
XIII International Conference of
Young Scholars
28th May, 2009 - Prague

Sustainable Development and the
Provision of EU Subsidies for Rural
Development: the Case of Bulgaria

Julia Dobрева - PhD student, 3rd year
Ivan Ivanov - Associate Professor

Sofia University "St. Kliment Ohridsky", Bulgaria

1. Why sustainable development?

- The results of excessive production and consumption:
 - Depletion of resources;
 - Spreading of dangerous pollutants;
 - Destruction of ecosystems;
 - Disruption of the planet's climatic balance



1. Why sustainable development?

We have less than 250 years to save the planet!

Is it possible to make policy changes that could lead to a sustainable world and what policies would be effective?



1. Why sustainable development?

To achieve sustainability, environmental protection and social welfare, we must opt for a less consumptive economy

But...

Is it possible to have both increased consumption and clean world?

Which is the key for governments to achieve this controversial symbiosis?

2. The three dimensions of sustainability

- We often refer to the three dimensions of sustainability as “systems” – the economic system, the environmental system and the social system – and each system has its own logic, so it seems almost impossible to analyze all of them at once

The three main objectives of our analysis:

- To make a differentiation between “Sustainability” and “Sustainable Development”
- To propose the three-dimensional model of sustainable development
- To prove that sustainable development can be achieved through the combined action of the three elements under the conditions of subsidizing public and private production

2. The three-dimensional model

- The function $\varphi(x, y, z)$ is an objective function, which we wish to maximize under a given linear constraint:

$$\max_{x \geq 0, y \geq 0, z \geq 0} \varphi(x, y, z)$$

$$\text{such that } \langle a^1, x \rangle + \langle a^2, y \rangle + \langle a^3, z \rangle \leq b$$

2. The three-dimensional model

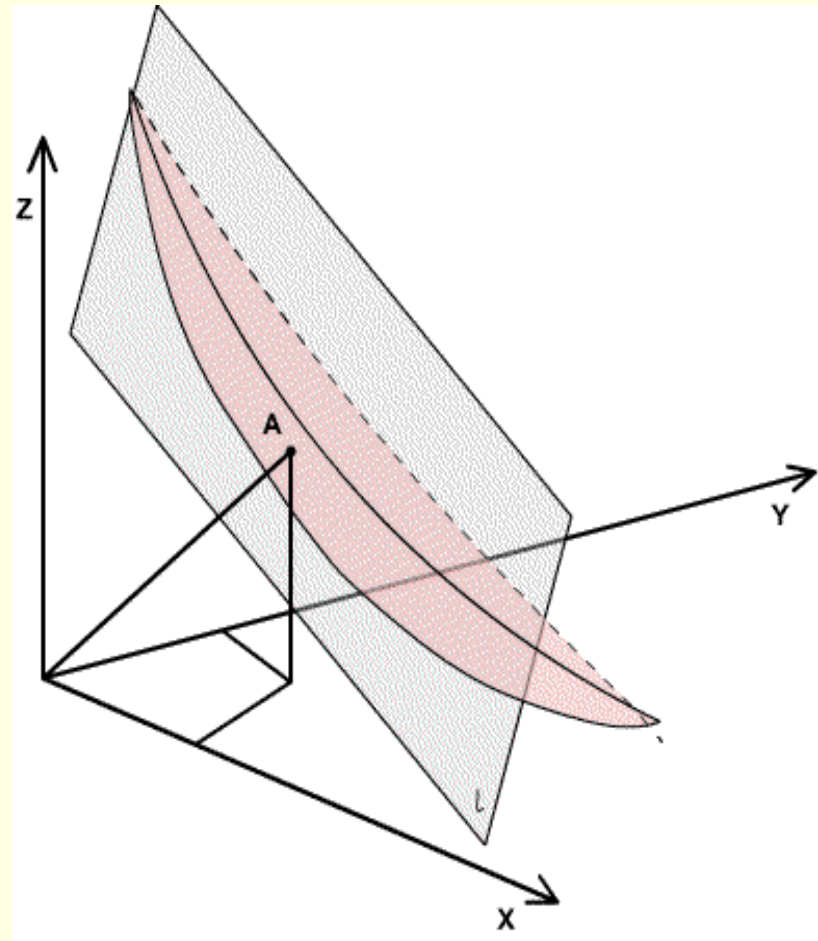
$$\varphi(x, y, z) = k$$

$$x \in R^1, y \in R^1, z \in R^1$$

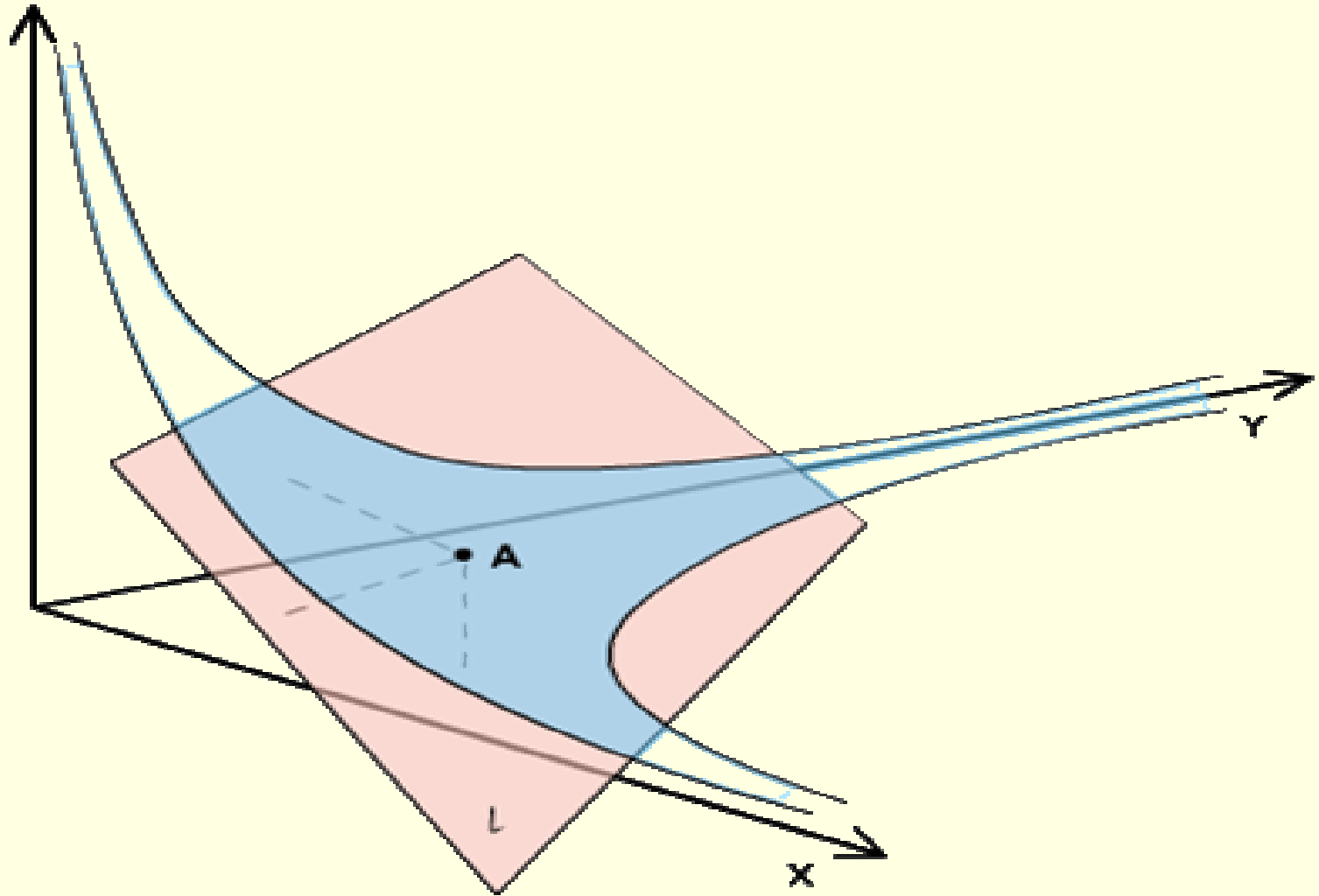
$$l: a^1 x + a^2 y + a^3 z = b$$

$$m^* = (x^*, y^*, z^*)$$

$$A(x^*, y^*, z^*)$$



2. The three-dimensional model



2. The three-dimensional model

$$v(a, b) = \max_{x \geq 0, y \geq 0, z \geq 0} \varphi(x, y, z)$$

$$\text{such that } \langle a^1, x \rangle + \langle a^2, y \rangle + \langle a^3, z \rangle \leq b$$

The solution to this equation is the vector $m^*(a, b)$ which defines the point of **maximum**.

$$g(a, k) = \min_{x \geq 0, y \geq 0, z \geq 0} \langle a^1, x \rangle + \langle a^2, y \rangle + \langle a^3, z \rangle$$

$$\text{such that } \varphi(x, y, z) \geq k$$

The solution to this equation is $h^*(a, k)$, which defines the point of **minimum**.

2. The three-dimensional model

- The Slutsky equation:

$$\frac{\partial m_i(a^*, b^*)}{\partial a_j} = \frac{\partial h_i(a^*, k^*)}{\partial a_j} - m_j(a^*, b^*) \frac{\partial m_i(a^*, b^*)}{\partial b}$$

- following the general equilibrium theory, and depending on the changes in the values of the constraint, we can classify the variables as **normal, ordinary, luxury, necessary, inferior or Giffen variables, and also as substitutes or complements**

3. Temporary sustainability and sustainable rural development

- Analyze sustainable rural development by introducing the time factor t , where $t \in [1, +\infty)$

$$v^t(p^t, M^t) = \max_{E, B, S^t \geq 0} u(E^t, B^t, S^t)$$

such that $\langle p_E^t, E^t \rangle + \langle p_B^t, B^t \rangle + \langle p_S^t, S^t \rangle \leq M^t$

- If $t \in \{1, 2\}$, then the solutions to the problem for $t_1 = 1$ and $t_2 = 2$ will be accordingly $x_1^*(p_E^1, p_B^1, p_S^1, M^1)$ and $x_2^*(p_E^2, p_B^2, p_S^2, M^2)$

3. Temporary sustainability and sustainable rural development

- The dual problem:

$$e^t(p^t, \bar{u}) = \min_{E, B, S^t \geq 0} \langle (p_E^t, p_B^t, p_S^t), (E^t, B^t, S^t) \rangle$$

$$\text{such that } u^t(E^t, B^t, S^t) \geq \bar{u}$$

- The solution to the minimization problem for period $t_1 = 1$ is the vector $h_1^*(p^1, u^1)$, and for period $t_2 = 2$ is the vector $h_2^*(p^2, u^2)$ and we also have $e_2 = h_2^* - h_1^* \geq 0$

Temporary sustainability

- *Temporary sustainability*: sustainability which is present when the solution for a maximum of the utility function and minimum of the expenditure for period t is higher in value than the solution to the same model for period $t - 1$, where $t \in [1, +\infty)$ or:

$$x_t^*(p^t, M^t) \equiv h_t^*(p^t, u^t) \geq x_{t-1}^*(p^{t-1}, M^{t-1}) \equiv h_{t-1}^*(p^{t-1}, u^{t-1})$$

Sustainable (Rural) Development

- ***Sustainable (rural) development:*** development which is analyzed in a three-dimensional optimization model in which the quantities of environmental goods, private goods and social welfare goods increase over time along the optimality path, i.e. they are either normal, ordinary or luxury goods. We have a process of sustainable development from moment t_0 when in each moment t that follows the goods remain of the type they were in the locus of the temporary sustainability.

4. The EU policy of financing sustainable rural development as a three dimensional model

- The Common Agricultural Policy
- The sustainability principle is laid down in the modern rural development policy of the EU as a three-dimensional model by covering the three main dimensions, i.e. environmental protection, economic growth through encouragement of business activities, and increased quality of public services which improves the level of social welfare.

4. The EU policy of financing sustainable rural development as a three dimensional model

- maximizing the utility from the subsidies for rural development:

$$v^t(\theta^t, F^t) = \max_{E^t, B^t, S^t \geq 0} W(u_1(E^t, B^t, S^t), \dots, u_n(E^t, B^t, S^t))$$

$$\text{such that } \theta_1^t E^t + \theta_2^t B^t + \theta_3^t S^t \leq F^t$$

4. The EU policy of financing sustainable rural development as a three dimensional model

- The dual (inverse) problem of cost minimization:

$$e^t(\theta^t, W^t) = \min_{E^t \geq 0, B^t \geq 0, S^t \geq 0} \theta_1^t E^t + \theta_2^t B^t + \theta_3^t S^t$$

such that $W(u_1(E^t, B^t, S^t), \dots, u_n(E^t, B^t, S^t)) \geq W^t$

4. The EU policy of financing sustainable rural development as a three dimensional model

- **successful sustainable rural development policy** is a policy in which the solution for a maximum of the social welfare function and minimum of the expenditure for subsidized production for period t is greater in value than the solution to the optimization model for period $t - 1$, or:

$$x_t^*(\theta^t, F^t) \equiv h_t^*(\theta^t, W^t) \geq x_{t-1}^*(\theta^{t-1}, F^{t-1}) \equiv h_{t-1}^*(\theta^{t-1}, W^{t-1})$$

5. Sustainable rural development and its incorporation in the Bulgarian Rural Development Programme for the period 2007-2013

The Bulgarian Rural Development Programme for the period 2007-2013:

- Axis 1 - Development of a competitive agriculture and forestry sector: 1 204 866 983 EUR of which 727 308 809 EUR contracted;
- Axis 2 - Protection of the environment and natural resources in the rural regions: 777 394 110 EUR of which 6 306 865 EUR contracted;
- Axis 3 - Increase in the employment levels and in the quality of life in rural regions: 877 666 684 EUR of which 761 524 796 EUR contracted.

5. Sustainable rural development and its incorporation in the Bulgarian Rural Development Programme for the period 2007-2013

- The consumption of private goods (in the form of business investments in agriculture) and public goods (supported investments in rural infrastructure and public services) has increased for period t_1 (2009) in comparison to the initial moment t_0 (2008);
- Private and public goods financed under axis 1 and 3 - normal and luxury – 60% growth for axis 1 and 87% growth for axis 3
- Local sustainability in the two dimensions, i.e. economic growth and social welfare
- 1% growth for axis 2. Are environmental activities inferior goods then? Is the model sustainable?
 - Yes. Subsidies under axis 1 and 3 are “**bound subsidies**”

6. Conclusions:

1. To examine the relation between a theoretical three-dimensional model and the results of the EU policy for sustainable rural development in Bulgaria;
2. To prove how a mathematical optimization model can be used in a practical application, namely the planning of political decisions by taking into account the precise measurement of their intended impact;
3. The Bulgarian Rural Development Programme for the period 2007-2013 provides substantial financial resource for achieving the targeted sustainability levels
4. More than half of the financial resource has been absorbed for the first year of its implementation, which demonstrates high levels of sustainable development in the Bulgarian rural regions

Thank you for
your
attention!

