

## APPENDIX 3 : DEFINITION OF THE INDICATOR “PRODUCTIVITY GAIN FROM LAND USE”

(Source : PROPOLIS Final Report, January 2004)

Indicator	Productivity Gain from Land Use	SOPG
Component/Theme:	Social Opportunities	

### Indicator description

This indicator is the measure of the impact of policies on the economic efficiency of the city. As described in the theoretical description these impacts are calculated on the basis of the potential dimension of the labour market. In brief, the extension of the area of employment opportunities is a measure of the productivity and of the competitiveness of the area.

The indicator is relevant for the estimation on how policies can impact on the economy of the region and on the labour market.

The policy testing, by means of this indicator, would produce an indication on how sustainable transport policies could affect the competitiveness of the economic productive sector. This is relevant therefore for the applicability of the policy. The indicator is computed as a percent variation of the productivity of the city.

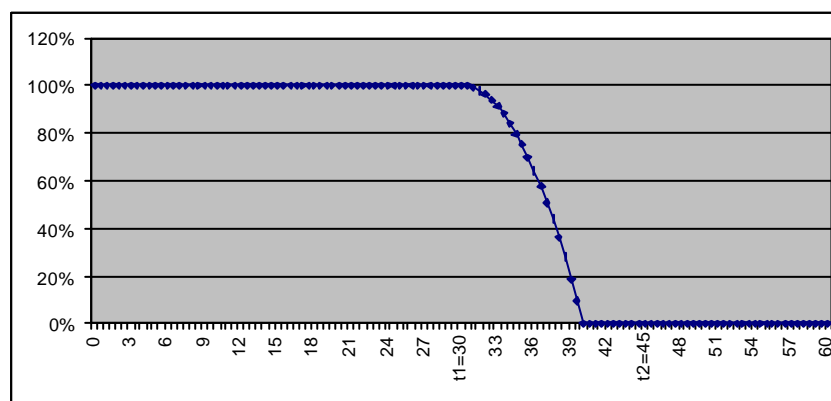
### Calculation method

The calculation is based on the comparison of the variable  $L(t)$  which represents the Labour Market size.  $L$  is defined for a chosen time threshold  $t$  (e.g. 30 minutes). The variation of  $t$ , filtered through the application of the proper elasticity value provides the change in productivity, which is indeed the desired indicator.

The value of this indicator may vary a lot in the modelling applications when some relevant zones at the border are included, or excluded; a second threshold was considered in order to introduce a smoothing factor. The Labour Market size is then defined by all the workplaces that can be reached within the lower time threshold  $t_1$ , and by a share of the ones that can be reached within the higher time threshold  $t_2$ . This share should decrease more than proportionally from  $t_1$  to  $t_2$ , and become null in  $t_2$ . It is identified by the profile of a parabola that passes through the two points  $(X=1, Y=t_1)$  and  $(X=0, Y=t_2)$  and whose directrix is the line  $(X=t_1)$ . Graphically the total of the labour market can be represented as the integral of the function, and so the total area of the figure below.

### Detailed description of the calculation method

Considering a city or a region, divided into  $n$  zones, 3 variables can be defined:



$W_i$ : the number of workers located in zone  $i$  with  $\sum_i W_i = W$ ;

$J_i$ : the number of jobs located in zone  $i$ , with  $\sum_i J_i = J$ ;

$T_{ij}$ : the time it takes to go from zone  $i$  to zone  $j$ .

$Y(t_{ij})$ : the coefficient defined by the curve represented in the figure

The definition of  $L(t)$ , where  $t_1$  and  $t_2$  are the time threshold chosen with  $t_2 = T_1 + 10 \text{Min}$ , is the average of the  $L_i$ , the effective size of labour market for the workers of the zone  $i$ .

For a given zone  $i$ ,  $L_i(t) = \sum_j (J_j * Y)$  for  $j$  such that  $T_{ij} < t_2$

The overall  $L(t)$  is obtained weighing the average of  $L_i(t)$  by the number of workers in each zone:

$$L(t) = \sum_i L_i(t) * W_i / W.$$

The variation in Labour market is therefore given by:

$$\ddot{A}L(\%) = (L(t)_{\text{policy}} - L(t)_{\text{reference scenario}}) / L(t)_{\text{reference scenario}}$$

The variation of labour market size is intended to induce changes in the overall productivity. The variation of productivity is obtained by the  $\ddot{A}L(\%)$  by applying a proper elasticity value

$$\text{SOPG} = \ddot{A}L(\%) * E$$

The value of  $E$  suggested is 0.18, as obtained by studies conducted in some French cities. It means for example that an increase of the labour market size by 10% induces an increase of productivity by 1.8%.

The application of the method in different cases does not show any particular problem as every model can produce the variables required.

#### References, notes

The theory has been developed on the basis of specific studies. A complete theoretical approach is reported in ECMT, Assessing the benefits from transport – Annex 4, “Size, sprawl, speed and the efficiency of cities” from Remy Prud’Homme and Chang-Woon Lee.

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In SCATTER, the time thresholds used were  $t_1 = 30 \text{ min}$  and  $t_2 = 40 \text{ min}$  (as in the PROPOLIS project), for Brussels and Helsinki.

In the case of Stuttgart, the time thresholds  $t_1 = 30 \text{ min}$  and  $t_2 = 40 \text{ min}$  were not appropriate to the general level of accessibilities and led to exaggerated boundary effects. The SOPG values for Stuttgart were therefore calculated with the more appropriate thresholds  $t_1 = 20 \text{ min}$  and  $t_2 = 30 \text{ min}$ .