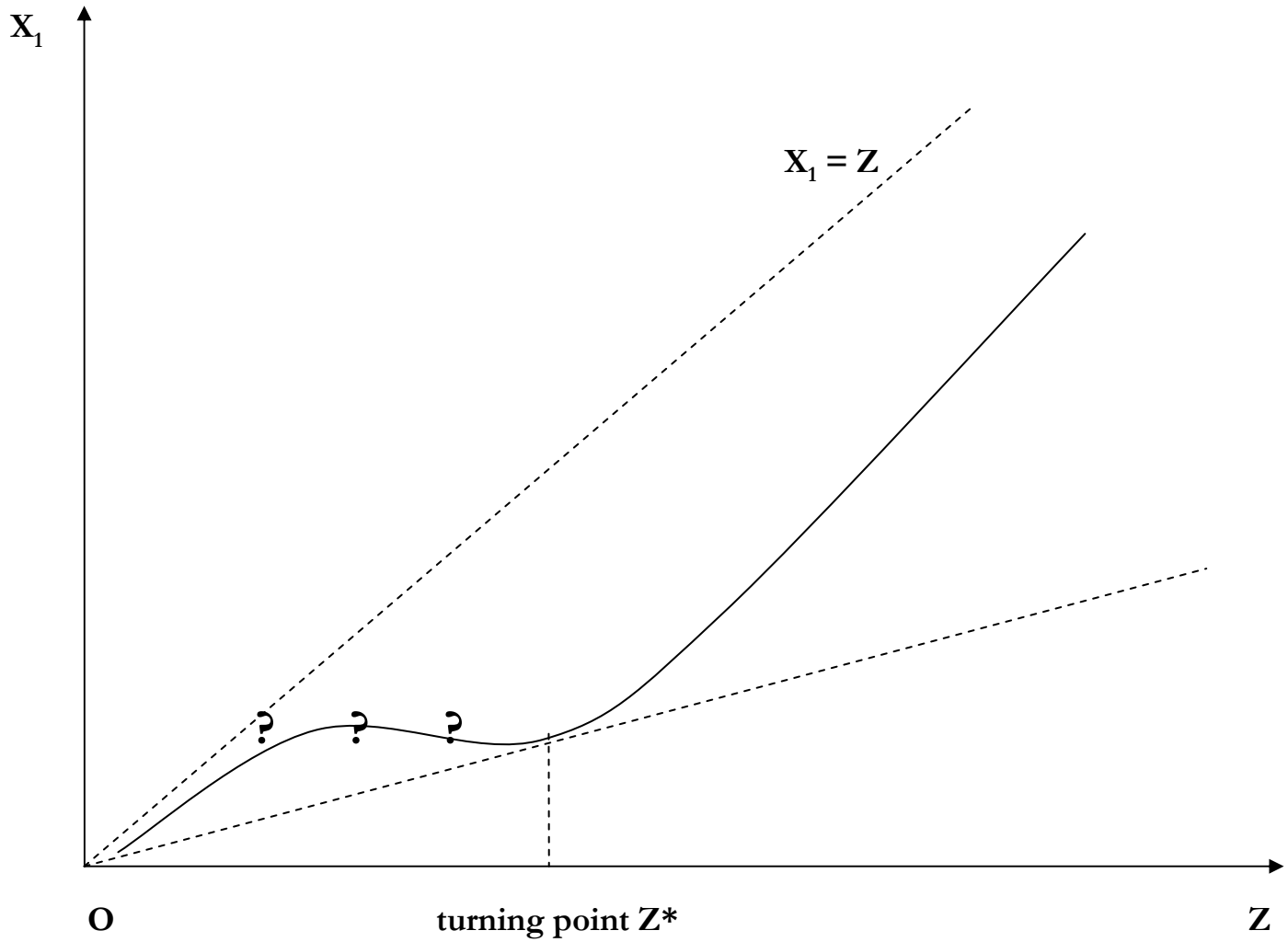
Projections



Projection onto the plane GOZ



Projection onto the plane X_1OZ



Main theoretical result

The drop in the Gini index after reaching the turning point is possible only with the low-income groups' income growth being ahead

The Gini index is a function of share incomes

$$G = \left(1 - \frac{1}{n} - 2\frac{n-1}{n} \cdot p_1 - 2\frac{n-2}{n} \cdot p_2 - \ldots - \frac{2}{n} \cdot p_{n-1}\right) \cdot 100\%$$

n – quantity of income groups,

G – the Gini index,

p_i - is the income share of i-th group, i = 1,…,n.

If n = 5, then

$$G = 100\% \cdot (0.8 - 1.6\,p_1 - 1.2\,p_2 - 0.8\,p_3 - 0.4\,p_4)$$

If G has inverted – U form as a function of Z (mean income), then $p_1,\ldots,p_n$ (income shares) have U – form as the functions of Z .

Source of data

Human development report 2006

Published for the United Nations

Development Programme

(UNDP)

29 countries with transition economy

Empirical results. Parametric specification

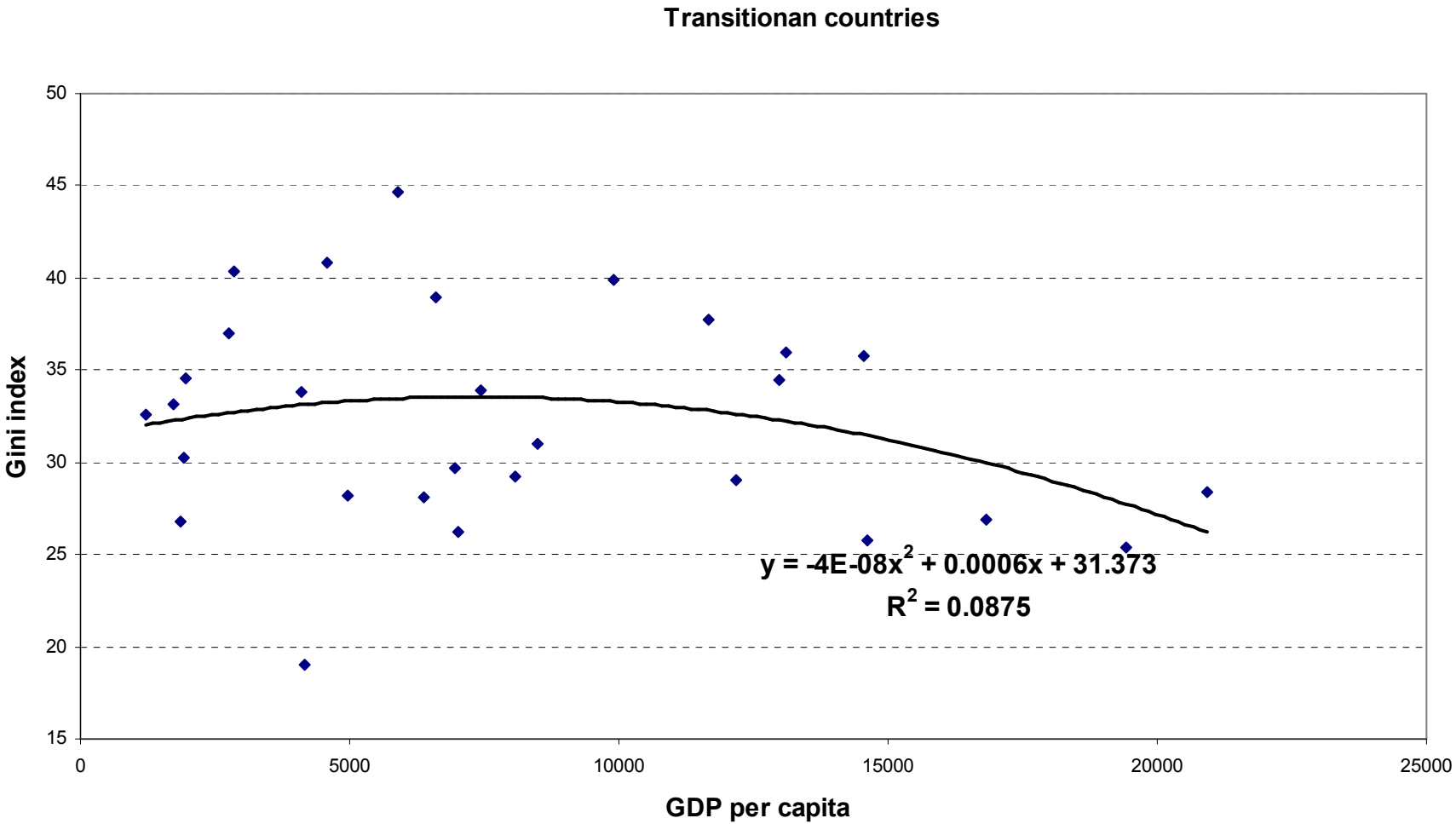
$$GINI = \beta_0 + \beta_1 GDP + \beta_2 GDP^2 + \varepsilon$$

Table 1. Regression of the Gini index on per capita GDP and its squared term

Source	SS	df	MS	Number of obs = 29	F(2, 26) = 1.25
Model	81.6520979	2	40.8260489	Prob > F = 0.3041	
Residual	851.578306	26	32.7530118	R-squared = 0.0875	
				Adj R-squared = 0.0173	
Total	933.230404	28	33.3296573	Root MSE = 5.723	

GINI	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
GDP	.00059	.0007261	0.81	0.424	-.0009024	.0020825
GDP2	-4.00e-08	3.49e-08	-1.15	0.262	-1.12e-07	3.17e-08
_cons	31.37331	3.020073	10.39	0.000	25.16546	37.58116

Empirical results. Parametric specification



Nonparametric specification

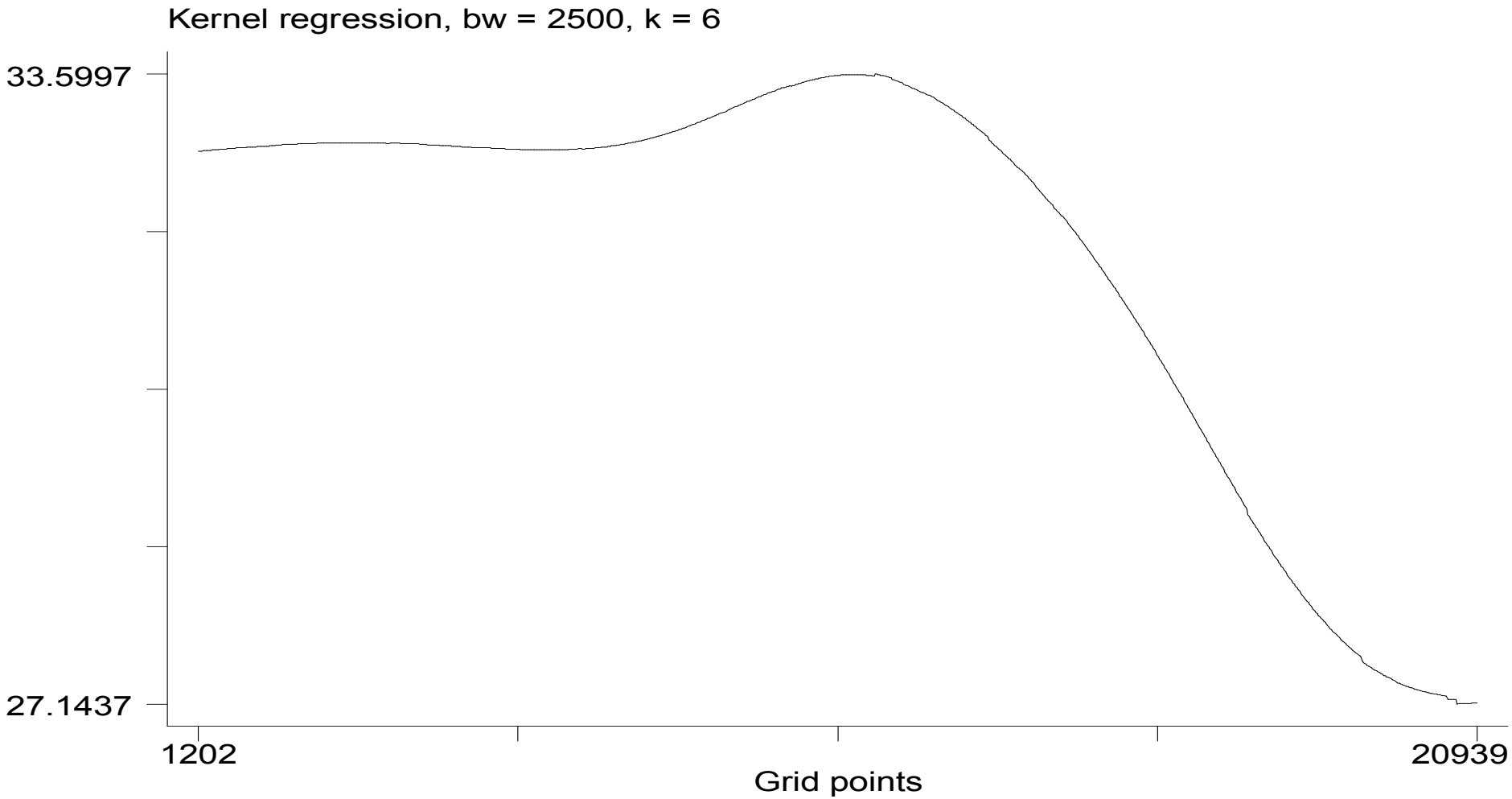
$$GINI = m(GDP) + \varepsilon$$

$$P20 = m(GDP) + \varepsilon$$

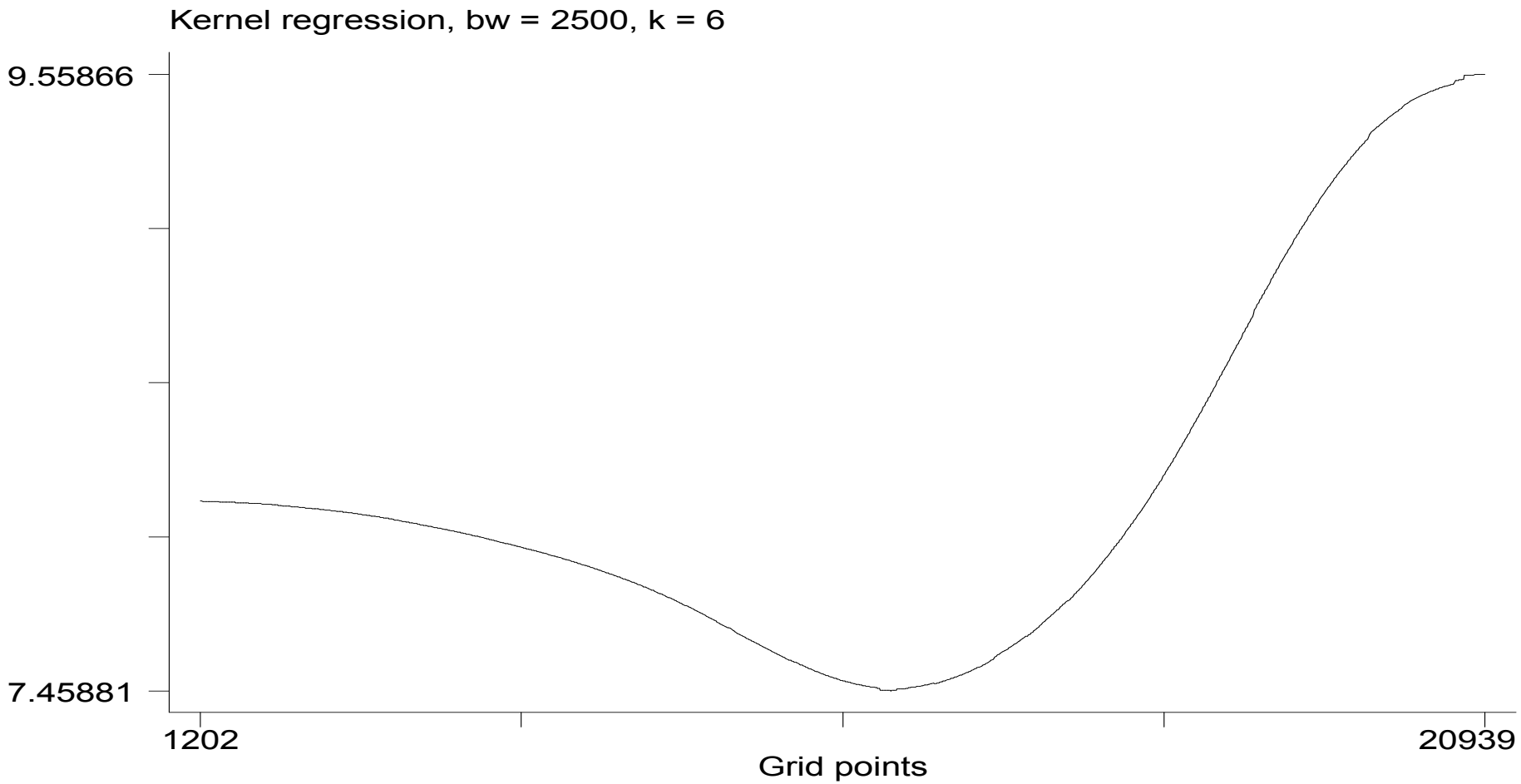
$$X20 = m(GDP) + \varepsilon$$

The conditional expectation function, *m(…)* was estimated using the Nadaraya - Watson nonparametric regression with Gaussian kernel.

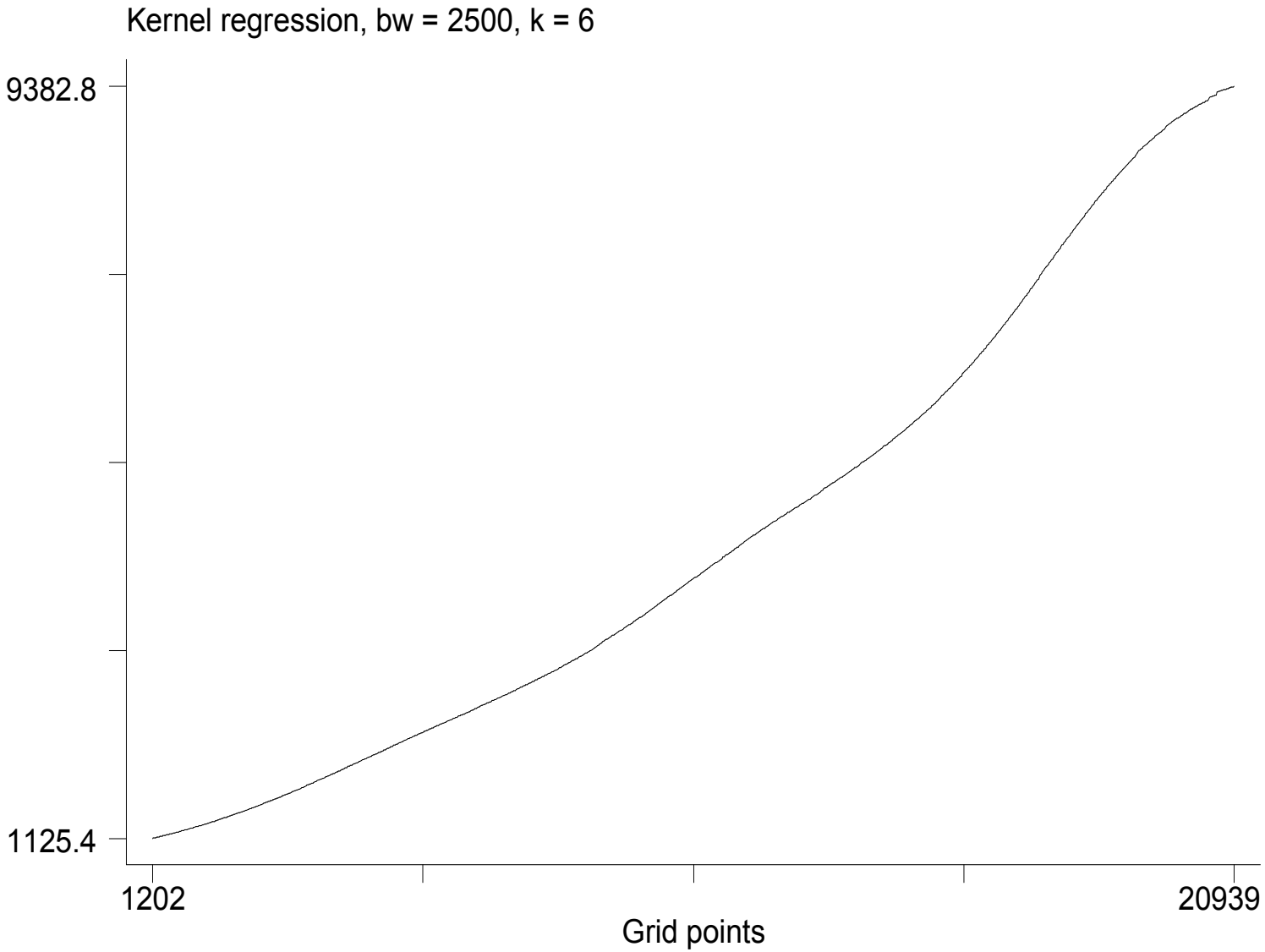
The estimated conditional mean of the Gini index on per capita GDP



The estimated conditional mean of the 20% low income share on per capita GDP



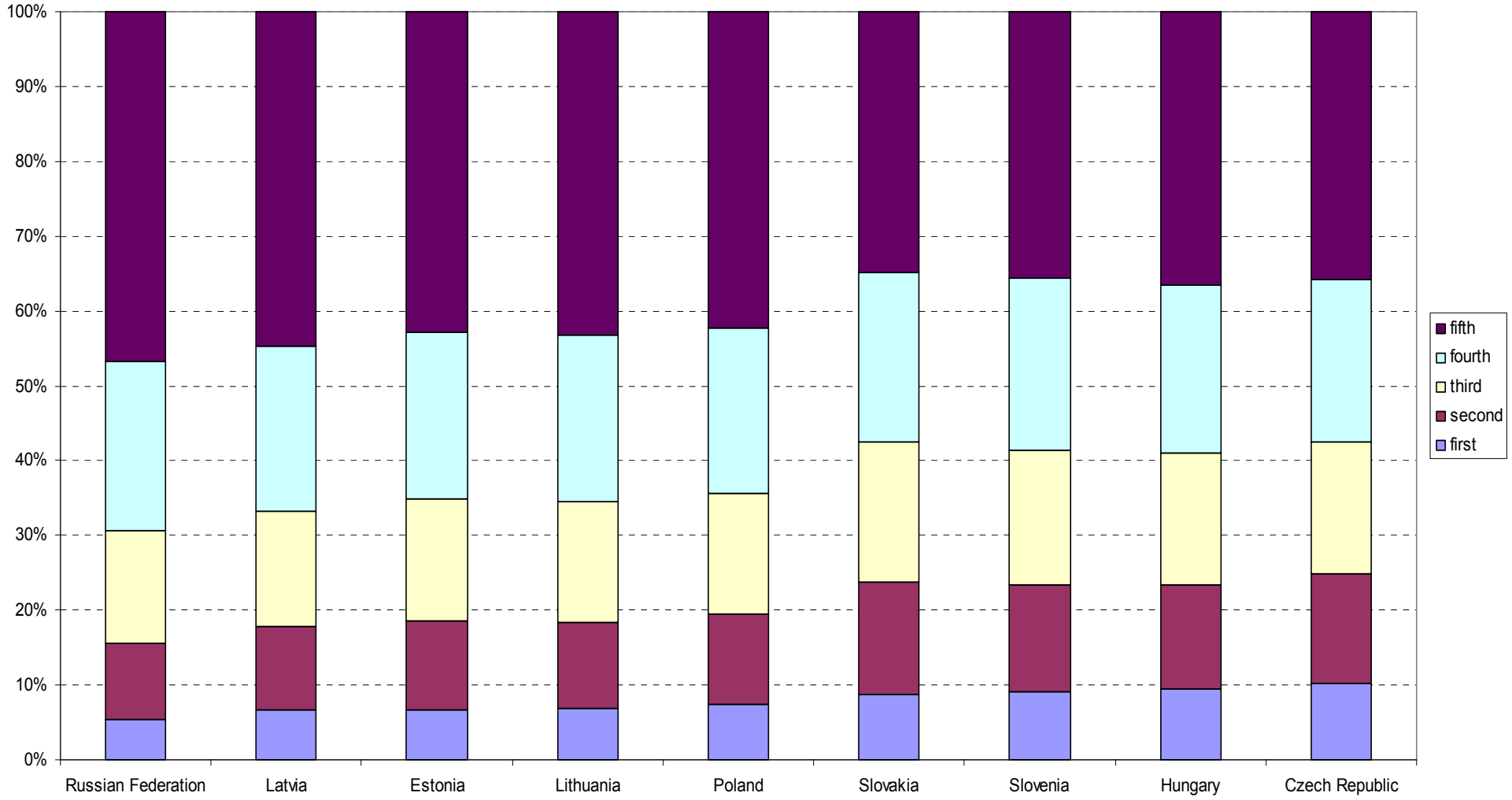
The estimated conditional mean of the 20 % low income on per capita GDP



Comparison Russian Federation with other countries

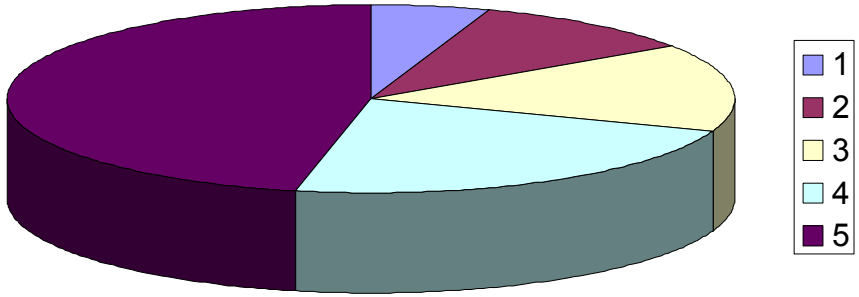
Country	GINI	GDP per capita
Tajikistan	32.6	1202
Moldova	33.2	1729
Uzbekistan	26.8	1869
Kyrgyzstan	30.3	1935
Lao People's Dem. Rep.	34.6	1954
Viet Nam	37	2745
Georgia	40.4	2844
Armenia	33.8	4101
Azerbaijan	19	4153
Turkmenistan	40.8	4584
Albania	28.2	4978
China	44.7	5896
Ukraine	28.1	6394
Macedonia	39	6610
Belarus	29.7	6970
Bosnia and Herzegovina	26.2	7032
Kazakhstan	33.9	7440
Bulgaria	29.2	8078
Romania	31	8480
Russian Federation	39.9	9902
Latvia	37.7	11653
Croatia	29	12191
Poland	34.5	12974
Lithuania	36	13107
Estonia	35.8	14555
Slovakia	25.8	14623
Hungary	26.9	16814
Czech Republic	25.4	19408
Slovenia	28.4	20939

20% shares of income

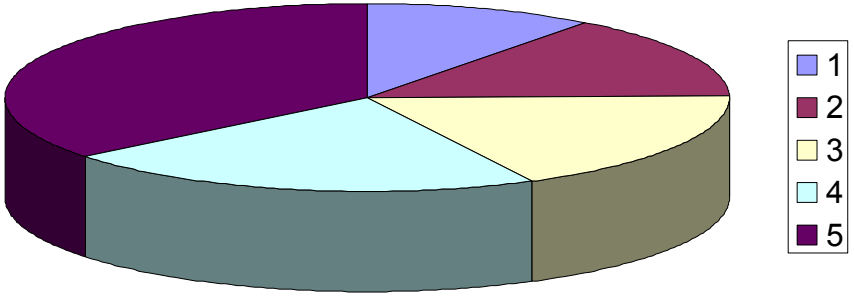


Comparison income shares for Russian Federation and Czech Republic

Russian Federation



Czech Republic



Conclusions

- **The drop in the Gini index after reaching the turning point is possible only with the low-income groups' income growth being ahead.**
- **The shape of the low-income groups' income dependence on the mean income after reaching the turning point must be convex.**
- **The data on 29 countries confirm the validity of the Kuznets hypothesis for transition countries.**
- **For this group of countries the turning point of ca. 11000 PPP USD was found.**
- **Among the countries with lower GDP per capita, Russia is the closest one to the turning point. We can expect reduction of the inequality level in this country with increasing GDP per capita.**

Thanks for attention!