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Land Value Uplift and Enabling Land Use Change: Considerations for Transport Appraisal

Transport Research Insights

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1. Executive Summary

- **Land Value Uplift (LVU)** occurs when transport investment leads to an increase in property values on or near the route corridor.

- Broad types of LVU include:
    - An uplift where the **current land usage remains unchanged**.
    - Uplift where there is a **change of use** or an **intensification** of use.

  Uplifts where there is a change or intensification of use can reflect a transport investment enabling development, particularly housing development. This type of enabling investment in transport should be the main focus of LVU assessments.

- Estimates of the impact of LVU on overall property values in the vicinity of light rail infrastructure **average around 10%,** but can range **up to 20%.** However, in some cases proximity to infrastructure can result in **a negative or neutral impact** on existing properties.

- Under the Transport Appraisal Framework (TAF) – the Irish appraisal framework for transport - **LVU can be included as a benefit where there is a change of land use** due to a transport project and the land use change is an objective of the project.

- However, directly **monetising LVU into Cost-Benefit Analyses can raise some fundamental methodological problems**, which must be addressed in any proposed monetisation of LVU:
    i. **Double counting:** if user benefits such as time savings are already counted in the Cost Benefit Analysis associated with the project, and LVU represents the user benefit being 'priced-in' to the property value (the property is worth more due to its travel user benefits), we may be double counting.
    ii. **Attribution:** ensuring that the transport investment is causing the LVU.
    iii. **Displacement:** increasing land values in one area by displacing activity at the expense of another.

- These issues may be resolved by focusing on land use changes which are unlocked by transport infrastructure. This may then be discussed qualitatively in appraisal documentation, so that a fuller picture of the impact of a scheme is available to decision makers, for example the value or scale of a potential development being enabled.

2. Introduction

LVU occurs when an investment in the transport network leads to a corresponding change in property values on or near the route corridor. Generally, this will occur in the form of improvements to transport networks causing property values to increase, referred to as an uplift.

LVUs can be large and varied. For example, research carried out for Transport for London found that past projects have produced significant land value uplifts, of 52% for the Jubilee Line extension, 23% for the Docklands Light Railway, and 6% for the incorporation of the North London Line into the Overground network.[1]

Uplifts in the region of 10% are commonly observed internationally; a review of LVU evidence carried out for the Australian Government in 2015 found an average observed uplift of 9.5% for light rail and 6.9% for heavy rail among research studying commercial and residential property values in the vicinity of transport infrastructure.[2] Given the potential scale of these uplifts it is important to consider the relevance of LVU and ask whether it could be incorporated more coherently into appraisal.

This paper will discuss the concept of LVU, how it is measured in academic literature, and how it may be appropriately considered in economic appraisals. While this paper focusses largely on light rail, due to the wealth of evidence in this area, it is likely that other public transport investments could cause similar property or land price impacts, for example the introduction of high-quality Bus Corridors.

Wider Context

Related to LVU, efforts to share some of the uplifts to fund infrastructure have been proposed. In April 2023, the General Scheme for the Land Value Sharing and Urban Development Zones Bill was published. This provided for a Land Value Sharing (LVS) charge of 30% on the difference between existing use value and the market value on land that has been zoned for housing. The Department of Housing, Local Government, and Heritage and the Department of Transport have also published a report on opportunities for Transport Orientated Development (TOD) in Dublin. TOD is a form of development which seeks to maximise provision of employment, amenities, and housing in close proximity to high quality public transport services.[3] This paper does not aim to deal with LVS, or with any particular funding mechanisms for infrastructure, or TOD, rather it is focused on the appraisal of projects and measurement of LVUs.[4]

[1] Transport For London *Land Value Capture, Final Report, Executive Summary* 2017
[2] Australian Government *Transport Infrastructure and Land Value Uplift* 2015
[3] Department of Housing, Local Government and Heritage; Department of Transport: *Opportunities for Transport Orientated Development (TOD) in Major Urban Centres – Dublin Study* 2023
[4] Department of Housing, Local Government and Heritage: *General Scheme Land Value Sharing and Urban Development Zones Bill 2022*

3. Theoretical Foundation of Land Value Uplift

What are Land Value Uplifts?

The term Land Value Uplift is used because it is the *land* itself which appreciates in these scenarios; the uplift to a piece of property is coming from the physical land and the location of the property. An uplift can occur on any type of land, including residential, commercial, industrial, or agricultural.

There are two broad categories of uplift.

1. An **increase in land value at its current use**, for example a house situated near a new rail station is likely to experience an increase in value after the station opens.
2. An **increase in land value given a change of use for the land**, for example an agricultural site which becomes suitable for housing development after a transport investment. This could also be a site which experiences an increased density of use, for example a pre-existing housing site which is suitable for redevelopment into more dense housing. In this case the land may appreciate, but the price of a unit of housing may stay constant or even reduce, due to increased density.

Change of use uplifts are likely to be more relevant for strategic policy alignment and therefore more directly relevant in appraisal, as they can represent increases in housing supply or industrial and commercial development in a particular area, in line with strategic goals.

4. Empirical Estimation of LVU

Hedonic Pricing Models

Much of the academic literature on LVU and land pricing more generally uses hedonic pricing models. Hedonic pricing models decompose the price of a unit into its observable constituent parts by treating housing and property as a bundle of attributes and estimating implicit prices for each attribute. An implicit price provides the marginal cost of purchasing a given attribute (such as access to a transport link).

Limitations of Hedonic Models

Estimating a hedonic model requires detailed datasets of property sales as well as building characteristics, measures of distance from the relevant transport infrastructure, and often additional measures of transport accessibility. Since a hedonic model relies on observing market outcomes, it is an ex-post tool that **can only be applied after a sufficient period of time** has elapsed for the LVU to be 'priced-in.' This limits the value of hedonic models for appraisal work as they can only make measurements retrospectively.

Hedonic models are also generally unable to capture change of use LVUs and are used either cross-sectionally to compare property with access to transport to property without access, or used over time to compare the value of a pre-existing property before and after an intervention. These limitations of hedonic models mean that while they often provide a useful measure of the value impacts of investments, they are insufficient to be the main tool for appraisal work, and need to be complemented by other methods to capture the change of use impacts which we are targeting.

Luas

Mayor *et. al*[5] use a hedonic model to measure the impact of the initial Green and Red Luas lines on property prices in Dublin. They compare house sales before and after the opening of the lines from 2001 to 2006, finding that **houses within 500 metres of a Green Line station experienced an uplift of 23% in Zone 2 and 17% in Zone 3**, controlling for other factors, such as house characteristics and transport and amenity access, and the wider increase in house prices. For houses between 500 metres and 2000 metres from a station, the uplift was 7%. Red Line results were less significant, with a 12% uplift within 1000 metres of a station.

Luas Cross-City Expansion

Connor[6] tests whether the opening of new stations increased property prices in their vicinity, and whether the Cross-City expansion increased property prices in the vicinity of *existing* stations, due to the increased travel range. The tests compare a treatment group made up of property sales within walking distance of a Luas stop and a control group made up of property sales outside walking distance, but within a 3000 metre radius of the station. The paper finds statistically significant positive impacts on property prices for both tests.

A new Luas station was associated with an increase of nearby residential property prices of 12.6% on average, with an average increase of 9.8% observed in the vicinity of existing Luas stations. However, this was more pronounced on the Red Line, with an average increase of 11.3%, and 5.2% on the Green Line.

UK Evidence

Manchester Metrolink

A report[7] carried out by the Leeds Institute for Transport Studies found that the average property value uplift associated with new stations was 6.3% within a 1000 metre catchment around stations, varying between a **10.5% uplift in higher-income catchments and insignificant uplifts in some lower income catchments**. The authors propose that a low underlying level of property demand

[5] Mayor, K., Lyons, S., Duffy, D. and Tol, R.S., 2012. A hedonic analysis of the value of rail transport in the Greater Dublin area. *Journal of Transport Economics and Policy (JTEP)*, *46*(2), pp.239-261.
[6] Connor, B., 2023. The Residential Property Price Impact of Luas Investments. *Qeios*.
[7] Institute for Transport Studies *Land Value and Transport Phase 2: Modelling and Appraisal* August 2019

likely constrained growth in prices in lower-income areas. The Airport line was associated with exceptionally large uplifts of 20.6%, with employment centres located at both ends of the line. The observed disparities indicate that policymakers should consider the distributional impacts of LVU. If areas with pre-existing higher property prices and higher incomes are likely to experience larger LVUs, policymakers should not overly focus on LVU to the detriment of other positive impacts of transport investments. Where there are LVUs such as this with no change of use, it is also important to consider that the benefit accrues to a landowner and there is not necessarily a social benefit, while there could be an increase in taxes e.g. Local Property Tax.

Similarly to their findings for residential property, the Institute's report found that the Manchester Metrolink lines generated increases in commercial property, with uplifts of 21% for the airport line (which serves the city centre and the airport; both large employment centres) and 11% for the South Manchester line.

Negative Impacts on Land Values

Proximity to Public Transport Infrastructure

Proximity to transport infrastructure may also have an adverse effect on property prices. Debrezion *et al*[8] found that in the Netherlands, dwellings very close to rail stations were on average about 25% more expensive than dwellings over 15km away, but that dwellings located within 250 metres of a rail line were about 5% less expensive than dwellings located 500 meters or more away. While proximity to any rail infrastructure brings negative effects such as noise, this is offset by accessibility benefits where a station is nearby.

Using spatial autoregressive and autocorrelation models, Efthymiou and Antoniou[9] found that proximity to the port and major national railway station in Thessaloniki were associated with lower property prices, and also that proximity to construction sites for a planned metro line also negatively impacted property prices for sales (but not rent prices). Similarly, they found in Athens[10] that proximity to national rail stations, airports, and ports were associated with a negative impact on property prices, likely due to negative externalities such as noise, but completed metro lines, tram, suburban rail, and bus stations all had a positive impact on property prices.

Proximity to Roads

Ossokina and Verweij[11] used a quasi-natural experiment to study the house price impact of increased traffic on local streets. Exogenous variation is provided by the opening of a state highway

[8] Debrezion, Ghebreegziabiher; Pels, Eric; Rietveld, Piet (2006): *The Impact of Rail Transport on Real Estate Prices: An Empirical Analysis of the Dutch Housing Market*, Tinbergen Institute Discussion Paper
[9] Efthymiou, D., & Antoniou, C. (2015). Measuring the effects of transportation infrastructure location on real estate prices and rents: investigating the current impact of a planned metro line. *EURO Journal on Transportation and Logistics*, *3*(3), 179-204.
[10] Efthymiou, D., & Antoniou, C. (2013). How do transport infrastructure and policies affect house prices and rents? Evidence from Athens, Greece. *Transportation Research Part A: Policy and Practice*, *52*, 1-22.
[11] Ossokina, I., & Verweij, G. (2011). Quasi-experimental evidence on the effect of traffic externalities on housing prices.

leading to changes in traffic density on smaller streets. Controlling for spatial and house characteristics, a doubling of traffic density was associated with a reduction in house prices of about 2%. Ossokina and Verweij[12] also studied a reduction in traffic due to the opening of a bypass, finding that on average, a 50% reduction in traffic density induced a 1.4% increase in housing prices.

Airports

A 2004 meta-analysis of hedonic property price studies on airport noise[13] found a noise discount in the US of about 0.5% to 0.6% per decibel at levels of 75 dB or less, and a discount of 0.8% to 0.9% per decibel in Canada. More recent research in Poland found a 0.87% discount per decibel for single family homes, and 0.57% for apartments.[14]

As with all impacts on existing properties, these adverse impacts are less relevant to appraisal work, but can be considered if they are deemed relevant.

5. LVU in Appraisal Guidance

The Transport Appraisal Framework

Primary and Secondary Impacts

Irish appraisal methodology for transport is set out in the Transport Appraisal Framework (TAF).[15] Within the TAF, primary impacts are those associated with the primary objectives of a project, which can be directly and fully attributed to the project. Benefits which do not meet these criteria can be considered secondary impacts. For example, increased ticket sales due to a public transport investment would generally be a secondary impact, unless the increased ticket sales were an objective of the scheme.

The TAF states that **changes in land value can be included and monetised within a CBA, where the transport project facilitates a change in land use, but 'extreme care' should be taken when doing this.** The TAF also states that land use changes should only be included if they are planned from the outset of a project and are an agreed objective of the project.

[12] Ossokina, I. V., & Verweij, G. (2015). Urban traffic externalities: Quasi-experimental evidence from housing prices. *Regional Science and Urban Economics*, *55*, 1-13.
[13] Nelson, J. P. (2004). Meta-analysis of airport noise and hedonic property values. *Journal of Transport Economics and Policy (JTEP)*, *38*(1), 1-27.
[14] Trojanek, R., Tanas, J., Raslanas, S., & Banaitis, A. (2017). The impact of aircraft noise on housing prices in Poznan. *Sustainability*, *9*(11), 2088.
[15] Department of Transport (2023), *Transport Appraisal Framework (TAF)*, Dublin.

Where the land use change is not fully attributable to the project, it is not monetised into Cost-Benefit Analysis and can be included as a secondary impact and discussed qualitatively. A qualitative approach is also taken for the potential value of what may be built in future on rezoned land banks, and for assessment under the *Zoned Land*, *Land Use Planning and Spatial Planning* TAF criterion, where schemes are assessed with reference to relevant strategic land-use planning documents. Qualitative discussion is broadly the approach suggested in this paper, due to some of the methodological issues associated with LVU monetisation that are discussed later on.

Box 1: MetroLink Property Value Impacts

Residential property price impacts are discussed in the MetroLink Preliminary Business Case Appendix I. The PBC discusses these impacts qualitatively and does not attempt to monetise them into the CBA.

The PBC estimates there are 20,000 existing housing units within 500m of a MetroLink station, and 95,000 within 500-2,000m. Applying a 10% uplift for properties within 500m, and 5% within 2000m, to an average property price of €380,000, this yields an estimated uplift of €2.57bn in 2019 prices and values.

The PBC does not attempt to assess the impacts associated with induced housing development, but it identifies residential zoned areas in Ballymun and Swords within a 2km buffer zone of the MetroLink route.

NTA Regional Modelling System

The National Transport Authority (NTA) Regional Modelling System (RMS) is the key tool for forecasting transport demand in Ireland, used in appraisals of major projects and strategies. It is based on population and employment projections and assigns this demand to the transport network. The planning data used in the reference case forecasts inputted into the NTA Model are aligned with the National Planning Framework and provides a spatial disaggregation agreed with local authorities to represent the likely distribution of land use growth in the future.

The model's outputs can be used to derive economic costs and benefits using the Economy Module[16]. This compares a Do-Minimum scenario against a Do-Something scenario which will include the proposed piece of transport investment. However, this will not give the impact of a land use change between the Do-Minimum and Do-Something, as within the model land use and planning are held constant between the Do-Minimum and Do-Something scenario. Other models

[16] https://www.nationaltransport.ie/wp-content/uploads/2022/09/Economy-Module-Development-Report-v3.1.1.pdf

such as Land Use Transport Interaction models would be required to assess the interaction between transport and land use in this way.[17] However, it may still be useful to test alternative land use and population distribution scenarios within the NTA RMS to better understand potential demand. Other transport models may also be appropriate to use for this analysis, and should be applied where appropriate.

International Appraisal Methodology

Land value impacts are considered in appraisal methodologies used by some other jurisdictions, such as the United Kingdom and Australia. In other cases, such as the United States, it is not considered appropriate to include LVU due to double counting concerns.[18]

United Kingdom

Land Value Uplift is covered in two sections of the UK appraisal guidance: Wider Economic Impacts[19] and Induced Investment[20]. The uplift is included as an 'indicative monetized impact.' This means that it is not included in the initial Value for Money metric, and is only considered at the last stage of an assessment, where it is determined whether these indicative metrics are likely to materially alter the overall value for money of the proposal i.e. move it into a higher or lower category.[21] UK guidance states that the standard methodology to estimate new user benefits becomes less accurate under significant land use changes. The guidance therefore focuses on transport schemes which can 'unlock' new housing developments, representing a significant land use change for the new housing site.

The standard methodology used to estimate user benefits assumes that land use is fixed, and calculates the user benefits for existing users and new users. This fixed land use methodology becomes less accurate as land use change increases, meaning there is a portion of 'missing' user benefits which are not being captured. This justifies using land value uplift to approximate the additional benefits in UK guidance.

Housing which is 'unlocked' through a transport investment is considered 'dependent development.' This can be thought of as housing which *would not* have been built without the transport investment. This is broadly in line with TAF guidance that LVU should only be counted where there is a change of land use. The associated land value uplift captures the user benefits to residents of the dependent development, which are considered additional to the fixed land use user benefits (benefits to existing and new users without the land use change being included).

[17] TAG Supplementary Guidance: Land Use/Transport Interaction Models
[18] Department of Transportation *Benefit-Cost Analysis Guidance for Discretionary Grant Programs* 2024
[19] TAG unit A2-1 *Wider Economic Impacts*
[20] TAG unit A2-2 *Induced Investment*
[21] UK TAG categorises value for money into 6 categories: Very Poor, Poor, Low, Medium, High, and Very High

Australia

Australian guidance[22] advises measuring land *use* value uplifts rather than simply land value uplifts, as it argues that LVU largely reflects the capitalisation of the primary user benefits already included in CBA, into the asset. Land use value uplifts can be an increase in the density of housing, or a change of use for a plot of land.

This distinction is explained as follows in the guidance: where a land *value* uplift is an increase in the value per square metre of floor space, a land *use value* increase is an increase in the amount of floor space, holding the value per square metre constant. A land use change to residential from another use could be thought of as an increase from zero square metres of residential floor space. These land use value increases in Australian guidance are change of use uplifts, as they represent either a change of land use or a change in the intensity of use.

This is similar in effect to the UK guidance, and how the matter is approached in the TAF, with the focus on additional square metreage of space at a given land use similar to the 'change of use' framing used in UK guidance and the TAF. **The key point in all guidance is the avoidance of uplifts that simply reflect user benefits being capitalised into property prices, as to include these would be double counting**.

Australian guidance also recommends that **only land-use changes that are conditional on the transport investment should be counted**, and not land-use changes which would be achieved with supply-side regulatory interventions. Making this distinction may be challenging in an environment of housing undersupply, as all land within the vicinity of employment centres could potentially be built on with supply-side reform (*e.g.*, granting planning permission), even if transport network capacity was insufficient. This underlines the importance of carefully considering additionality, ensuring that any development being measured for LVU would not have taken place without the transport investment. For example, if there is an explicit link in planning decisions whereby a housing development could not have been constructed without the transport investment, this would be sufficient to determine additionality.

6. Considerations for LVU in Appraisal

Double counting

Double counting occurs when a cost or benefit is counted twice in an appraisal. It is important to ensure that double counting does not occur, as it will lead to an inaccurate estimation of the relative costs and benefits of the scheme. This requires careful consideration of the causal mechanism

[22] Australian Transport Assessment and Planning Guidelines *Land-use benefits of transport initiatives* 2022

through which LVU occurs, to determine whether the LVU and user benefits are both measuring the same impacts. There are two questions to answer here:

1. **Do land value uplifts derive from user benefits being 'priced in' to property values?** This would mean that prospective property purchasers are willing to pay a premium, to access these user benefits. For example, the property price increase reflects the reduced travel time associated with the transport investment. It is likely that this is the case.
2. **If LVU is driven by these user benefits, are they captured already in appraisal?** If it is the case that LVUs generally represent the capitalisation of user benefits into asset prices, if those user benefits are already captured within the appraisal, it is double counting to also include the LVU. Under current appraisal guidance this is likely to be the case unless user benefits are excluded.

It is likely that LVU does capture user benefits in some way, so including it as an additional benefit on top of other user benefits will cause a problem of double counting, unless the transport users benefiting from land value uplifts can be excluded from the modelling scenarios, which is unlikely to be feasible or beneficial when using the NTA RMS, as it already fully accounts for future spatial plans.

Displacement

The TAF states that if the impacts of a scheme are likely to displace activity elsewhere, this must be explicitly considered. For LVU, a form of displacement could occur if an uplift in one area comes with a commensurate reduction in property values in another area due to a displacement of households, for example if an improved motorway network facilitated urban sprawl by allowing commuters to live further from their places of work at the expense of city-centre housing sites. Within the NTA RMS, this would be represented by an increase in population in one area offset by a commensurate reduction in other areas. This would need to be carefully considered, to ensure scenarios are consistent with spatial policy, however given the current housing shortage in Ireland it may be the case that any site brought into feasibility will be developed, with little risk of displacement due to the high levels of demand in the system.

Additionality

It is important to ensure that where a change of use uplift is identified, it can confidently be attributed to the transport investment. It is not sufficient to show that a development is served by a new transport investment, **it is essential to demonstrate that the development *would not* have been built without the transport investment**. In an Irish context demonstrating that a development is attributable to the transport investment could potentially be shown through planning permission

applications, as developments can be refused planning permission partly due to transport deficits, or refused permission until after a transport investment is complete.[23]

It also may be the case that **some housing developments become economically feasible due to a transport investment** without any direct planning permission relevance. For example, a site which was previously not economical to develop but is in an area impacted by LVU may become feasible to develop, or feasible to develop more intensively. Case-by-case judgement would be required to determine attribution of the development to the transport investment. It will also be important to consider the timing of uplifts: whether a site appreciates in value at the announcement of a transport link or at the granting of planning permission for the transport (or enabled development), or at any other point in the lifecycle.

7. Conclusions

LVUs can be large. Uplifts of around 10% are commonly observed in the vicinity of light rail infrastructure such as the Manchester Metrolink and the Luas. This is an important impact of transport projects and should be captured where possible to gain the best possible understanding of the impacts of investments.

LVUs will generally represent some portion of the user benefit to a property owner being capitalised, or 'priced-in' into asset values. Due to the relationship with user benefits, any integration of LVU into appraisal will need to avoid double counting. The attribution of uplifts to transport investments to establish additionality also requires careful consideration. Additionally, there can be large observed disparities within areas which experience LVU. If LVUs are experienced by property owners in more affluent areas, and a smaller benefit accrues to property owners in other areas, this could have adverse distributional consequences. Generally, uplifts on existing properties are also less relevant to policy goals. A property price uplift on existing property is a private benefit to the landowner, and not likely to be one of the objectives of a transport investment scheme, or delivering on strategic objectives.

However, there may be applications for LVU in appraisal. Approaches such as the UK's focus on dependent development may provide a useful methodology to estimate LVU within certain contexts. The TAF allows the inclusion and monetisation of LVUs where there is a change in land use, given 'extreme care' is taken, but in practice any direct monetisation of LVU is likely to be inappropriate. If direct monetisation is to be pursued, then the key criteria of double counting, displacement, and attribution will need to be fully addressed. It may also be appropriate to consider

[23] TheJournal.ie *Planning Refused for 16-storey Grand Canal Square-style scheme for Cabra East*

the secondary impact on property tax revenue, as increases in property values i.e. LVUs with no change of use, will generally increase the rates paid by property owners. If a robust methodology can be demonstrated to estimate these impacts, there could be scope for their inclusion in CBA along with other secondary impacts on tax revenues.

Where relevant, estimation and qualitative discussion of 'change of use' LVUs could improve appraisal, particularly where an investment may facilitate development. This may help to give a better understanding of the overall benefits of projects, with the understanding that they should not be considered fully additional to user benefits. Discussion of this induced development could focus on the land price uplift, or simply on the potential for future development i.e. numbers of housing units that can be enabled. This could be on greenfield sites, or on brownfield/infill sites.

Many projects will not induce these changes, but many of the projects which do lead to significant land use changes will be large and capital-intensive projects, such as new rail lines serving greenfield sites, or brownfield sites undergoing rezoning. Understanding these changes where possible and appropriate should lead to a better-informed appraisal process and decision-making.