Evaluation of the Financial Feasibility for Private Operators in Urban Redevelopment and Social Housing Investments

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Abstract. In this work an evaluation model to support Public Administration decisions in planning urban strategies that aim to involve private investors has been developed. The model allows to define the maximum amount of subsidized housing to be realized by the private investor and the administered selling price to be applied. This model has been developed translating in the field of urban planning, criteria and tools borrowed from the marginal economic theory. The results obtained by the application to a real case study confirm the potentialities and the user-friendly configuration of the model.

Keywords: Break-even analysis · Social housing · Urban redevelopment · Financial feasibility

1 Introduction

In Italy, the number of applicants for social housing has increased from 600,000 in 2008 to currently about 650,000, whereas the social housing production – related to an unchanged total expenditure for social housing – has suffered a slowdown since 2009 [11]. Indeed, Italy is the only State Member that has not registered an improvement in the social housing sector, due to the high number of units characterized by lack of basic amenities, further worsened by overcrowding issue. Despite new plans for the protection of the weaker members of society and the requalification of the existing housing patrimony [15], there are 2,5 million individuals unable to independently satisfy their housing needs [4].

In recent years, aiming to improve housing offers' methods and typologies for urban requalification [1, 2], there has been a development of several tools focused on involving, through different types of partnerships [3, 12, 13], private abilities and resources. Following the article 26 of L. 164/2014, an important directive has been issued, that aims to enhance unused public assets considering also social housing opportunities. According to the first subparagraph of the article 26, aiming to promote initiatives for enhancing unused public buildings to support economic and social development, a negotiated agreement between Public Administration and private investor is possible to consider - with regard to recovery actions of unused public buildings – as town planning amendment. In this way, the administrative procedure

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related to changes of functions for public buildings that need to be enhanced and at the same time to reduce operational time and risk, is possible to streamline. In particular, the aforementioned comma states that priority should be given to the recovery of public buildings intended, as a whole or partially, to develop new public housing units.

Although social housing production and urban renewal constitute both themes of primary importance in the current economic situation, hardly ever Public Administrations have appropriate skills to rationally set the best implementing modality [20–22]. As a consequence, the planned strategies almost always fail or are not duly taken into account by private investors, due to the wrong analysis of financial feasibility or even for the total absence of any kind of evaluation [14, 18].

2 Aims

With regard to the depicted scenario, the aim of this research is to develop an evaluation model to support Public Administration decisions in planning urban renewal initiatives involving private investors. The model allows to define the maximum amount of subsidized housing – as a percentage of the total housing gross floor surface that has been planned – to be realized by the private investor and the respective administered selling price, able to ensure the financial feasibility of the initiative. In this way, it is possible to facilitate the cooperation between collective instances of urban reorganization, social housing implementation and private needs for financial convenience [7, 9].

The model has been developed using the *Break-Even Analysis* (BEA). BEA is a decision support tool used for business planning to validate short-medium term choices. In this way, it is possible to obtain a flexible tool, user-friendly, implementable by collecting a few information that are easily traceable during the preliminary planning phases of the initiatives and usable in any territorial context.

In this paper, BEA is applied with an "instantaneous approach", without considering time effects. This means that costs/revenues of the procedure can be considered synchronously, with regard to the moment of the evaluation. Consequently, following this hypothesis, when BEA needs to be implemented with some financial items, influenced by time variable, they need to be evaluated as lump amounts. This is the case of interests on the capital borrowed from the credit institute to the private investor. This assumption is coherent with the aim of the work, that is the definition of a simple user-friendly tool. In this way the model can be used by inexperienced users, simply providing the amount of different variables involved within the process for a short-medium period.

The research is structured as follows. In Sect. 3 the basis of BEA are introduced using equations and assumptions. In Sect. 4 the evaluation model is presented. In Sect. 5 BEA is implemented to a real case concerning the urban renewal of an area in disuse, located in southern Italy. In Sect. 6 the conclusions of the work are drawn.

3 Outlines of BEA

In the international literature, BEA has been studied and applied since more than 50 years, especially in the Anglo-Saxon territory [5, 8, 16, 17].

In the evaluation of an investment, BEA considers only the monetary aspects of the initiatives in the *short term*, because it provides the order of magnitude of the variables examined over a period of a short duration [19]. Therefore, it operates by limiting the aspects of the monitored investment, and the analysis is focused: on the *total* costs (*Ct*), which are disjointed in the components of the *fixed* costs (*Cf*), that are cost items defined without considering the amount of the product to be realized (e.g. acquisition of land, its environmental remediation and restoration, the urbanization and the infrastructure for mobility, the recovery of existing buildings, the establishment of spaces and equipment of collective interest) and *variable* costs (*Cv*), that are cost items defined considering the amount of the product to be realized and sold within the initiative (e.g. energy costs, cost of raw materials directly used in the production, costs for the distribution and sale of the products, workers' salaries based on flexible contracts); on *total* revenues (*Rt*); on the quantity (*q*) of the goods or services that are expected to be produce and sell; on the financial feasibility of the initiative, computed in terms of *total* profit (*Pt*).

These are elements linked together in the mathematical relationship that expresses the total profit of the initiative:

$$Pt = Rt - Ct = Rt - (Cf + Cv) \tag{1}$$

According to microeconomic laws, the aforementioned parameters can vary depending on the amount of product (*q*) through a non-linear relation, coherently with the law of diminishing returns. For this reason, it is possible to introduce some assumptions to simplify BEA application: (i) costs and revenues are produced instantaneously, which means that the time dimension is not considered in the evaluation. In practice, it is as if the operator asserts expenses and realizes the value of the products and services at the same time; (ii) the total production costs have a linear trend. The variable costs can calculated as the product of the unit variable costs (*Cvu*) and the amount to be realized ($Cv = Cvu \cdot q$); (iii) the total revenues have equally a linear trend, so that they must be defined by the product of their unit price and the quantity to produce and sell ($Rt = pu \cdot q$).

Substituting into Eq. (1), the algebraic expressions of the variable costs and total revenues arising from the working hypothesis:

$$Pt = pu \cdot q - Cvu \cdot q - Cf \tag{2}$$

By determining the quantity (*q*) to be produced and sold and imposing the zero-total profit condition ($Pt = 0$), that – by definition – should be verified corresponding to the break-even point, it is possible to obtain:

$$Cf + (pu - Cvu) \cdot q = 0 \tag{3}$$

By solving Eq. (3), it is possible to define q^*:

$$q* = \frac{Cf}{pu - Cvu} \tag{4}$$

This relation links the main financial variables of the investment and allows to calculate through a direct and rapid method the break-even quantity q^*, knowing fixed costs (*Cf*), selling price per unit (*pu*), variable production cost per unit (*Cvu*) of the initiative.

Within the fixed costs items it is also important to include the "normal" profit of the private investor. This profit is the expected compensation for the generic investor – in a specific area and for a specific typology of initiative – considering his activities of production's coordination and assumption of the risk investment. This means that q^* defines the minimum amount for the financial convenience, ensuring also the normal profit to the private investor. Amounts to be produced or sold that are bigger than the amount of q^*, will produce an extra-profit.

In order to check the feasibility of the initiative, the quantity q^* needs to respect all technical, normative and market restrictions. In fact, there will be a convenience for the private investor only if the break-even point is lower than the maximum threshold estimated. If it is possible to gather in the balance items of the initiative - in the form of measures of the fixed/variable cost and revenues - the financial "translations" of the restrictions, project choices, negotiated agreements for the solutions to be realized, and also considering the amount of public works to be realized by the private investor, the break-even analysis will be able to define the amount of q^* as building products to be realized and sold. This amount will ensure the balance between the several conveniences for the whole set of operators involved within the initiative.

4 The Model

With reference to urban renewal projects to be realized through the participation of the private investors, the proposed model has been developed to support territorial transformations for which Public Administration – taking into account also the financial convenience of the private – decides to maximize the percentage of subsidized housing to be realized by the private investor, that will sell the units respecting administered selling prices.

In fact, the share of social housing to be realized by the private investor reduces his total incomes. The selling price per unit of subsidized housing (p_{sh}) needs to be lower than the selling price per unit of housing for the free market (p_m). In Italy, criteria for the definition of administered prices are established by law, considering the selling prices related to the costs of construction of the housing units, and using a direct proportionality defined at regional level (L. No. 457/1978). However, it is not always verified that social housing prices are lower than housing prices in the free market: considering areas affected by depressed property market, the application of this

principle could generate administrated selling prices that are incompatible with the local scenario. For this reason, the proposed model considers a multiplying coefficient (w), lower than 1, that compares administered prices with the free market, considering prices which normally are defined within the area of study, following the relation:

$$p_{sh} = w \cdot p_m \qquad 0 \leq w < 1 \tag{5}$$

At this point, starting from Eq. (2) it is possible to disaggregate the price per unit (pu) and variable cost per unit (Cvu), considering the different functions that contribute to define the project. Taking into account the Eq. (5) it is possible to write:

$$Pt = \left(\frac{p_m \cdot q_m + w \cdot p_m \cdot q_{sh} + p_c \cdot q_c}{q}\right) \cdot q - \left(\frac{Cvu_m \cdot q_m + Cvu_{sh} \cdot q_{sh} + Cvu_c \cdot q_c}{q}\right) \cdot q - Cf \tag{6}$$

The meanings of the elements of Eqs. (5) and (6) are summarized in Table 1.

Table 1. Parameters of the model

Cf	fixed costs of the transformation [€]
Rt	total revenues of the transformation [€]
Pt	total profit (extra-profit) of the private investor [€]
q	total gross floor surface (GFS) of the project [m^2]
q_m	GFS of housing sold in the free market [m^2]
q_{sh}	GFS of subsidized housing [m^2]
q_r	total residential GFS [m^2]
q_c	GFS for not residential functions (e.g. commercial) [m^2]
p_m	selling price per unit for housing in the free market [€/m^2]
p_{sh}	selling price per unit for subsidized housing [€/m^2]
p_c	selling price per unit for non residential functions [€/m^2]
w	coefficient for the definition of the selling price per unit for subsidized housing
Cvu_m	variable cost per unit for housing in the free market [€/m^2]
Cvu_{sh}	variable cost per unit for subsidized housing [€/m^2]
Cvu_c	variable cost per unit for non residential functions [€/m^2]

Considering also that the aim of the model is to define the amount of subsidized housing (q_{sh}) and the percentage (w) of deduction for the selling price per unit of housing in the free market able to nullify the total profit (Pt), Eq. (6) must be equal to zero:

$$P_m \cdot (q_m + w \cdot q_{sh}) + p_c \cdot q_c - Cvu_m \cdot q_m - Cvu_{sh} \cdot q_{sh} - Cvu_c \cdot q_c - Cf = 0 \tag{7}$$

Specifying with q_r (= q_m + q_{sh}) the total gross floor area to be allocated to the housing units, it is possible to write:

$$p_m \cdot [q_r - (1-w) \cdot q_{sh}] + p_c \cdot q_c - Cvu_m \cdot (q_r - q_{sh}) - Cvu_{sh} \cdot q_{sh} - Cvu_c \cdot q_c - Cf = 0 \quad (8)$$

From Eq. (8), isolating the amount of subsidized housing (q_{sh}) that zeros the total profit:

$$q_{sh} \frac{Cf + (Cvu_c - p_c) \cdot q_c + (Cvu_m - p_m) \cdot q_r}{[Cvu_m - Cvu_{sh} - (1-w) \cdot p_m]} \quad (9)$$

Knowing dimensional data of the initiative, considering the distribution – defined through demand analysis - between the total gross floor area and the non residential functions, gathering registered fixed costs from the market, cost items that contribute to define variable cost per unit and selling prices for the different functions of the project's elements, Eq. (9) has two variables, i.e. q_{sh} e w. Actually, the variable cost per unit for the realization of subsidized housing (Cvu_{sh}), depends on the percentage of deduction (w) for the selling price per unit of housing in the free market: this cost item considers the normal profit per unit of the private investor, that can vary depending on the administered selling price per unit defined for subsidized housing.

If it is possible to prefigure several alternatives for the public and private actors involved within the urban renewal investment, Eq. (9) allows to define combinations of q_{sh} e w able to ensure the financial convenience of the initiative.

It is important to underpin how the empirical evidence shows that if w assumes values close to 1 – meaning the possibility to define social housing prices close to the ones of the free market – the amount of subsidized housing to be realized by the private investor increases; vice versa, if w assumes values close to 0 – meaning that the administrated price is really low, and the private can only gives the housing units for free to the Public Administration - the amount of subsidized housing to be realized by the private investor decrease considering the restriction of financial convenience.

5 Application of the Model

The illustrated model has been applied to an urban renewal investment of an area located in southern Italy. The intervention area is owned by the Public Administration, well served by infrastructures, extended for 11,200 m^2, located in an expansion area characterized by five levels buildings with commercial functions in the ground floors and residential units for the others.

The strong demand for affordable social housing expressed by local people induced the Public Administration to arrange a transformation project for the area. It consists of the realization of nine buildings with five levels above ground and one basement level to be realized by a private investor. In particular, a part of the housing accommodations should be sold in free market regime, another part with fixed price values, whereas ground floor commercial units and appurtenant basement parking should be sold on the free market.

Considering that the model borrows the BEA operative process, the organization of costs/revenues items within the financial balance in "fixed" and "variable" has been developed in Table 2.

Table 2. Organization of the private investor's balance items in "fixed" and "variable"

Fixed costs	
Land purchase	250,627 €
Taxes and notary's fees	27,569 €
Local planning fees for the commercial share	104,479 €
Normal profit of the investor (commercial)	962,050 €
Commercial construction costs	1,924,100 €
Realization of the green area	580,014 €
Technical and general expenses (commercial and green area)	200,329 €
Financial charges	100,322 €
Total	**4,149,490 €**
Variable unit costs	
Subsidized residential	
Local planning fees	13.80 €/m^2
Normal profit of the investor	f(w)
Technical and general expenses	72 €/m^2
Financial charges	32.04 €/m^2
Construction costs	900 €/m^2
Total	***f(w)***
Free market residential	
Local planning fees	45.80 €/m^2
Normal profit of the investor	440 €/m^2
Technical and general expenses	88 €/m^2
Financial charges	40.10 €/m^2
Construction costs	1,100 €/m^2
Total	**1,713.90 €/m^2**
Unit revenue	
Subsized residential sale	***f(w)***
Free market residential sale	**2,200 €/m^2**
Commercial sale	**2,500 €/m^2**

For the case study, within the fixed items there are land purchase, taxes and notary's fees, costs for the realization of the green area and costs items related to the realization of the commercial share (local planning and construction fees, normal profit of the private investor, construction costs).

Among *fixed* costs there are also technical and general expenditures related to the realization of the commercial share and of the green area. Furthermore, there are also finance charges related to the aforementioned items.

Within the *fixed* revenues there are the incomes generated by the sale of the commercial share, equal to 4,810,250 €. They have been evaluated applying to the surfaces with commercial purpose a price per unit defined through a market survey, equal to 2,500 €/m^2.

Among *variable costs* there are the sums related to the distribution of the total residential GFS in the subsidized share (q_{sh}) and in the share for the free market (q_m), local planning and construction fees for the subsidized housing and for the ones on the free market, construction costs, the amount of normal profit of the investor, technical and general expenses and finance charges related to the residential share. It is important to notice that the normal profit of the private investor related to the sale of subsidized residential GFS depends on w for the definition of the administered selling price per unit: this means that the realization cost per unit for subsidized housing units depends, in its turn, on the value that will be defined for the coefficient w. The variable cost per unit for residential share in the free market is equal to 1,713.90 €/m^2.

Within the *variable* revenues there are the incomes generated by the sale of subsidized housing GFS and GFS of the housing in the free market.

In Table 3, considering increases in the value of w equal to 0.10, the amount of subsidized housing (q_{sh}) defined through the Eq. (9) and the amount of housing in the free market (q_m) are reported. The latter is calculated through the difference between total residential GFS defined within the investment, equal to 10,450 m^2, and the amount of subsidized housing related to each w value considered. The value $w = 0.54$ – meaning an administered price per unit slightly higher than the half of the price per unit of the residential share in the free market – represents the maximum threshold for the case study. This is the scenario in which all the planned residential share can be intended for social housing.

Table 3. Outputs of the application of the model

w	q_{sh} [m^2]	q_m [m^2]
0.00	3,817	6,633
0.10	4,323	6,127
0.20	4,983	5,467
0.30	5,882	4,568
0.40	7,176	3,274
0.50	9,200	1,250
0.54	10,450	0.000

It is important to underpin how the empirical evidence shows that if w assumes values close to 1 – meaning the possibility to define social housing prices close to the ones of the free market – the amount of subsidized housing to be realized by the private investor increases; vice versa, if w assumes values close to 0 – meaning that the administrated price is really low, and the private can only gives the housing units for

free to the Public Administration - the amount of subsidized housing to be realized by the private investor decreases considering the restriction of the financial convenience.

6 Conclusions

Urban requalification projects are the model's range of application. These kind of projects needs first of all a preview about housing to be sold with controlled price, because of the actual socio-economic conjuncture that allowed an increase of subjects unable to access to the free housing market. Moreover, with urban requalification projects are essential both the private investor's sources involvement and competences, even if he is interested to participate only in investment with verified restriction of financial feasibility.

The model is firstly composed of a procedure that borrow main logical features of BEA to later calibrate combinations of two variables, "price" and "share" of social housing, on total, that guarantee to the private investor the initiative's balance.

The logical and functional relations of the developed model allow to easily and mutually link the technical and financial variables of the initiative, underlining interconnections and critical aspects.

The application of the model to a tangible case has highlighted its adaptability to specific territorial conditions because of its simple structure, rationalizing the process of decision making [6].

The possibility to retrace operations legitimates the management of both private and public actors involved, with positive consequences about transparency and decision effectiveness.

Finally, stability and flexibility elements, whose introduction in the planning of the investments is allowed by the model, amortize unruliness and hesitations caused not only by property market changes [10] but also by the complex nature of urban requalification initiatives.

References

1. Attardi, R., Bonifazi, A., Torre, C.M.: Evaluating sustainability and democracy in the development of industrial port cities: some Italian cases. Sustainability **4**(11), 3042–3065 (2012)
2. Attardi, R., De Rosa, F., Di Palma, M.: From visual features to shared future visions for Naples 2050. Appl. Spat. Anal. Policy **8**(3), 249–271 (2015)
3. Calabrò, F., Della Spina, L.: The public-private partnerships in buildings regeneration: a model appraisal of the benefits and for land value capture. Adv. Mater. Res. **931**, 555–559 (2014)
4. Censis. http://www.censis.it/1
5. Conine Jr., T.E.: A pedagogical note on cash break-even analysis. J. Bus. Finance Acc. **14**(3), 437–441 (1987)
6. D'Alpaos, C.: The value of flexibility to switch between water supply sources. Appl. Math. Sci. **6**(128), 6381–6401 (2012)

7. D'Alpaos, C., Marella, G.: Urban planning and option values. Appl. Math. Sci. **8**(157–160), 7845–7864 (2014)
8. Dean, J.: Cooperative research in cost-price relationships. Account. Rev. **14**(2), 181–184 (1969)
9. Del Giudice, V., De Paola, P., Torrieri, F.: An integrated choice model for the evaluation of urban sustainable renewal scenarios. Adv. Mater. Res. **1030–1032**, 2399–2406 (2014)
10. Del Giudice, V., Manganelli, B., De Paola, P.: Spline smoothing for estimating hedonic housing price models. In: Gervasi, O., Murgante, B., Misra, S., Gavrilova, M.L., Rocha, A. M.A.C., Torre, C., Taniar, D., Apduhan, B.O. (eds.) ICCSA 2015. LNCS, vol. 9157, pp. 210–219. Springer, Heidelberg (2015)
11. European Central Bank, Eurosystem, Statistical Data Warehouse. https://sdw.ecb.europa.eu/home.do
12. Gabrielli, L., Copiello, S.: Marginal costs and benefits in building energy retrofitting transaction. In: Hamburg International Conference on Sustainable Built Environment Strategies (SBE16), pp. 836–845. Zebau (2015)
13. Guarini, M.R., Battisti, F.: Evaluation and management of land-development processes based on the public-private partnership. Adv. Mater. Res. **869**, 154–161 (2013)
14. Guarini, M.R., Battisti, F.: Social housing and redevelopment of building complexes on brownfield sites: the financial sustainability of residential projects for vulnerable social groups. Adv. Mater. Res. **869**, 3–13 (2013)
15. Housing Europe, The state of housing in the EU 2015. http://www.housingeurope.eu/resource-468/the-state-of-housing-in-the-eu-2015
16. Ingraham, H.A.: Elementary presentation of volume, cost and profit relationships. Acc. Rev. **26**(3), 414–416 (1951)
17. Kee, R.C.: Implementing cost-volume profit analysis using an activity based costing system. Adv. Manag. Acc. **10**, 77–94 (2001)
18. Las Casas, G., Lombardo, S., Murgante, B., Pontrandolfi, P., Scorza, F.: Open data for territorial specialization assessment territorial specialization in attracting local development funds: an assessment procedure based on open data and open tools. TeMA. J. Land Use, Mobility Environ. 581–595 (2014)
19. Morano, P., Tajani, F.: Break Even Analysis for the financial verification of urban regeneration projects. Appl. Mech. Mater. **438**, 1830–1835 (2013)
20. Nesticò, A., Pipolo, O.: A protocol for sustainable building interventions: financial analysis and environmental effects. Int. J. Bus. Intell. Data Min. **10**(3), 199–212 (2015)
21. Rosato, P., Alberini, A., Zanatta, V., Breil, M.: Redeveloping derelict and underused historic city areas: evidence from a survey of real estate developers. J. Environ. Plann. Manage. **53**(2), 257–281 (2010)
22. Scorza, F., Casas, G.L.: Territorial specialization in attracting local development funds: an assessment procedure based on open data and open tools. In: Murgante, B., et al. (eds.) ICCSA 2014, Part II. LNCS, vol. 8580, pp. 750–757. Springer, Heidelberg (2014)