



Dependency on Completely Knocked Down (CKD) Kits Imports and the Assembly Trap: An Empirical Study of Foreign Direct Investment (FDI) in the Automotive Sector of Pakistan

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ABSTRACT

Pakistan has attracted foreign investment in the automotive sector with the objective of growth in the industry. As the industry matures, it should benefit from having vertical and horizontal linkages resulting in import substitution, self-reliance and export promotion. This paper empirically tests whether the expansion of FDI has actually been translated into automobile production, or whether production remains more closely associated with CKD imports. By employing a log-linear time series model using data from 2004 to 2025, this study highlights that the auto sector is in an 'assembly trap' due to heavy dependence on CKD kits. Recommended policies for the automotive sector to get out of this trap and benefit from FDI include providing incentives to local manufacturers of high-tech auto components, strengthening domestic human capital, and instead of relying heavily on imports, promoting the home industry to become self-sufficient and consequently be able to compete in the international market.



Introduction

Developing countries generally experience shortage of capital, therefore external financing in the form of foreign direct investment supports economic growth (Khan, 2007). In developing countries, among different forms of foreign capital inflows, FDI contributes more to economic growth because it brings technology and managerial knowledge with capital (Borensztein, DeGregario & Lee, 1998). The automobile industry in Pakistan requires large and heavy investment in the form of establishment of factories, high-tech machinery, technical know-how, managerial skills and supplier networks. So when FDI was injected in this sector in the 1980s, three Japanese car makers began to assemble cars with local companies and at the same time, protection was given to these locally assembled cars by imposing high tariffs on Completely Built Units (CBUs) (Competition Commission of Pakistan [CCP], 2018).

For over forty years, Pakistan's automobile industry has been dependent on imports of Completely Knocked Down (CKD) kits and is trapped in an assembly loop. A CKD kit includes all the high-tech components of a vehicle such as an engine, transmission, body panels and electronic control unit. The industry has seen two main eras with varying tariff policies aiming to check the imports of CBUs and attract

foreign direct investment in the form of joint ventures with local companies. Era 1, the Incumbent Era or The Big Three Era spans 1990s to 2016, and Era 2, the Policy Shift Era is from 2016 to 2021 (Qadir et al., 2024).

Era 1 began when Pak Suzuki Motor Company, a joint venture incorporated as a public limited company, began its commercial production in Jan 1984 (Board of Investment [BOI], n.d.). Later in 1993, the first locally assembled Toyota Corolla was launched by Indus Motor Company, closely followed by Honda Atlas showcasing their first locally assembled car in July 1994 (Pakistan Stock Exchange [PSX], n.d.).

For many years, Pakistan's automotive industry was dominated by The Big Three. Achievements of The Big Three cannot be ignored as they replaced CBUs. They were also able to transfer the technical assistance and technology to domestic enterprises for making parts like exterior sheets, interior plastics and exhaust systems locally for passenger cars, which contribute about 65 percent of total building pieces (BOI, 2022). Furthermore, the absorption of The Big Three in Pakistan's economy impacted the downstream engineering sector by giving a great push to the local Tier1 industry (supply of locally made components like tyres, seats, wiring harnesses etc directly to the Original Equipment Manufacturers) which makes up to more than 50 local vendors (Pakistan Association of Automotive Parts and Accessories Manufacturers [PAAPAM], 2024).

Though The Big Three helped import substitution by volume, the long run objective of self-reliance was not achieved because the import dependency simply shifted from manufactured vehicles to high tech intermediate components called completely knocked down (CKD) kits. The local industry grew with time but remained confined to low tech and simple products like seats, glass, tyres, plastic bumpers, steel metal stampings. The high value, high-tech, brain and heart of the cars such as engines, transmissions, electronics and ECU systems were never localised (PIDE, 2024).

Also, as the consumers had no option other than the cars being assembled, the Big Three could sell basic, older generation cars with high profit margins, and consumers not only paid the upfront cash but also paid premiums just to reserve a vehicle. As a result, every time the local car sales grew, the import of CKD kits spiked, draining Pakistan's foreign exchange reserves and causing Balance of Payment crises (PIDE, 2024).

In 2016, which is the beginning of Era 2, the government of Pakistan through automotive development policy (ADP) 2016-2021 gave a two tiered investment incentive to other foreign car makers, namely Green Field Investment and Brownfield Investment. Under the old policy, new entrants had to pay the same heavy import duties as the existing Big Three whereas the ADP 2016-2021 gave new entrants a 5-year concessional tariff holiday. Greenfield could import non-localised parts at 10% custom duty and localised parts 25% (BOI, n.d.). PIDE's (2026) review notes that the ADP's New Investment Policy successfully encouraged the entry of several new international players, expanding the competitive landscape after decades of concentration. The ADP facilitated the entry of more than 10 new players such as Kia, Hyundai, Haval etc. which began manufacturing or assembling vehicles in Pakistan over the last decade (Qadir et al., 2024).

However, ADP 2016-2021 did not prove to be successful either where strategic objectives of foreign investment are concerned. The policy was designed to encourage localization but the local industry remained confined to simpler parts and Pakistan continued to depend heavily on imports for many high-value components. The Competition Commission (2026) says the policy succeeded in attracting investment and new entrants, but the expected spillovers in the form of localization, self reliance, import substitution and export competitiveness were not achieved. So, instead of structural change leading to lowered level of import dependency, Era 2 duplicated the assembly model and thus, the auto industry continued to depend heavily on imported CKD kits and automobile or auto-parts exports remain negligible (PIDE, 2025).

Most of the previous studies related to Pakistan have examined the macro economic effects of FDI but FDI in the auto mobile sector has not been studied extensively with the exception of a few valuable qualitative analyses focusing on industrial policy, localisation and technological capability (Ahmed & Batool, 2017). Consequently, there is a large scope of empirical analysis examining the role of FDI in the growth of Pakistan's auto mobile industry.

Literature Review

The foreign capital inflows in developing countries bridge the gap between domestic savings and investment (Romer, 1990). Foreign investment comes in the form of multinational firms, they introduce new technologies and the local firms imitate them and then enter into competition with them. As a result, not only productivity increases, quality also improves and often it is called the contagion effect of FDI (Findlay, 1978). However, FDI does not guarantee technological spillovers unless domestic firms have the absorptive capacity which also depends on the backward linkages (Aitken & Harrison, 1999). FDI accelerates growth

more than domestic investment because it brings with it modern technology; but at the same time human capital is the prerequisite for the absorption of foreign technology (Khan, 2007).

Pakistan has experienced the monopoly of Big Three for more than two decades but with ADP 2016-2021's new policy, consumers feel they have more options open in terms of budget, safety, comfort and style. A landmark study on the automotive sector by Berry Levinsohn and Pakes (1995) specifically proves that foreign investment in this sector expands consumer choices and as a result consumer welfare increases (Dixit & Stiglitz, 1977). Among other benefits to the consumers, competitive prices of cars on the basis of the features play a decisive role in making the right choices and it is established that market competition always brings down the prices (Helpman & Kruger, 1985; Aitken & Harrison, 1999).

The entry of foreign assemblers under various auto policies ensured upgrading of products along with improved quality standards but the desired R&D spillovers were not realised as OEMs (Original Equipment Manufacturer) only encouraged the local production of low tech parts like seats, glass, plastics and heavy import of high tech components continued (PIDE, 2024). Pakistan has experienced the monopoly of Big Three for more than two decades but with ADP 2016-2021's new policy, consumers feel they have more options open in terms of budget, safety, comfort and style. In a nutshell, the foreign assemblers introduced production systems, quality controls, supply development in the host country and promoted localization efforts but the main heart and brain of automobiles remained unexposed and untapped areas (JICA, 2021).

Another objective of FDI is export promotion after self-reliance but lack of modern technological capability did not let it happen so the automobile industry served the domestic market only (Ahmed & Batool, 2017). Lack of competition, limited integration into global value chains and continued reliance on the import of sophisticated components never let the auto industry in Pakistan grow as expected. Core system technologies including ECUs and powertrains were never localised (EDB, 2021; JICA, 2021).

Despite high overall deletion rates in terms of part count, local automotive assembly remains heavily reliant on imported Complete Knocked-Down (CKD) kits for high-value components such as engines, transmissions, and electronic control units (PIDE, 2024).

The latest CCP study reveals that localization by part count can reach 50 to 70% for older, high-volume models, but localization by value is only around 40 to 60%, because expensive components such as engines, transmissions, hybrid systems and advanced electronics are still imported (CCP, 2026).

Based on the interviews with experts, local manufacturing companies in Pakistan do not have the capacity to produce auto parts that meet the quality required by the OEMs. Owing to sub-standard auto parts being used in the local production of cars, the quality of finished vehicles in Pakistan is considered inferior to those produced abroad (JICA, 2021).

From the facts and figures provided by the existing literature, it is noted that despite FDI inflows into Pakistan's automobile sector over the past four decades, this industry has not been able to generate the desired technological spillovers and been stuck in making simple, low-tech and low-value components only. As a result the industry remains heavily dependent on imported CKD kits while constantly adding pressure on the foreign exchange bill. The goal of this study is to empirically prove what the most qualitative previous studies have already established that the auto industry of Pakistan has been heavily reliant on the imports of costly CKD kits and the domestic manufacturing has not benefitted from the FDI as it is still making the low tech, low cost low value components only.

Methodology

To empirically test the relationships highlighted above, this study uses quantitative time-series data for Pakistan and runs a regression framework to isolate the extent to which intermediate inputs (imports of CKDs), foreign direct investment, and macroeconomic controls impact domestic automobile output.

Data and Sample Selection

The primary aim of this research methodology is to establish an empirically sound, econometric framework to evaluate the dynamic short-run drivers of automobile output in Pakistan. An annual time-series dataset from 2004 to 2025 is employed as the basis of this empirical analysis. This time period is ideal due to a number of reasons: it captures the latter part of Era1 (The incumbent era 1990-2015) and the entirety of Era2 (ADP 2016-2021), it absorbs the shocks of 2008 global financial crisis, and it also covers the historic economic turmoil of Covid 19.

Local vehicle assembly in developing nations relies heavily on imported intermediate components, capital inflow for industry expansion, and purchasing power of domestic consumers. Therefore, our model specifies automobile production as a function of intermediate supply inputs, foreign capital inflows, per capita income, and interest rate.

Data for this study were compiled from a combination of official statistics portals:

1. Pakistan Automotive Manufacturers Association (PAMA): Total production output of light four-wheeler vehicles.
2. State Bank of Pakistan (SBP) Data Portal: Sector-specific Foreign Direct Investment (FDI) in transport equipment manufacturing and Completely Knocked-Down (CKD) import values.
3. World Bank Open Data Portal: GDP per capita and real interest rate series.

Model Specifications

To measure the extent to which intermediate inputs, FDI, and macroeconomic factors drive auto output, the baseline theoretical function is as follows:

$$\ln \text{Output} = \beta_0 + \beta_1 \ln \text{CKD} + \beta_2 \ln \text{FDI} + \beta_3 \ln \text{GDPPC} + \beta_4 \text{Real_int} + \varepsilon$$

Where each variable in the model is defined as:

ln Output (Log Auto Production): The natural logarithm of total light four-wheeler production volume (in units). This serves as the dependent variable measuring output. Natural logarithms are applied to convert raw production figures into constant elasticities.

ln CKD (Log CKD Imports): The natural logarithm of Completely Knocked-Down vehicle kit imports (USD Million). This independent variable captures the industry's reliance on imported intermediate supply inputs required for domestic assembly lines.

ln FDI (Log Auto Sector FDI): The natural logarithm of foreign direct investment inflows specifically allocated to transport equipment manufacturing (USD Million).

ln GDPPC (Log GDP per Capita): The natural logarithm of real GDP per capita (current USD). This is included as a control variable; it captures purchasing power and macroeconomic market demand.

Real_int (Real Interest Rate %): This control variable reflects domestic borrowing costs affecting consumers' ability to purchase vehicles, therefore also affecting demand.

ε (Error Term): Accounts for stochastic shocks and unobserved factors.

To arrive at our final econometric model, the dataset underwent three critical stages:

Stage 1: Unit Root Testing (Augmented Dickey-Fuller)

To prevent spurious regression, all variables were subjected to Augmented Dickey-Fuller (ADF) unit root tests to ensure no variable was integrated of order two I(2).

As reported in Table 1, *ln CKD*, *ln GDPPC*, and *Real_int* exhibit unit roots in levels I(1), while *ln Output* and *ln FDI* are stationary in levels I(0). Upon taking first differences, all series reject the null hypothesis of non-stationarity at the 1% significance level ($p < 0.01$), confirming a mixed integrated system of I(0) and I(1) variables with no I(2) series.

Table 1: Augmented Dickey-Fuller (ADF) Unit Root Test Results

Variable	Levels Z(t)	p-value	First Difference Z(t)	p-value	Order of Integration
ln Output	-3.596	0.0058	-4.847	0.0000	I(0)
ln CKD	-2.116	0.2383	-5.173	0.0000	I(1)
ln FDI	-5.977	0.0000	-8.283	0.0000	I(0)
ln GDPPC	-1.849	0.3564	-4.034	0.0012	I(1)
Real_int	-2.182	0.2127	-4.107	0.0009	I(1)

Stage 2: Cointegration Testing (Ardl Bounds Framework)

Given the mixed integration orders, an ARDL Bounds test was conducted to test for the existence of a long-run level relationship among the mixed series. As shown in Table 2, the computed F-statistic of 2.262 falls below the lower bound I(0) critical value (2.45) at the 10% significance level. Consequently, the null hypothesis of no levels relationship (H0) cannot be rejected. Estimating long-run level parameters under these conditions would introduce spurious correlation.

Table 2: Pesaran/Shin/Smith (2001) ARDL Bounds Test

Test Statistic	Calculated Value	Significance Level	I(0) Bound	I(1) Bound
F-statistic	2.262	10%	2.45	3.52
		5%	2.86	4.01
		1%	3.74	5.06
t-statistic	-1.855	5%	-2.86	-3.99

Stage 3: Short-Run Dynamic Ols Model Specification

In the absence of cointegration, the model is specified in dynamic first differences. Sector-specific operational variables (*ln Output*, *ln CKD*, and *ln FDI*) enter with contemporaneous (Δ) and one-period lagged (Δ t-1) dynamic structures to account for physical assembly scheduling, supply chain clearing, and capital absorption lags. Macroeconomic demand controls (Δ *ln GDPPC* and Δ *Real_int*) enter contemporaneously to reflect immediate market demand while preserving degrees of freedom (N = 20):

$$\Delta \ln Output_t = \beta_0 + \beta_1 \Delta \ln Output_{t-1} + \beta_2 \Delta \ln CKD_t + \beta_3 \Delta \ln CKD_{t-1} + \beta_4 \Delta \ln FDI_t + \beta_5 \Delta \ln FDI_{t-1} + \beta_6 \Delta \ln GDPPC_t + \beta_7 \Delta Real_int_t + \varepsilon_t$$

Findings and Discussion

The short-run dynamic OLS regression results are summarized in Table 3. The model exhibits high overall explanatory power, with an adjusted R-squared of 0.8499, indicating that approximately 85% of the variance in domestic vehicle production growth is explained by the specified short-run inputs. The overall model is highly statistically significant ($F(7, 12) = 16.37$, $p = 0.0000$)

Table 3: Short-Run Dynamic Growth Regression (Dependent Variable: $\Delta \ln Output$)

Variable	Coefficient	Std. Error	t-statistic	P > t	95% Confidence Interval
$\Delta \ln Output_{t-1}$	-0.1827	0.2123	-0.86	0.407	[-0.6453, 0.2800]
$\Delta \ln CKD_t$	0.7095***	0.1427	4.97	0.000	[0.3985, 1.0204]
$\Delta \ln CKD_{t-1}$	0.3724	0.2157	1.73	0.110	[-0.0976, 0.8425]
$\Delta \ln FDI_t$	0.0729	0.0436	1.67	0.120	[-0.0221, 0.1679]
$\Delta \ln FDI_{t-1}$	0.0043	0.0421	0.10	0.919	[-0.0873, 0.0960]
$\Delta \ln GDPPC_t$	1.5878**	0.5802	2.74	0.018	[0.3237, 2.8518]
$\Delta Real_int_t$	-0.0024	0.0127	-0.19	0.851	[-0.0302, 0.0253]
Constant	-0.0997**	0.0378	-2.63	0.022	[-0.1821, -0.0172]

Model Diagnostics: $N = 20$, $F(7, 12) = 16.37$ ($p = 0.0000$),
 $R^2 = 0.9052$, Adjusted $R^2 = 0.8499$,
Root MSE = 0.14199.
Significance levels: $p < 0.05$, *** $p < 0.01$.

Crucial Role of Intermediate CKD Imports

The estimated coefficient for contemporaneous intermediate imports ($\Delta \ln CKD_t$) is positive and highly significant at the 1% level. Holding all else constant, a 1% increase in the growth of CKD kit imports results in a 0.71% increase in automobile output. This shows that local production of vehicles is purely an elastic function of foreign components and this also confirms the claims of existing literature discussed earlier. This also highlights the extreme supply-side dependence of Pakistan's assembly lines on foreign intermediate inputs.

Macroeconomic Demand Elasticity

Real GDP per capita growth ($\Delta \ln GDPPC_t$) is statistically significant at the 5% level. This indicates that consumer demand for vehicles in Pakistan is highly income-elastic, where a 1% increase in per capita economic growth expands vehicle production growth by 1.59%. Real interest rates ($\Delta Real_int_t$) carry the expected negative sign (-0.0024, $p = 0.851$), though they display insignificant short-run elasticity compared to direct income shocks.

FDI Dynamics in Short-run

Contemporaneous auto FDI ($\Delta \ln FDI_t$) shows a positive impact (0.0729, $p = 0.120$), though it remains marginally insignificant in the short run. The results reveal that sectoral FDI exhibits a negligible or inconclusive direct effect on automotive output unless it is complemented by continuous import of CKD kits. Our results also confirm that FDI has simply funded screw-driver assembly plants because without the import of high tech components, vehicles can not be produced. This clearly tells us that FDI in Pakistan has been used as ‘Assembly Enabling Capital’ rather than ‘Capability Building Capital’. Over the years, Pakistan’s automotive sector has neither developed localised component supply chains nor the self-sustaining manufacturing industry.

Diagnostic Verification And Robustness

To confirm that the short-run estimates are robust and unbiased, post-estimation diagnostic tests were conducted. As summarized in Table 4, the model successfully satisfies all classical linear regression assumptions:

Table 4: Post-Estimation Diagnostic Verification Summary

Diagnostic Test	Purpose	Test Statistic	p-value	Conclusion
Breusch-Pagan / Cook-Weisberg	Heteroskedasticity	$\chi^2(1) = 0.26$	0.6072	Constant variance (H0 accepted)
Breusch-Godfrey LM (Lag 1)	Autocorrelation	$\chi^2(1) = 1.339$	0.2472	No serial correlation (H0 accepted)
Ramsey RESET	Omitted Variables	$F(3, 9) = 1.74$	0.2288	Correct functional form (H0 accepted)
Mean VIF	Multicollinearity	Mean VIF = 3.10	—	No severe collinearity (VIF < 10)

Policy Recommendations

According to Pakistan Bureau of Statistics data, imports of CKD car kits reached approximately \$1.47 billion between July 2025 and March 2026, compared with \$680 million during the corresponding period of 2024 to 2025, representing a substantial increase in dependence on imported kits (PBS, n.d.). State Bank of Pakistan’s foreign reserves stand at \$17billion as of 31 July 2026 so it is important that the upcoming auto policy which is already underway must aim to reduce CKD/SKD import bill by encouraging localisation of high value parts (SBP, 2026). Another area of concern is that Korean and Chinese OEMs are

not sourcing from local manufacturers, therefore the new policy must prioritise local procurement and support small and medium enterprises in the auto sector (Khan, 2026).

We have examples of Thailand, India and Indonesia. The Thailand model teaches us to make concessions to assemblers conditional with localisation targets, and develop efficient supply linkages (Natsuda & Thoburn, 2013). Indonesia also provides a relevant policy example through its Domestic Component Level framework, which aims for maximising the value-added domestically made components and the product development rather than counting the number of locally produced parts (Giovannus, 2020). Similarly in India, many incentives have been given for the domestic production of sophisticated parts. Moreover, instead of giving tariff concessions simply for setting up assembly plants, India incentivises the manufacturers to achieve deep localisation of advanced and value-added components (Ministry of Heavy Industries, n.d.).

Pakistan is already on its way to finalise the latest auto policy so keeping in view our current status of dependency on imported CKD kits, the localised low-value and low quality components, weak supply chains and foreign exchange burden, we may tread on the path which the listed countries have taken. We need to invest in human capital to have the absorptive capacity, we need to push our local manufacturing standards high to compete with the international market, we need to incentivise domestic companies engaged in making high value components; we must also measure localised parts by value and not just by number; we must aim to export first the quality components and then the final products.

Hence, a successful automotive policy does not merely attract foreign assemblers; it gives incentives to firms to become competitive, helps develop supply chains, integrates into global value chains and upgrades technologically.

Conclusion

On the basis of empirical evidence from this study and the existing literature, a major economic paradox in Pakistan's automotive industry is highlighted: despite substantial foreign direct investment and decades of government protection under successive auto policies, FDI has not succeeded in making Pakistan's automobile sector self-reliant in car manufacturing, instead it remains trapped in an expensive import-assembly loop. The empirical findings of this study showing that FDI is not as significant a contributor to automobile production as the imports of CKD kits further strengthens the claim of previous studies that the desired technological spillovers and backward linkages of foreign investment have not been materialised. The proposed policies may prove to be a corrective measure for the shortcomings of the previous policy frameworks. It needs to support the local vendors for the production of value-added components, ensure knowledge spillovers to have a trained and skilled workforce and provide incentives to domestic manufacturers to produce high-quality parts that meet international standards.

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