The Impact of the Transportation Sector on the Jordanian Economy

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Abstract

Objectives: This study aimed to assess the impact of the transport sector on the Jordanian economy. The study explores the interdependence between transport sector and other sectors.

Method: two main indices were adopted by analyzing the input-output tables for 2006 and 2019. The first indicator focused on forward and backward inter-sector linkages, while the second indicator examined the sector's impact on output, income, employment, taxes, and imports through multipliers.

Results: The results of the first indicator revealed that the transport sector played a key role in terms of forward linkages, ranking fourth in 2006 and third in 2019. However, it did not fare well with respect to backward linkages, with its ranking dropping from fifth in 2006 to ninth in 2019. These findings emphasize the significance of the sector in driving growth, enhancing competitiveness, and attracting foreign investments. Additionally, the results indicated an apparent decline in the sector's indicators for 2019 compared to 2006. This decline may be attributed to low efficiency, as indicated by global competitiveness reports, and the government's energy policy, which liberalized the prices of oil products and imposed additional taxes on these products.

Conclusions: In view of the study findings, it is imperative for decision-makers to prioritize creating a conducive environment that supports and develops the sector, allowing it to achieve its desired goals of growth, competitiveness, foreign investment attraction, and tourism promotion, among others. Furthermore, the study recommends encouraging investment in an industrial base that strengthens backward linkages with the transport sector, such as the spare parts industry. Moreover, there is a need to stimulate the adoption of energy-efficient electric vehicles. Finally, the study recommends that future input-output tables include four detailed transport sectors, similar to other countries.

Keywords: transport sector, input-output table, multipliers, inter-sector linkages, Jordan.

تأثير قطاع النقل على الاقتصاد الأردني

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ملخّص

الأهداف: هدفت هذه الدراسة إلى تقييم تأثير قطاع النقل على الاقتصاد الأردني. اذ تبحث الدراسة في التشابك الاقتصادي لقطاع النقل مع القطاعات الأخرى.

المنهجية: تم تطبيق مؤشرين رئيسيين باستخدام تحليل جداول المدخل-المنتج لعامي 2006 و 2019. ركز المؤشر الأول على الروابط القطاعية الأمامية والخلفية، بينما تناول المؤشر الثاني تأثير القطاع على الإنتاج والدخل والتوظيف والضرائب والواردات من خلال المضاعفات.

النتائج: كشفت النتائج أن قطاع النقل كان قطاعا رائدا في مجال الروابط الأمامية، حيث جاء في المرتبة الرابعة عام 2006 والثالثة في عام 2019. الا انه لم يحقق ذات النتائج من حيث الروابط الخلفية، حيث تراجعت مرتبته من المركز الخامس عام 2006 إلى التاسع في عام 2019. تسلط هذه النتائج الضوء على أهمية القطاع في دفع عجلة النمو وتعزيز التنافسية وجذب الاستثمارات الأجنبية. بالإضافة إلى ذلك، أشارت النتائج إلى انخفاض واضح في قيم المؤشرات للقطاع لعام 2019 مقارنة بعام 2006. يُعزى هذا الانخفاض إلى ضعف الكفاءة، كما اشارت الى ذلك تقارير التنافسية العالمية، وسياسة الطاقة الحكومية في تحرير أسعار المشتقات النفطية وفرض ضرائب إضافية على هذه المنتجات.

الخلاصة: في ضوء هذه النتائج، من الضروري أن يُعطي صانعو القرار الأولوية لخلق بيئة مواتية تدعم وتنمي القطاع، مما يسمح له بتحقيق أهدافه المرجوة في نمو الاقتصاد وتعزيز التنافسية وجذب الاستثمارات الأجنبية وتعزيز السياحة، وغير ذلك. علاوة على ذلك، توصي الدراسة بتشجيع الاستثمار في قاعدة صناعية تعزز الروابط الخلفية مع قطاع النقل، مثل صناعة قطع الغيار. كما توصي بتوفير حوافز لاستخدام المركبات الكهربائية لتخفيض كلفة الطاقة. وأخيرًا، توصي الدراسة بأن تشمل جداول المستخدم-المنتج المستقبلية أربعة قطاعات نقل مفصلة، مماثلة لغيرها من البلدان.

الكلمات الدالة: قطاع النقل، جدول الإدخال-الإخراج، مضاعفات، الصلات بين القطاعات، الأردن

1. INTRODUCTION

Transportation is a fundamental component of any economy, playing a crucial and significant role through various modes such as water, road, rail, and air. Efficient transportation systems are widely recognized as drivers of economic growth. Empirical studies have shown that these systems enhance productivity, promote local and international tourism, increase competitiveness, and attract foreign direct investment. Moreover, they generate job opportunities, facilitate international trade, and crucially, enable the movement of people and goods (Hakim and Merkert, 2016).

The importance of the transport sector in Jordan is no exception, especially given the country's limited economic resources and the government's commitment to establishing efficient infrastructure for sustainable economic growth. Decision-makers are striving to capitalize on tourism opportunities, improve economic competitiveness, attract foreign investment, and boost productivity. A developed infrastructure, particularly a robust transport sector, is pivotal in achieving these goals.

This study aims to analyze the role of the transport sector in the Jordanian economy, focusing on its potential for economic growth, job creation, and tourism development. It also examines its interrelations with other sectors and the opportunities it presents for them. The study is structured into six sections: Section 1 introduces the topic, Section 2 discusses the transport sector in Jordan, Section 3 reviews previous studies, Section 4 describes the methodology used, Section 5 presents the study's applications, and Section 6 concludes the paper.

2. THE JORDANIAN TRANSPORT SECTOR

Decision-makers in Jordan have placed special emphasis on the transport sector due to its crucial role in driving growth and development. Transportation facilitates the movement of people and goods, providing access to markets and essential services such as health and education.

Jordan’s transport sector has experienced significant development, with its value added increasing from JOD 1,424 million in 2008 to JOD 1,850 million in 2022, reflecting an average annual growth rate of 3.4% over this period. The sector's contribution to GDP has also risen slightly, from 4.1% in 2008 to 6% in 2021 (Jordan Department of Statistics, 2022). In terms of employment, opportunities have remained relatively stable, with a slow average annual growth rate of 0.27%. Employment figures stood at 29,521 workers in 2006 and slightly decreased to 28,106 in 2021. The sector accounts for an average of 3% of total employment in the economy (Jordan Department of Statistics, 2022).

The contribution of Jordan's transport sector to the economy could be further enhanced through development initiatives. International competitiveness reports, such as those from the World Economic Forum (2019), highlight a low level of infrastructure quality across the country's four main transport modes. These reports indicate a decline in Jordan's global rankings across all transport types: the road quality index dropped from 38 in 2008 to 68 in 2019, the maritime transport quality index decreased from 46 to 60 over the same period, and air transport rankings fell from 31 to 40. Jordan's rail transport also lags behind, with rankings remaining in the low nineties compared to other modes.

Several challenges significantly hinder the transport sector, thereby limiting its efficiency and its overall contribution to the economy. Foremost among these challenges is the scarcity of financial resources required for building new infrastructure or maintaining existing infrastructure. Additionally, the sector faces increasing strain due to population growth rates and urban concentration, which place a growing burden on transport services. Another critical challenge is the sector's heavy reliance on imported energy and widespread individual ownership of facilities, both of which adversely affect its economic role.

3. LITERATURE REVIEW

The impact of the transport sector on the economy has been a focal point in numerous empirical studies. Many of these studies have emphasized the importance of transport for economic growth (Hakim and Merkert, 2016; Mohmand et al., 2017), attractiveness to foreign investment (Barzelaghi et al., 2012; Pungnirund, 2020), productivity (Carbo and Daniel, 2020; Baek and Park, 2022; Xu and Feng, 2022), and promotion of tourism (Rizal and Asokan, 2013; Dinu, 2018). While some employed econometric tools, others utilized input-output analysis to explore the interdependence between the transport sector and other sectors, aiming to assess its impact on GDP, employment, imports, and taxes.

Bagoulla and Guillotreau (2020) utilized input-output analysis to examine the impact of maritime transportation and its environmental consequences, particularly air pollution, within the context of France. They found that the transportation sector significantly influences the economy, contributing substantially to GDP through activities such as marine energy, shipbuilding, fishing, offshore oil, and ports. However, they also highlighted the sector's environmental impact, identifying it as one of the major contributors to pollution in the economy. The study emphasized the need for pollution mitigation strategies and underscored the importance of sustainable oceanic transport practices.

Conversely, Choi et al. (2008) analyzed maritime freight transport in the Korean economy from 1995 to 2003 using input-output analysis. Their study revealed that the maritime transport industry is highly productive in Northeast Asia and exerts a significant production-driven impact on the economy. They found strong inter-industry backward linkages but relatively weaker forward linkages. The study also highlighted the industry's potential for causing supply shortages across the broader Korean economy.

Meersman et al. (2022) investigated the direct and indirect economic impact of rail freight transport in Belgium. The authors utilized a primary dataset from Belgium's largest freight operator and an input-output model to analyze the outcomes. The study employed Leontief multipliers to examine how the transport sector influences the economy, supplemented by a sensitivity analysis to assess the impact of different production structures on economic outcomes. Key findings indicated a positive and significant relationship between rail freight transport and the economy, showing that an increase in final demand led to an economic boost of EUR 2,985.

Similarly, Farooq et al. (2008) studied the economic impact of intelligent transportation systems (ITS) in Michigan using Leontief's input-output model. They applied macroeconomic factors such as multipliers to analyze changes in output and employment. Results demonstrated broad economic benefits from statewide ITS operations, with a sensitivity analysis addressing data uncertainties. The study underscored the role of ITS in the transport sector, emphasizing its influence on other industries and confirming significant economic gains for Michigan.

In another study, Vukić et al. (2021) evaluated the economic impact of the transport sector in Croatia using the input-output method. The research highlighted the substantial effect of the transport sector, particularly air transportation, on Croatia's economy. However, compared to several other EU nations, Croatia's transport sector exhibited smaller economic multipliers despite depending more on imported inputs. The authors noted that the sector had larger value-added multipliers similar to modern EU members. The study also discussed the severe economic downturn caused by COVID-19 in the transport industry and related sectors. It emphasized that Croatia's transport sector contributed significantly to GDP (5%) while stressing its importance to the economy, detailing both strengths and weaknesses.

Similarly, Zhao et al. (2022) utilized the input-output method to examine the role of transportation modes in the Chinese economy. The study focused on the impacts of rail, road, water, air, and pipelines on inter-industry relations, production, supply, and employment from 2007 to 2020. Findings revealed that road transport had a strong influence, while air transport showed a

declining backward impact and pipelines played a role in supply shortages. The study also highlighted the unexpected impact of COVID-19 on transportation, with rail and water transport remaining stable while road, air, and pipeline transport declined in 2020. Across all modes, there was a shift towards more technology-intensive practices in employment.

The authors further employed the input-output method to analyze the dynamic role of air transport. They evaluated sector interrelations and economic contributions of air transport over different periods, finding that initially, air transport exhibited increasing coefficients but experienced a 25.4% decline after the COVID-19 outbreak. Air transport showed a decreasing trend in its production-inducing multiplier and an increasing supply deficiency impact. The pandemic significantly reduced both the production-inducing effects and supply shortages within the air transport industry.

In another study, Morrissey and Donoghue (2013) used an input-output model to examine the economic role of the marine sector in the Irish economy. By constructing an input-output table, they assessed production impacts, inter-industry connections, and employment multipliers within sectors such as seafood processing, oceanic transport, and water construction. Results showed strong backward linkages in sectors crucial as input providers to others, while oceanic transport demonstrated critical forward linkages impacting production methods in sectors including finance, insurance, and wholesale trade. This research underscored the substantial economic impact of marine sector activities on both the sector itself and various related industries.

Furthermore, Lee and Yoo (2016) conducted an input-output analysis on the economic significance of the transport sector in South Korea. Results indicated that rail transportation had the most significant production-inducing impacts compared to road, water, and air transportation. Inter-industry connections showed weaker associations between transportation and other industries. The study also examined the price effects of transportation rate changes, demonstrating that a 10% increase in transportation rates had relatively low national economic impacts, with road transportation showing the greatest price impact.

Similarly, Chiu and Lin (2012) employed an input-output investigation method to examine the inter-industry relations and economic impact of the transportation industry in Taiwan from 1991 to 2006, using data from 33 sectors. The study identified several economic impacts, including production-inducing effects, price effects, supply shortages, and employment impacts. The conclusion emphasized that road transportation had the most significant production-increasing impact compared to other transportation sectors, while warehousing services had the largest supply deficiency impacts. The research demonstrated that the transport industry had a strong capacity to attract and support domestic industries, with road transportation emerging as the primary driver of economic support.

In another study, Chang et al. (2014) utilized an input-output model to assess the macroeconomic impact of South Africa's ports on its economy based on data from 2002. The analysis indicated that port disruptions were expected to cause a 17% financial loss. The authors highlighted the sector's robust forward linkage impacts, underscoring its importance to various industries. Port investments also had a significant employment impact, providing jobs for nearly 50,627 people. While the study offers crucial insights for policymakers regarding the essential role of the port industry, it did not examine potential negative externalities or social costs associated with port activities.

Furthermore, Muryani and Swastika (2018) used an input-output method to examine the transportation sector's relationships and multiplier effects in Indonesia, focusing on the 2010 budget. The study revealed that five of the six transportation subsectors exhibited strong backward linkages, indicating their support for other sectors, while forward linkages were relatively small overall. A reduction in the transportation budget resulted in decreased economic output, although income and employment multipliers were low. The authors stressed the importance of budget stability in the transport sector to enhance economic growth.

4. METHODOLOGY.

Several economic approaches have been employed to assess the impact of the transport sector on the economy: computable general equilibrium (CGE) models (Konan and Kim, 2003; Robson et al., 2018; Boonpanya and Toshihiko, 2021), social accounting matrices (SAM) (Alejandro and López-Cabaco, 2018; Morrissey et al., 2019; Njoya and Nikitas, 2020), regression analysis (Khadaroo and Seetanah, 2008; Saidi et al., 2020), and input-output (I-O) analysis. The input-output analysis quantifies direct and indirect interdependencies between the transport sector and other sectors of the economy. It evaluates the overall economic impact of the transport sector by identifying multipliers, particularly for output, employment, and income. This analytical approach heavily relies on input-output tables, which can be represented through the following system of equations.

$$X_1 = X_{11} + X_{12} + \ldots\ldots\ldots X_{1n} + F_1$$
$$X_2 = X_{21} + X_{22} + \ldots\ldots\ldots\ldots X_{2n} + F_2 \qquad (1)$$
$$X_n = X_{n1} + X_{n2} + \ldots\ldots\ldots\ldots X_{nn} + F_n$$

Where: X_1 is the output of sector 1, X_2 is the output of sector 2, and X_n is the output of sector n.

F_1 represents final demand for sector 1 products, F_2 represents final demand for sector 2 products, and F_n represents final demand for sector n products.

X_{11} is an output of sector 1 which is input into sector 1, X_{12} is an output of sector 1 purchased by sector 2 to use as an input, and so on.

The above system of equations can be summarized as:

$$X_i = \sum X_{ij} + F_i \qquad (2)$$

Where X_i is the total output of sector i, X_{ij} is the output of sector i used as an input in sector j representing the intermediate demand of the other sectors from sector i, and F_i is the final demand for sector i products.

To calculate the direct requirements of each sector from other sectors we apply the following equation.

$$a_{ij} = \frac{x_{ij}}{x_j} \qquad (3)$$

Where a_{ij}, called the technical coefficient, represents the amount of sector i output that was used to produce one unit in sector j.

If we rearrange equation 3, we get the following.

$$X_{ij} = a_{ij} X_j \qquad (4)$$

By substituting equation 4 in equation 2, we arrive at the following equation.

$$X_i = \sum a_{ij} X_j + F_i \qquad (5)$$

Equation 5 can be expressed in matrix form.

$$X = AX + F \qquad (6)$$

Where X is the output vector, F is the final demand vector, and A is the technical coefficient or Leontief matrix. This equation can also be shown as the following.

$$\begin{bmatrix} X_1 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} \end{bmatrix} \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} + \begin{bmatrix} F_1 \\ \vdots \\ F_n \end{bmatrix} \qquad (7)$$

Solving the matrices in equation 6 produces the following.

$$X = (I - A)^{-1} F \qquad (8)$$

Where I is an identity matrix and $(I - A)^{-1}$ is a Leontief inverse matrix.

To explore the interdependence between the transport sector and others, two measures were used: forward and backward linkages. Backward linkages indicate how much the sector's output relies on inputs from other sectors, while forward linkages show how much of the sector's output is used by other sectors. Each type of linkage—direct, indirect, and total—can be calculated. The column sum in the technical coefficient matrix A measures direct backward linkages, whereas the column sum in the Leontief matrix $(I - A)^{-1}$ measures total backward linkages. Subtracting direct from total linkages yields indirect backward linkages. Similarly, forward linkages are calculated using row summation instead of column, yielding direct, indirect, and total forward linkages.

Input-output analysis also provides an output multiplier, indicating how GDP changes with a one-unit increase in final demand for a sector. This multiplier is calculated by column summation in the Leontief inverse matrix $(I-A)^{-1}$.

Additional indicators derived from input-output analysis that illuminate the impact of the transportation sector on the economy include several multipliers: income, employment, imports, and taxes. Each multiplier shows the effect of a one-unit change in final demand for the transport sector on the entire economy. For instance, an employment multiplier for the transport sector measures how a change in final demand for transport affects total employment in the economy. Calculating each multiplier involves two steps, starting with constructing a coefficient matrix of relevant variables using the following formula.

$$E_i = \frac{L_i}{X_i} \qquad (9)$$

Where E_i is the coefficient of labor for sector i, L_i is labor quantity employed by sector i, and X_i is total output for sector i. In the next step we compute the specific multiplier for each sector by column summation of the below M matrix.

$$M = E\,(I-A)^{-1} \qquad (10)$$

Where E is a nxn coefficient matrix of labor whose elements on the main diagonal are labor coefficients, while the off-diagonal elements are zero. The inverse Leontief matrix is given by $(I-A)^{-1}$. M is the nxn multiplier matrix.

Equations 9 and 10 should be performed in the same manner and separately for income, employment, imports, and taxes.

5. APPLICATION

This study utilized the latest input-output data from Jordan for 2019, comparing it with data from 2006. The 2019 input-output (I-O) table comprised 40 sectors, while the 2006 table included 81 sectors. To ensure consistency in analysis, sectors for each year were grouped into 14 categories, with particular focus on the transport sector.

Analysis of the 2019 transaction matrix (A) revealed that 45% of the total output in the transport sector served as intermediate inputs in other sectors, while 55% met final demand. Similarly, the percentages for 2006 were 44% and 56%, respectively, showing no significant difference over time. The transport sector ranked fifth among providers of intermediate inputs to other sectors, following electricity, refinery products, agriculture, and mining, underscoring its crucial role in supporting other sectors.

Regarding the transport sector's dependence on other sectors, the 2006 technical coefficient matrix (A) indicated that 56% of its total production required inputs from other sectors, with the remaining 44% constituting value added. The most significant sector for transport was oil derivatives, with each Jordanian Dinar (JOD) produced in transport necessitating 0.22 JOD from the oil derivatives sector. Contributions from other sectors varied, ranging from negligible in agriculture to 0.03 JOD in the financial sector.

In 2019, the distribution differed slightly, with 49% of the sector's output allocated to input requirements and 51% to value added. Oil derivatives remained crucial, with each JOD in transport requiring 0.26 JOD from this sector. Contributions from other sectors ranged similarly, from minimal in agriculture to 0.05 JOD from the financial sector.

To explore how other sectors rely on the transport sector through its services as an intermediate input, we computed three types of forward linkages: direct, indirect, and total. Direct linkages were derived from row summation in the coefficient matrix A, while total linkages were obtained from row summation in the Leontief Inverse (I-A)-1. Indirect forward linkages were calculated by subtracting direct linkages from total linkages. Table 1 below presents these linkages for the years 2006 and 2019.

In 2006, the transport sector ranked fourth in all three indicators, with values of 2.5727, 1.8301, and 0.7427 for total, indirect, and direct forward linkages, respectively. It was preceded by mining, manufacturing, and oil derivatives. Despite a decline in these indicators by 2019, the transport sector improved its ranking to third place, trailing only manufacturing and the financial sector. The total forward linkage index was 1.7128, with direct and indirect linkages measuring 1.1881 and 0.5247, respectively.

The higher ranking of the transport sector in forward linkages highlights its significance to other sectors and, consequently, to the economy. It underscores its critical role as an essential infrastructure component.

Table 1: Forward linkages for Jordan for 2006 and 2019

sector	For 2006			For 2019		
	direct	**indirect**	**total**	**direct**	**indirect**	**total**
agriculture	0.3526	1.5203	1.8729	0.2135	1.1241	1.3376
mining	1.0207	2.7458	3.7664	0.0448	1.0555	1.1003
manufacture	1.7967	2.849	4.6456	1.2063	1.6121	2.8184
Petroleum refineries	0.7533	1.9275	2.6807	0.2734	1.1293	1.4027
electricity	0.267	1.323	1.5899	0.286	1.0833	1.3693
construction	0.1942	1.0907	1.2849	0.1996	1.069	1.2687
trade	0.2218	1.2273	1.4491	0.1922	1.0642	1.2564
hotel	0.028	1.012	1.04	0.0219	1.0079	1.0298
transport	0.7427	1.8301	2.5727	0.5247	1.1881	1.7128
telecom	0.3119	1.162	1.4739	0.1342	1.047	1.1812
finance	0.652	1.4235	2.0755	0.8146	1.276	2.0906

sector	For 2006			For 2019		
	direct	indirect	total	direct	indirect	total
education	0.0157	1.0076	1.0233	0.0252	1.0045	1.0297
health	0.0659	1.0192	1.0851	0.0101	1.0025	1.0126
government	0.1892	1.2709	1.4602	0.0334	1.0141	1.0475

Backward linkages measure the extent to which the transport sector depends on other sectors, illustrating how changes in transport production levels affect other sectors. Table 2 presents indices for three types of backward linkages: direct, indirect, and total. Direct backward linkages to the specified sector are summed in matrix A. In 2006, the transport sector ranked fifth with a value of 0.56, following petroleum refining (0.95), construction (0.81), electricity (0.64), and manufacturing (0.61). The sector maintained its ranking in 2019, but with a lower value of 0.49. These results indicate that the transport sector has a more significant impact compared to other service sectors such as trade, telecommunications, finance, education, health, and government in both 2006 and 2019.

Similar findings were observed for indirect and total backward linkages in 2006, where both types ranked fifth, with total backward linkages recorded at 2.3387 and indirect at 1.7755. However, in 2019, the results diverged significantly, with the sector's ranking dropping to ninth for total backward linkages and twelfth for indirect linkages.

Table 2: Backward linkages for Jordan in 2006 and 2019.

sector	For 2006			For 2019		
	direct	indirect	total	direct	indirect	total
agriculture	0.471	1.5514	2.0224	0.4222	0.9910	1.4132
mining	0.3897	1.4583	1.848	0.3814	1.0629	1.4443
manufacture	0.6134	1.7348	2.3481	0.641	0.9735	1.6145
Petroleum refineries	0.9476	1.8471	2.7947	0.7639	0.2967	1.0606
electricity	0.6382	1.8914	2.5296	0.6913	0.6919	1.3832
construction	0.8123	2.0931	2.9054	0.7723	1.1374	1.9097
trade	0.3752	1.2981	1.6733	0.3729	1.0624	1.4353
hotel	0.4619	1.5010	1.9629	0.542	1.0664	1.6084
transport	0.5632	1.7755	2.3387	0.4363	0.9174	1.3537
telecom	0.3828	1.2314	1.6142	0.3574	0.9369	1.2944
finance	0.1443	1.1078	1.2521	0.1857	1.0335	1.2192
education	0.2156	1.2182	1.4337	0.1772	1.0151	1.1923
health	0.55	1.6538	2.2038	0.393	1.0112	1.4042
government	0.0477	1.0458	1.0935	0.2966	1.0281	1.3247

While forward and backward linkages are useful for identifying leading sectors, total backward linkages also serve as a measure of the output multiplier. This multiplier indicates how much GDP changes with a one-unit increase in final demand for the transport sector. For Sector i, this multiplier is derived by summing the column corresponding to Sector i in the Leontief inverse matrix $(I-A)^{-1}$.

The impact of this multiplier can be divided into two parts. First, intra-sector effects occur within the sector itself,

represented by the diagonal element of the sector in the matrix. Second, inter-sector effects occur between sectors and are calculated by summing the diagonal elements in the column of the studied sector.

The results of this multiplier, shown in Table 3, reveal that a one JOD increase in final demand for transport services resulted in a GDP increase of JOD 2.3386 in 2006, with 56% attributed to intra-sector effects (1.3142) and 44% to inter-sector effects (1.0244). By 2019, however, the transport sector's ranking had dropped from fifth to ninth place. The multiplier value decreased to 1.3537, with 79% attributed to intra-sector effects (1.073) and 21% to inter-sector effects (0.2807).

Table 3: Multipliers for the transportation sector.

multiplier	2006				2019			
	Intra-sector	Inter-sector	total	rank	Intra-sector	Inter-sector	total	rank
output	1.3142	1.0244	2.3386	5	1.0730	0.2807	1.3537	9
income	0.5947	0.4222	1.0169	2	0.5413	0.1139	0.6552	10
employment	0.0130	0.0166	0.0296	13	0.0078	0.0027	0.0105	13
tax	-0.021	0.0036	-0.017	13	0.0636	0.0042	0.0677	1
import	0.2692	1.3124	1.5816	5	0.1668	0.1102	0.2770	5

The input-output tables provide various multipliers beyond the output multiplier, including those for income, employment, taxes, and imports. These multipliers quantify how changes in final demand for the transport sector affect income, employment, taxes, and imports. Estimates of these multipliers are detailed in Table 3.

The income multiplier decreased in value and rank between 2006 and 2019, dropping from second place with a score of 1.0169 to tenth place with a score of 0.6552. The majority of the impact on incomes was within the transport sector itself; the intra-sector effect increased from 59% in 2006 to 83% in 2019, while the impact on other sectors was limited, decreasing from 42% in 2006 to 17% in 2019.

Changes in final demand for transport services had minimal impact on employment, with the sector ranked 13th out of 14 sectors. The employment multiplier in 2006 indicated that a 100 JOD change in final demand for transport services resulted in nearly 3 job opportunities, whereas by 2019, it only resulted in one opportunity.

The most significant change observed was in the tax multiplier, shifting from the second-to-last rank with a negative multiplier value of -0.017 in 2006 to the top rank with a multiplier value of 0.067 in 2019. This shift may be attributed to the transition from subsidizing oil refinery products to taxing them, given that energy is a critical input in the sector's production.

Lastly, regarding the imports multiplier, the results showed that a one JOD increase in final demand for transport services led to an increase in imports by 1.5816 JOD in 2006 and 0.277 JOD in 2019. The sector ranked fifth in both years for its impact on imports.

6. DISCUSSION AND CONCLUSION

To assess the impact of the transportation sector on the Jordanian economy, we utilized input-output (I-O) tables for the years 2006 and 2019. Various indicators from these tables were employed, including forward and backward inter-sectoral linkages, as well as five types of multipliers: output, income, employment, taxes, and imports.

One of the most significant findings from the analysis is that other sectors rely more on the transport sector than vice versa. In terms of forward linkages, transport ranked fourth in 2006 and third in 2019, while in terms of backward linkages,

it fell from fifth in 2006 to ninth in 2019. This underscores the importance of transport services as critical intermediate production inputs. The efficiency and costs of these services affect other sectors, thereby influencing their competitiveness, productivity, and overall economic growth. The relatively weak dependence of the transport sector on other sectors can be attributed to the structure of the Jordanian economy, which lacks a robust industrial production base capable of supplying the necessary inputs for the transport sector.

Another important finding revealed by the analysis is a noticeable decline in the sector's indicators from 2006 to 2019. Both types of linkages and the calculated multipliers have decreased. This decline may be attributed to reduced efficiency in the sector's services, as indicated by international competitiveness reports that highlight a decline in Jordan's global quality index for the four main transport modes (road, maritime, air, and rail) from 2008 to 2019. Additionally, changes in the government's energy policy, such as liberalizing oil derivative prices and imposing additional taxes, likely contributed to higher production costs in the sector. On average, energy accounts for 25% of total production costs and 35% of the value of intermediate inputs in the transport sector.

Based on the first finding highlighting the transport sector's crucial role as a provider to other sectors, and the second finding concerning the impact of efficiency and energy costs on its production processes, it is imperative for decision-makers to prioritize creating an enabling environment that supports and enhances the sector. This approach is essential to achieve overarching goals such as economic growth, improved competitiveness, attraction of foreign investments, and promotion of tourism.

Furthermore, we recommend promoting investments in an industrial base that strengthens backward linkages with the transport sector, particularly in areas like the spare parts industry. Additionally, stimulating the adoption of energy-efficient electric vehicles can significantly reduce operational costs. This measure would not only enhance the sector's contribution to economic growth and competitiveness but also bolster efforts to attract tourism and foreign investments.

To comprehensively capture the impact of the four main types of transport on the Jordanian economy, we suggest that future input-output (I-O) tables should be prepared with detailed breakdowns of these transport sectors, similar to practices in other countries.

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