A measurement approach to real estate activities: Based on input - output system

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Abstract: According to the International Standard Industrial Classification (ISIC)[1] and Vietnam Standard Industrial Classification (VSIC)[2], real estate sector is industry L under VSIC sub-sector level 1 and industry code level 2 is 68, level 3 is 681, 682. Like most other industries, managers and even professionals understand the "real estate business" very differently from the UN's ISIC standard sub-sector and Vietnam's VSIC sub-sector; so, the real estate business is understood to include the construction of houses for sale? This activity is in principle according to ISIC and VSIC under the construction industry (class I: F) and the second level is industry 41.

This study put forwards the concept of real estate not only according to the ISIC and VSIC, but also expanded such as: 1. Real estate in the processing and manufacturing industry; 2. Real estate in hotels and restaurants; 3. Real estate in entertainment; 4. Build houses for sale; 5. Real estate under ISIC.

The study is based on the Vietnam national input - output table in 2016 with the number of industries aggregated as follows: 1. Real estate in the processing and manufacturing industry; 2. Real estate in hotels and restaurants; 3. Real estate in entertainment; 4. Build houses for sale; 5. Real estate under ISIC; 6. Other basic construction; 7. Agriculture, forestry and fisheries; 8. Mining industry; 9. Manufacturing and processing industry; 10. Services.

Keywords: Input – output, multiplier, output, real state, value added

I. Introduction

According to the International Standard Industrial Classification (ISIC)[1] and Vietnam Standard Industrial Classification (VSIC)[2], real estate sector is industry L under VSIC sub-sector level 1 and industry code level 2 is 68, level 3 is 681, 682. Thus, this activity according to international and Vietnamese sub-sectors includes:

-Trading in real estate, land use rights of owners, users or renters (code 6810): Buying and selling houses and residential land use rights (68101); Buying and selling houses and non-residential land use rights (68102); Leasing, operating and managing houses and residential land (68103); Leasing, operating and managing houses and non-residential land (68104); Other real estate business (68105).

- Consulting, brokerage, real estate auction, land use right auction (6820): Consulting, brokerage of real estate, land use rights and real estate auction, land use right.

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This study tries to give the measure on effects of an industry or a group of industries to the economy not only as a share of that industry to GDP but also to account for the spillover of that industry to the value added of other industries and more over production of other industries induce to value added of the industry or group of industries to be researched. Currently, in the world, there are several approaches to measuring the influence of a group of industries in the economy on the economy, typically there are two approaches to measuring the influence of the digital economy on the economy as follows:

+ To date, quantitative assessment of the impact of a group of industries on the economy is very rare. Only a few studies demonstrating such efforts were found such as OECD [4], ADB (2021) [5] , Duc and Linh (2018)[6], Bui and Nguyen (2022)[7] applied input - output system to assess the impact of the digital economic on the economy".

+ The influence of a group of industries on the economy is estimated from the Cobb-Douglas production function and the coefficients estimated from the input - output system [8].

II. Methodology

The basic relationship of competitive import type and non-competitive import type input - output tables are shown as follows:

$$X = (I - A)^{-1}.Y \tag{1}$$
$$X = (I - A^d)^{-1}.Y^d \tag{2}$$

With: A is the coefficient matrix of direct intermediate costs, A^d is the matrix of coefficients of direct intermediate costs using domestic products, X is the matrix of output induced by factors of final demand, Y is the final use matrix consisting of final consumption, gross capital formation and net exports, Y^d is the final use of domestic products, and I is the unit matrix.

From there, it can be known that when increasing by 1 unit of final product, which industry induce to output the most through backward linkage and forward linkage. Moreover, it is possible to know how the final demand induce to the value added (V), which is really important for policy makers.put: $vi = Vi/Xi$

So we have:

$$V = v.(I - A^d)^{-1}.Y^d \tag{3}$$

Leontief's basic relation is rewritten as submatrix as follows:

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \begin{bmatrix} I & 0 \\ 0 & I \end{bmatrix} \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} \tag{4}$$

OR

$$: \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}, \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}_+ \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix}_- \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \tag{5}$$

With: X_1 is the output vector of industry group 1, X_2 is the output vector of the rest of the economy; The matrix of direct intermediate cost coefficients (A) is divided into sub-matrixes A_{11} represents industry group 1 using its own inputs, A_{12} represents the production current of the remaining industries using the group's inputs industry 1 for production, A_{21} represents industry group 1 that uses the inputs of other industries in the economy, and A_{22} shows how the rest of the economy uses its own products in the production process.

Let Get B be the Leontief inverse matrix with the basic relation rewritten as follows:

$$B = \left(\begin{bmatrix} I & 0 \\ 0 & I \end{bmatrix} - \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \right)^{-1} = \begin{bmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{bmatrix}$$

(6)

The symbol GVA is the total value added, and v is the coefficient of the value added per output. Thence inferred:

$$GVA_1 = v_1 . X_1 = v_1 . (B_{11} . Y_1 + B_{12} . Y_2) \tag{7}$$

$$GVA_2 = v_2 . X_2 = v_2 . (B_{21} . Y_1 + B_{22} . Y_2) \tag{8}$$

From that definition: the value added of real estate activities is determined as follows:

$$GVA_{\text{Real estate}} = GVA_{\text{core Real estate}} + GVA_{\text{Real estate Induced impacts}} + GVA_{\text{spillover Real estate}}$$
$$GVA_{\text{core Real estate}} = v_{11} B_{11} . Y_1$$
$$GVA_{\text{Real estate Induced impacts}} = v_1 . B_{12} . Y_2$$
$$GVA_{\text{spillover Real estate}} = v_2 . B_{21} . Y_1$$

Thus, it can be seen that the final products of the real estate sector that induced to the value added of economy is $(v_2.B_{21}.Y_1)$ and the economy uses the products of that industry group in production induce to value added of real estate is $(v_1. B_{12}.Y_2)$.

III. Experimental study

The study introduces the concept that the value added of the core real estate industry is the value added of real estate business activities that is spread directly from the final products (formula (10), the value added on the addition of real estate business activities is spread by the production of other industries (formula 11) and the final products of real estate activities is spilled over to the value added of the economy (formula 12).

The Leontief inverse matrix (matrix B) is calculated as follows:

Table 1. The Leontief inverse matrix (times)

Name of sectors	Code	1	2	3	4	5	6	7
Expansion Real Estate	1	**1.058**	0.123	0.005	0.005	0.003	0.007	0.015
Real estate according to ISIC	2	0.007	**1.064**	0.008	0.006	0.006	0.028	0.043
Agriculture, forestry and fisheries	3	0.084	0.031	**1.386**	0.054	0.227	0.031	0.062
Mining	4	0.019	0.007	0.012	**1.113**	0.053	0.006	0.011

industry							
Manufacturing and processing industry	5	0.432	0.161	0.282	0.324	**1.412**	0.142	0.257
Tourism	6	0.000	0.000	0.000	0.000	0.000	**1.018**	0.000
Other services	7	0.140	0.147	0.127	0.124	0.130	0.491	**1.288**

In matrix B includes sub-matrixes B_{2x2}, B_{2x5}, B_{5x2} and B_{5x5} as formula (6)

The value-added matrix of the core real estate business is spread by the final product $(V_1.B_{11}.Y_1)$ $(V_1.B_{11}.Y_1)$ and production for the final demand other sectors $(V_1.B_{12}.Y_2)$ $(V_1.B_{12}.Y_2)$. Thus, in this study shows be seen that the contribution of the extended real estate sector to GDP is 4.57% and the contribution of real estate according to ISIC is 4.26% of GDP and here the added value of the whole real estate industry is up to GDP is 8.84%.

Table2. The effects to added value added of two groups of real estate industries (Thousands Vietnam Dong)

	$V_1B_{11}Y_1$	$V_1B_{12}Y_2V_1$	Total	$V_1.B_{11}Y_1/GDP$	$V_1.B_{12}Y_2/GDP$	Total effects
Expansion Real Estate	238,815,375	15,939,945	254,755,320	4.29%	0.29%	**4.57%**
Real estate according to ISIC	137,151,862	100,253,377	237,405,239	2.46%	1.80%	**4.26%**
Total	**375,967,237**	**116,193,322**	**492,160,559**	6.75%	2.09%	**8.84%**

However, the final product of the real estate industry group not only affects the value added of this industry group but also affects to value added of other sectors of the economy as shown in formula 13. Thus, the total contribution of the product the final product of the real estate industry in GDP by this calculation is 12.2% of GDP.

Table 3. Contribution of real estate to GDP

	$GVA_{\text{core Real estate}}$	$GVA_{\text{Real estate Induced impacts}}$	$GVA_{\text{spillover Real estate}}$	Total effects
Real estate	6.75%	2.09%	3.36%	12.20%

IV. Conclusion

The importance of an industry is intrinsically not only the share of that industry's value added in total value added (GVA) or GDP, but also its final products (including final consumption, gross capital formation, export) of those industríe spillover into output and value added to other sectors of the economy. The real estate industry creates value added to other sectors in the economy is relatively high, which shows that when the real estate industry faces difficulties, it will have a significant impact on the economy.

Therefore, the core of the problem is people's income, the Vietnamese people's housing requirement are still very high, but due to declining incomes and income disparity of quite large population groups. In Vietnam seem two

groups have been formed. popular residents: one group of people who own a few houses and the rest are the vast majority of people with housing difficulties. Some people buy real estate to sell to make a profit, however, when the residential income does not increase much while it will still have to pay bank interest. In order to increase people's income. To recover the real estate market, it is necessary to create conditions for the business system to develop well; Thereby increasing income for residents.

When in Vietnam, people all do real estate business by buying and reselling non-human-made products according to this calculation, which will lead to a decrease in the influence of the real estate industry in GDP. and at some point, the economy will collapse when money does not go into production but like a volleyball that goes back and forth between banks, bonds and real estate. The economy will gradually recover when corruption, group interests and speculation are minimized. After the screening process of backyard businesses, those that develop because of relationships will be eliminated and so on. To be create conditions for businesses doing right away to develop

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