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Abstract: Previous "oil curse" studies primarily estimate a single, linear effect of oil rents on income using time-invariant parameters over entire sample periods. This means the true effects of oil dependence cannot be captured if structural changes are taking place, or effects are non-linear. We introduce a two regime Markov-switching model into the resource effects literature to assess the time-varying effects of oil rent dependence on the Malaysian manufacturing sector. We also allow for non-linear threshold effects. We find the impact of oil rents is regime-dependent. Under a rarer "first regime" structure there is no significant effect. Under a predominant "second regime" there is an inverted U-shaped effect, with oil rents' share of GDP up to 8% positively associated with manufacturing, and negatively associated beyond this. We find connections between regime changes and the 1997 Asian financial crisis and 2008 global financial crisis. Implications for effective diversification policies are discussed.

Keywords: Oil curse, Oil rent, Markov Switching Model, Manufacturing sector, Malaysia

JEL Classifications: C22, O11, O13, Q33

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1. Introduction:

Historically, economic growth in oil and resource-rich countries has been attributed in part to their natural resource revenues. Yet since the 1990's some economists have found the economic performance of resource-scarce economies exceeds that of their resource-rich counterparts, supporting Auty's (1993) "resource curse" hypothesis that resource abundance inhibits growth (see Sachs and Warner, 1995, 1997, 2001; Gylfason, 2001; Gylfason and Zoega, 2006; Haseeb et al., 2020; Mehlum et al., 2006; Badeeb et al., 2017 and Majumder et al. 2020).

The idea that natural resources might hinder rather than promote growth has since been extensively researched with a variety of theoretical and empirical approaches (see for example Papyrakis and Gerlagh, 2006; Mehrara, 2009; Badeeb et al. 2016; Adams et al., 2019; Henry, 2019; Shahbaz et al., 2019). The concept is sometimes called the "oil curse" when examining the effects of oil production-dependence in particular. There have been numerous causal explanations proposed, including that resource dependence crowds out non-resource investments in physical and human capital that better aid long-run growth, or that it causes appreciation of the real exchange rate during resource booms, resulting in a persistent decline of domestic non-resource production and loss of international competitiveness (Humphreys et al., 2007; Sala-i-Martin and Subramanian, 2008).

Although the subsequent literature investigating the resource curse has been vast and inconclusive, we argue two important gaps remain unaddressed. First, resource effect papers generally estimate a single time-invariant effect of oil or resource rents on income (or other outcomes of interest) throughout their sample periods. Yet the true impact of resource rents cannot be captured properly if structural changes are taking place that alter the relationship between rents and outcomes of concern. While many researchers recognize that differences in trade policies, institutional quality or technology can alter resource effects on growth (e.g. Arezki and Van der Ploeg, 2010), they have not allowed for such differences *within* countries over time.

Second, most previous studies have assumed that resource effects are linear (i.e. independent of the degree of dependence). Yet the few more recent studies to have addressed the second restriction have not been supportive. Mehrara (2009) first tests for simple linear effects of oil revenues on growth across oil-exporting countries, and finds a positive effect. However, when he allows for nonlinear effects using splines, he finds real oil revenue growth has a positive effect on real GDP growth only up to threshold increases of 18-19%, and slows economic growth beyond this. This implies an inverted 'U' shaped relationship between oil rents and GDP. Shahbaz et al. (2019) similarly find an inverted 'U' relationship between real per capita natural resource rents and real per capita GDP within the United States.

Mehrara explains this reversal as follows. During oil busts, when oil revenues grow slowly if at all, oil-dependent economies often suffer from under-capacity in access to capital and imported factors of production, particularly in the presence of capital market imperfections (Hausmann and Rigobon 2003). In such settings, modest increases in oil revenues can finance productive physical and social investment. In contrast, when oil revenues grow rapidly during oil booms, the real exchange rate becomes highly overvalued at the expense of net exports, and public spending rises rapidly. Such proliferating spending tends to be lower in quality, and to introduce recurring cost commitments that are not sustainable. This in turn leads to unfinished projects, which lower subsequent returns on capital that cannot be effectively used because of shortages of resourcing for recurring costs. While Mehrara's explanation is plausible, his inverted U findings have not been adequately tested in a within-country, within-sector study.

Our paper makes three contributions. First, we allow for structural change when investigating the effects of oil rent dependence on the manufacturing sector in Malaysia, using a Markov-regime switching model. For reasons of limited data length, we assume that any relationship between oil dependence and size of manufacturing may take on a maximum of two patterns, or "regimes." To the best of our knowledge, this is the first study to use a regime-switching model in the resource effects literature. However such models are widely used in other economic and finance applications regarding stock markets (Chkili and Nguyen, 2014; Walid et al., 2011), monetary policy (Francis and Owyang, 2005), commodities (Apergis et al., 2019; Bhar and Hammoudeh, 2011), the Environmental Kuznet's Curve hypothesis (Charfeddine, 2017), or financial development (Pan et al., 2019).

Second, we allow for non-linear quadratic effects of oil rent dependence on manufacturing to better identify the nature of the relationship under either regime and capture any threshold turning points (Shahbaz et al. 2019). Confirming the existence of oil dependence 'turning points' could assist policymakers make informed decisions regarding conditions under which diversification interventions are warranted to avoid harm to non-resource sectors and to overall growth.

Third, we examine resource effects on manufacturing in particular, rather than overall GDP. Effects on manufacturing are of particular interest because of the prominence of the "Dutch disease" as an explanation for the resource curse (e.g. Sachs and Warner 2001). As Frankel (2010) explains, resource rents can hinder manufacturing by reallocating production away from it, via expansion of the natural resource sector itself, but also by expansion of government spending and of non-traded goods sectors (e.g. construction). The high inflation of these sectors, in turn, is attributed to the real appreciation of the currency or rent-financed government spending.

The remainder of the paper is organized as follows. Section 2 discusses the structural changes that have occurred in the Malaysian manufacturing sector. Section 3 presents a review of the literature regarding resource effects on manufacturing, while Section 4 describes the Markov-regime switching model and data used for the study. Section 5 presents our empirical results. Sections 6 suggests policy implications and Section 7 concludes.

2. Structural changes in Malaysian manufacturing

Malaysia is an oil-dependent country in which oil rents are the main source of government revenues. The country extracts about 653,000 barrels of oil per day and is ranked 26th worldwide in crude oil extraction (BP Statistical Review of World Energy, 2020). Notwithstanding oil's prominence, some argue that Malaysia has also successfully built a well-diversified economic base with a robust manufacturing sector. Over the past five decades manufacturing has contributed over 20 percent of Malaysian GDP, though with cyclical movements as illustrated in Figure 1. Some researchers argue that Malaysia can serve as an exemplar country that has escaped the resource curse (Gylfason, 2001; Rosser, 2006). Others, however, such as Doraisami (2015) and Badeeb et al. (2016), argue that "easy money" from oil has encouraged the Malaysian government to spend on inefficient activities and unproductive investment. Rasiah (2011) claims Malaysia has been facing premature deindustrialization, or secular slowdown in manufacturing value-added. These opposing claims warrant a further investigation into the relationship between the country's oil dependence and its manufacturing.

We argue that the cyclical movements in Figure 1, together with a brief overview of important policy changes in Malaysia's international trade and investment liberalization, and of

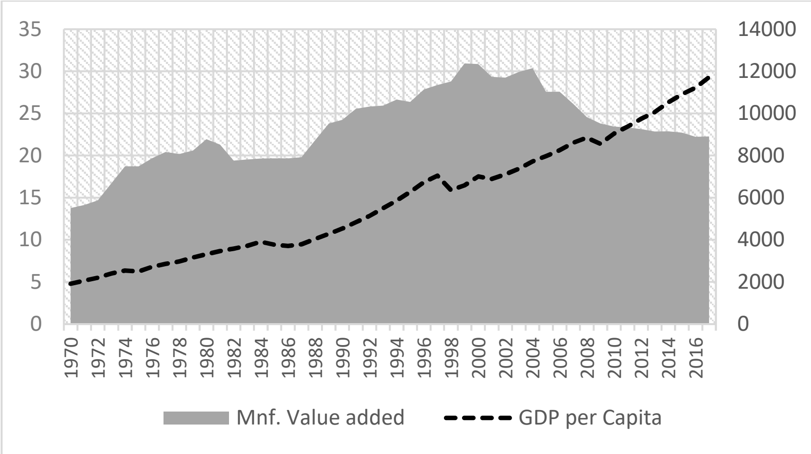

Figure 1: Manufacturing Value added (as % of GDP) and GDP per Capita (real 2010 $US)
Source: World Bank World Development Indicator (WDI), 2020

external shocks over the past fifty years, would suggest that any investigation of oil's effects on manufacturing should allow for possible structural changes in the relationship. We briefly summarize these changes here.

From the mid-1970's the Malaysian government pursued state-owned heavy industrialization (Athukorala 2005). However, a severe economic downturn from 1985-1987 put an end to this form of interventionist industrial policy. Under the Industrial Master Plan (IMP) for 1986 to 1995, the government instead placed greater emphasis on the role of the private sector, and on strengthening conditions for the expansion of exports more broadly. This involved gradual privatization and restructuring of state-owned enterprises. By the early 1990's state ownership in manufacturing was limited to the automobile, petrochemical, and iron sectors. Export policy was liberalized, with the removal of export licensing requirements, duties, and some export taxes. Other reforms in the late 1980's and early 1990's included trade liberalization, as the government reduced import tariffs and lessened manufacturing protection. Notwithstanding the withdrawal of protection, starting from 1989/1990 the manufacturing sector witnessed accelerated growth in production, employment, and exports (Okamoto, 1994).

Unfortunately, Malaysia was subsequently one of the Southeast Asian countries greatly affected by the Asian Financial crisis (AFC) of 1997. Within the country, the AFC was experienced less via direct currency or banking crises than via sharp drops in investment and (mainly manufacturing) exports that slowed growth in manufacturing output. Manufacturing production fell by 7.1% in 1998, (Bank Negar Malaysia, Annual report, 2012), and private investment by 31.2%. Public investment fell much less severely, by 12.4%, raising its share in total investment.

Undeterred by the serious setback of the AFC, the Malaysian government again pursued a diversification strategy in the late 1990's, formulated in the National Information Technology Agenda. The Agenda encouraged the transformation of Malaysia into a knowledge-based economy (or "K-economy"). The government again actively encouraged export-oriented firms, but in particular those with knowledge-intensive production. For this and other reasons, manufacturing rebounded after the AFC, contributing more than 80% of the country's exports between 1998 to 2001, and about 30% of GDP (Bank Negar Malaysia, Annual report, 2012). Another serious external shock came with the Global Financial Crisis (GFC) of 2008, again felt as sharp drops in investment and manufacturing exports, as Malaysia traded heavily with the United States and Japan. Manufacturing production dropped by 11.2%, private investment by 10.9%, and public investment by 8.7%.

We argue that any of these substantial changes in ownership, or trade liberalization that removed protections for manufacturing, or two financial crises could alter the effect of oil revenue dependence (or other macroeconomic factors) on manufacturing, so that estimations of the relationship should allow for structural change.

We find two main results. First, the oil dependence – manufacturing relationship varies over years in a way captured well by a "two regime" specification. Second, in the (rare) years of the first regime, oil rent dependence has no significant impact on manufacturing, while in the (predominant) second regime, there is a significant inverted U-shaped relationship between the two. Specifically, we find a rise in oil rent dependence to the point of 8% of GDP stimulates manufacturing, but crowds it out above this. Finally, we find plausible connections between the timing of our data-driven regime breaks and known major changes in Malaysia's manufacturing and trade policies, and external crises.

3. Literature review

3.1 The Natural Resource Curse

Over the last few decades, economists have noted the paradoxical outcome of resource-rich nations (often in Africa, Latin America, and the Middle East) attaining poorer economic growth than more resource scarce countries. Starting with the seminal empirical work of Sachs and Warner (1995 and 2001), researchers found evidence of what Auty (1993) coined a "resource curse," or negative causal effect of natural resource abundance or dependence on economic growth (Gylfason, 2001; Gylfason and Zoega, 2006; Nabli and Arezki, 2012; Van der Ploeg and Poelhekke, 2009).

Subsequent research suggested several causal mechanisms for this negative effect, such as corruption (Dong et al., 2019), poor institutions and governance (Mehlum et al., 2006; Papyrakis and Gerlagh, 2006; Tsani, 2013), or impediments to socio-economic growth and development within oil-dependent countries (Adams, et al., 2019). However, perhaps the most prominent economic channel cited has been the "Dutch disease" (Iimi, 2007).

Corden and Neary (1982) and Corden (1984) describe the Dutch disease as follows. Under a "spending effect", natural resource booms spawn higher domestic income and demand for goods. This generates inflation and appreciation of the real exchange rate, causing rising imports and falling exports. This fall in net exports causes a country's traded good sector to contract against its other non-resource sectors. Second, Humphreys et al. (2007) also identify a "pull effect," in which resource booms cause the natural resource sector to attract more domestic inputs such as human capital and materials, which leads to the escalation of input prices in the domestic market. As a result, a shrinkage appears in traditional tradeable sectors like agriculture and manufacturing as their production costs increase.

Finally, it should be noted that while some resource curse researchers investigate causal mechanisms such as the Dutch disease, others have challenged the existence of a curse in the first place. For example, James (2015) calls the curse a "statistical mirage" after finding a non-negative relationship between resource dependence and economic growth in resource production sectors. Similar counter-claims have been made by Alexeev and Conrad, 2009; Brunnschweiler and Bulte, 2008; Lederman and Maloney, 2008, and others. This has left the overall relationship between natural resources and economic growth unresolved.

3.2 Non-Linear Resource Effects

As mentioned, papers testing for a resource curse have mainly followed the seminal work of Sachs and Warner (1995) in looking only for linear effects of resource abundance or dependence. In doing so, studies fail to capture a potential divergence in the growth experiences of more and less resource-dependent countries. Exceptions have included the aforementioned cross country study by Mehrara (2009) and United States-based study by Shahbaz et al. (2019), which find sufficiently high additional oil rents become a drag on growth, possibly by causing appreciation of the real exchange rate consistent with a Dutch disease (Corden and Neary, 1982). A few other researchers have also tested for non-linear effects of natural resources on growth, such as Abdulahi et al. (2019); Ampofo et al. (2020); Tiba and Frikha, (2019) and Damette and Seghir (2018). These studies have used panel threshold regression or nonlinear autoregressive distributed lag (NARDL) approaches. To date, however, no study has used a Markov-regime switching model. The model does not require a threshold variable (unlike panel threshold regression), nor the generation of positive and negative series for non-linear variables (unlike the NARDL approach). Rather, it allows coefficients to switch between regimes and can capture the dynamic patterns of time series in different regimes. Markov switching models are commonly used to investigate the relationship between macroeconomic variables if structural changes occur that affect the relationship between the variables during the sample period.

3.3 Resource effects on Manufacturing

Influential early papers cite a Dutch disease explanation for resource dependence harming growth. Sachs and Warner (2001), for example, argue that export revenues generated from the resource sector are beneficial for the handful of the population that has no incentive to invest them more productively. Rather, export revenues are spent in such a way as to inflate the prices of non-tradable goods and services and domestic wages. The manufacturing sector, which relies on such non-tradable inputs and labour becomes less competitive in the world market. In contrast, in resource scarce countries, the manufacturing sector receives a larger share of export revenues. Since manufacturing is a relatively competitive sector in these non-resource countries, investment there is siphoned to new capital and new technologies. As a result, the productivity of labour, output, and wages rise over time. In short, the manufacturing sector may generate greater positive externalities to an economy than the resource extraction sector (Sachs and Warner, 1995). Frankel (2010) adds that manufacturing in resource-intensive countries is also crowded out from expansion of the government and non-traded goods sectors due to resource-boom induced inflation.

Notwithstanding the prominence of Dutch Disease explanations for the resource curse, only a limited number of studies have investigated the effects of resource dependence or abundance on manufacturing, rather than on overall output. These studies have generally looked for linear effects, and some have found negative effects, while others have not. We review each in turn.

First, Sachs and Warner (1995 and 2001) find a negative association between resource development and the exports of manufactured goods in cross country analysis. In similar cross country analysis, Stijns (2005) finds that greater known oil and gas reserves are associated with a smaller share of manufacturing in exports. In a literature survey, Van der Ploeg (2011) reports mixed evidence, but from Brahmbhatt et al. (2010) that countries in which the resource sector accounts for more than 30 percent of GDP have smaller than typical tradeable sectors (including manufacturing). Papyrakis and Raveh (2014) find for Canada a negative association between mineral, oil and gas production and the growth in other exports. More ambiguously, Amiri et al. (2019) find that the impact of resource rents on growth in manufacturing depends on the efficiency of countries' institutions. Sufficiently efficient institutions can alleviate the negative effect of resource dependence on the growth of manufacturing.

Yet other researchers find no such negative association. Conceptually, this may not be surprising, since it seems plausible that a prudent allocation of oil extraction rents could boost public and private investments that increase demand for manufactured goods, or fund research and development in the manufacturing sector, particularly for producing inputs complementary to the resource sector. In any event, Bulte et al. (2005) find that manufacturing can expand during oil-booms in oil-rich countries. Sala-i-Martin and Subramanian (2013) in cross country analysis do not find a clear association between resource dependence and the share of manufacturing in GDP. In a within-country study of Uruguay, Estrades et al. (2016) find the exchange rate appreciation driven by resource booms does not affect the output of the manufacturing sector. Similarly, Ito (2017) finds that oil-price spikes in Russia that caused its exchange rate to appreciate did not prevent a rise in manufacturing output. Hilmawan and Clark (2021) also find for Indonesian districts over time that three of four measures of resource dependence are positively associated with manufacturing output.

We argue that one possible explanation for these mixed findings is that more attention should be paid to whether resource rents have non-linear effects on manufacturing. In addition, the literature has not investigated how manufacturing responds to oil rents in the presence of structural change. We turn now to explain our approach for doing this, applied to Malaysia.

4. Model, Methodology and Data

4.1. Model specification

The general form of empirical model investigated in this study is inspired by Farhadi et al. (2015) and Badeeb et al. (2016). We use a neoclassical Cobb–Douglas production function with the level of manufacturing output (Y) depending on total factor productivity (A), labor force (L), capital level (K), and output elasticity alpha.

$$Y = AK^{a}L^{1-\alpha} \tag{1}$$

Taking natural logs to improve the normality of the disturbances in regression and provide a simpler interpretation of coefficients (Chica-Olmo et al. 2020) yields

$$\ln(Y) = \ln(A) + \alpha\ln(K) + (1-\alpha)\ln(L) \quad . \tag{2}$$

We next allow that total factor productivity may be affected by an economy's dependence on oil rents as a proportion of total output, *OR*, or by its trade openness *TO* (i.e. its share of imports and exports to GDP):

$$A = f\,(OR,\ TO) \tag{3}$$

We then rewrite (2) as a regression that includes *OR* and *TO* as independent variables and a white noise error term, *t* denoting year, and all variables in natural logs.

$$Y_t = \alpha_0 + \alpha_1 OR_t + \alpha_2 K_t + \alpha_3 L_t + \alpha_4 TO_t + \varepsilon_t \quad . \tag{4}$$

Finally, in the light of the findings of Mehrara (2009) and Shahbaz et al. (2019) regarding non-linear effects of real oil rents on Y_t, we model the long-run oil-dependence relationship in quadratic form:

$$Y_t = \alpha_0 + \alpha_1 OR_t + \alpha_2 OR_t^2 + \alpha_3 K_t + \alpha_4 L_t + \alpha_5 TO_t + \varepsilon_t \quad . \tag{5}$$

For example, a U-shaped (inverted U-shaped) relationship between oil rent dependence and manufacturing output would be represented by $\alpha_1<0$ and $\alpha_2 > 0$ ($\alpha_1>0$ and $\alpha_2<0$). The turning point can be calculated as $Y^* = -\alpha_1/2\alpha_2$. Since the variable *OR* is measured in logs, e^{OR} will yield the value representing the turning point.

***4.2 Methodology*:**

4.2.1 Unit Root Test

Two standard unit root tests are used to investigate the order of integration for all time series used in regressions: Augmented Dickey Fuller GLS and Kwiatkowski et al. (1992) (KPSS) tests. The ADF–GLS tests are based on the null hypothesis of a unit root, while the KPSS test is based on the null of no unit root.

To allow for structural breaks, we implement the structural break unit root test of Clemente et al. (1998). This test assumes there are two structural breakpoints, and uses the time series data to identify when they occur. Clemente et al.'s test can be applied to an additive outlier (AO) model or an innovational outlier (IO) model. The first (AO) allows for sudden change in the means of the variables, while the second (IO) allows for gradual change.

4.2.2 Cointegration Tests

We use two different approaches to test the long-run relationships between the variables: Bayer and Hanck's test (2013) and the structural break cointegration test proposed by Gregory and Hansen (1996).

Bayer and Hanck's (2013) test combines all the main cointegrating test approaches (i.e. Banerjee et al.'s, 1998; Engle and Granger's 1987; Johansen's 1991; and Boswijk's 1994) to provide a uniform and efficient result. This test also makes robust inference in comparison to an individual t-test, and it eliminates the common problem of inconsistent findings associated with other existing cointegration approaches (Mallick et al., 2018). Following Fisher's (1932) formulation, Bayer and Hanck (2013) structure their cointegrating model as follows:

$$EG\text{-}JOH = -2[\ln(P_{EG})+\ln(P_{JOH})]$$

$$EG\text{-}JOH\text{-}BO\text{-}BA = -2[\ln(P_{EG})+\ln(P_{JOH})+\ln(P_{BO})+\ln(P_{BA}) \quad . \tag{6}$$

Here P_{EG} , P_{JOH} , P_{BO} and P_{BA} are the probability values of the individual cointegration tests of Engle and Granger (1987), Johansen (1991), Boswijk (1994) and Banerjee et al. (1998), respectively. The null of no cointegration between the variables is rejected if the critical value of

Bayer and Hanck (2013) is greater than the statistical value of Fisher (1932). Otherwise, the null is not rejected.

Unfortunately, Bayer and Hanck's (2013) test assumes the cointegrating relationship does not change over the period under study, which may be unrealistic. Gregory and Hansen (1996) argue that structural breaks that change the cointegrating relationship are a common phenomenon in longer time series. The long-run relationship is thus likely to witness at least one regime shift in the sample period. Ignoring the presence of structural changes can result in misspecification and misinterpretation (Gregory and Hansen, 1996). We thus also investigate cointegration with structural breaks, but given the limited length of our time series in Malaysia (see below), follow Gregory and Hansen's (1996) approach that assumes the cointegration vector is subject to a single break.

Gregory and Hansen (1996) allow a structural break for both intercept and slope. Their equation is defined as

$$Y_t = \alpha_0 + \alpha_1 D_{1t} + \sigma_t + b_0 x_t + b_1 D_{1t} x_t + \omega_t \quad . \tag{7}$$

Here a_0 is the common intercept and a_1 is the additional intercept beyond the common one with the structural break. b_0 and b_1 are defined as the slope and additional slope coefficient vectors without and with the structural break, respectively. σ_t defines the coefficient of the linear trend and ω_t is the error term. D_{1t} is a dummy variable for the endogenous structural break at time t=1, 2,..,n, and is defined as:

$$D_{1t} = \begin{cases} 0 & \text{if} \quad t \leq [nT] \\ 1 & \text{if} \quad t > [nT] \end{cases} \quad . \tag{8}$$

The dummy variable belongs to the set (0, 1) with the parameter T known, and indicates the relative timing of the structural break point or point of regime change.

In general, the standard method of testing the null hypothesis of no cointegration is the residual-based approach of Engle and Granger (1987). However, Gregory and Hansen (1996) argue that if the timing of structural breaks is unknown, residual-based tests such as the Augmented Dickey–Fuller (ADF) or Z_a, and Z_t tests proposed by Perron (1989) lead to misspecification of cointegration. They thus propose bias corrected modified ADF*, Z_t^* , and Z_α^* tests for testing cointegrating relationship of the underlying variables. These three tests are as follows:

$$\begin{aligned} &ADF^* = \inf ADF(\tau) , (\tau) \in T \\ &Z_t^* = \inf Z_t(\tau) ,(\tau) \in T \\ &Z_\alpha^* = \inf Z_a(\tau) ,(\tau) \in T \end{aligned} \tag{9}$$

The selected statistics are the minimum values for each test among all possible breakpoints for (τ) ∈ T.

4.2.3 The Markov Regime Switching Model

The traditional econometric methods that address the relationships between macroeconomic time series assume that the mean, variance, and covariance of series are constant during the sample period. Practically, this assumption is often not met due to the changing behavior of macroeconomic time series. Different structural or strategic decisions may bring changes in the real economy and subsequently in the values of macroeconomic variables. To capture how these changing characteristics alter the impact of one variable on another, Markov-regime switching models have been introduced to time series empirical research. In a Markov switching model, the switching mechanism is directed by an unobserved state variable that follows a first-order Markov chain. The structure prevailing for a random period in a Markov model will be replaced by another structure when switching occurs.

In this paper, we apply Markov-regime switching to study the impact of oil rent dependence on the size of the manufacturing sector in Malaysia. Having only 47 years of annual observations, we restrict our analysis to a two-regime model with shifts in the intercept and the slope coefficients of the oil rent dependence variables. While N = 47 is a smaller sample size than is ideal for time series analysis, its annual frequency ensures substantial variation within sample. Examples of two regime Markov Switching Model studies using annual data with this duration or less include Dogan and Bigili (2014), Charfeddine (2017), Pan et al. (2019), and Rahman et al. (2021).

A strength of the Markov-regime switching model is that it checks for the existence of the second regime[1], and estimates the dates and number of breaks between the two regimes endogenously, minimizing the amount of prior information assumed (Pan et al. 2019). The general form of the proposed model can be written as follows:

$$\Delta Y_t = \mu_{st} + \beta_{st} Z_t + \sum_{i=1}^{r} \emptyset_j \Delta X_t + \varepsilon_{st} \quad , \tag{10}$$

where Δ is the difference operator ($\Delta Y_t = Y_t - Y_{t-1}$), Y_t is the natural log of manufacturing value-added, and μ_{st} is the state-dependent intercept. Z_{st} is the state-dependent switching variable, here oil rent and its square, and X_t are the state-invariant variables such as K, L and TO, while $\varepsilon_{st} \sim N(0, \sigma^2)$. S_t refers to the unobserved state or regime taking the value 1 or 2. It is governed by a first-order Markov chain with transition probabilities given as follows:

[1] It checks the validity of the existence of a second regime via the statistical significance of the estimated transition matrix parameters between the regimes.

$$S_t = \begin{cases} 1 & \text{with probability } p_{11} \\ 2 & \text{with probability } p_{22} \end{cases} \quad , \tag{11}$$

where p_{11}=P[S_t=1|S_{t-1}=1], p_{22}=P[S_t=2| S_{t-1}=2] and $\sum_{i=1}^{2} p\mathrm{ij} = 1$ for j=1,2.

The intercept and slope coefficients in (10) can be written as follows:

$$\begin{aligned} \mu_{st} &= \mu_1 + (\mu_2 - \mu_1)(S_{t-1}) \\ \beta^{st} &= (\beta_1^1 \beta_1^2), (\beta_2^1 \beta_2^2), \ldots, (\beta_k^1 \beta_k^2) \ , \end{aligned} \tag{12}$$

where k is the number of independent variables. The key slope coefficients of oil rent (OR) and oil rent squared (OR^2) under the first and second regimes are denoted by $\beta_1^1, \beta_1^2, \beta_2^1, \beta_2^2$, respectively.

4.3 Data:

We use annual data for Malaysia over the 47 year period 1970-2017. Data on manufacturing value added (i.e. the value of manufacturing in GDP) are obtained from United Nations national accounts (www.unstats.un.org/unsd/snaama). We use total oil plus gas rents over GDP as our measure of oil rent dependence (Badeeb et al., 2016; Bhattacharyya and Hodler, 2010, 2014). According to the World Bank, oil and gas rents are defined as the difference between the values of their production at world prices and their total production costs. To proxy for capital level, we use the investment (i.e. change in capital) measure of gross fixed capital formation (Inglesi-Lotz, 2016). According to the World Bank, this measure includes land improvements, purchases of plant, machinery, and equipment, and the construction of roads, railways, schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Labor force and trade openness are sourced from the World Bank's World Development Indicators (WDI). All variables are transformed using natural logs.

5. Empirical Findings and Discussion

Descriptive statistics for manufacturing value-added, oil rent dependence, capital, labor force, and trade openness are provided in Table 1 in natural logs. The mean and median for each variable are close together, indicating limited skewness. In fact, the normality hypothesis cannot be rejected at the 5% for all variables. The average oil rent dependence over the sample of ($e^{1.53}$ =) 4.64% is moderate, reaching a sample maximum of 12.9%.

Testing for order of integration, both Augmented Dickey-Fuller GSL and KPSS unit root tests confirm order one integration for all data series.[2] We next implement the Clemente et al. (1998) structural break unit root tests assuming two structural breakpoints. We report results for the additive outlier (AO) model for sudden changes in variable means, and innovational outlier (IO) model for gradual changes, in Table 2. We argue that oil price shocks have created sudden changes in oil rent movements in major oil producing countries like Malaysia, and that the abrupt emergence of the Asian Financial Crisis and the Global Financial Crisis in annual time series could quickly change the relationship between oil and macroeconomic variables. We therefore emphasize the AO model results, and use them to base our decision regarding the order of integration of the variables. Using this approach, we confirm the GSL and KPSS test results (without structural breaks) that all variables are integrated to order one.

There are two groups of date breaks of the dependent variable. The first is dates around 1986, and the second is dates around 1997. The first may correspond to a global recession and

[2] We do not reproduce the results of the unit root tests to conserve space, however the results are available upon request.

Table1: Descriptive Statistics

	Y_{mnf}	OR	K	L	TO
Mean	23.641	1.534	23.877	15.804	4.922
Median	23.900	1.799	24.206	15.830	4.945
Max.	25.151	2.558	25.252	16.534	5.396
Std. Dev.	1.137	1.165	0.967	0.434	0.315
Skewness	-0.348	-3.253	-0.441	-0.083	-0.195
Kurtosis	1.736	14.752	1.979	1.934	1.870
Jarque-Bera	4.162	0.088	3.640	2.326	2.859

Notes: All variables are in natural logs. N = 47 annual observations for all variables.

Table 2: Results of Unit Root Test

Variable	Additive Outlier						Innovative outlier					
	Level			1st difference			Level			1st difference		
	T-Stat.	TB1	TB2	T-Stat.	TB1	TB2	T-stat.	TB1	TB1	T-stat	TB1	TB2
Y_{mnf}	-5.910	1986	2008	-7.557^{***}	1986	1996	-3.371	1988	2000	-2.062	1986	1995
OR	-2.372	1972	1997	$- 7.985^{***}$	1975	1981	-1.520	1992	1999	-1.156	1977	1998
OR^2	-2.484	1977	1989	-14.670^{***}	1978	1999	- 3.091	1976	1988	-1.198	1977	1998
K	-3.561	1986	2009	-8.244^{***}	1985	1997	-2.722	1981	1992	-7.756^{***}	1984	1996
L	-4.347	1987	2008	-7.134^{***}	1998	2008	-2.785	1990	2007	-8.358^{***}	2000	2007
TO	-3.160	1990	2010	-6.229^{***}	1984	1999	-4.845	1986	2007	-6.902^{***}	1984	1999

*** denotes the significance at 1% level respectively.

associated severe economic downturn in Malaysia in 1985-87[3]. The second likely corresponds to the 1997 Asian financial currency crisis. Both events had a direct effect on economic activity, demand for manufactured goods, and oil rent/GDP ratios. The two break years identified are clearly visible in a plot of Malaysia's manufacturing output over our sample years in Figure 2.

Finally, we test for a cointegrating relationship between the economic variables. Starting with the Bayer Hanck (2013) approach, we allow a maximum of two-year lags on the first difference of each variable in the study. We use the Schwarz-Bayesian Criterion (SBC) to select

[3] The global recession in 1986 led to weakened international demand for electronics and commodities, which severely affected related production in Malaysia, particularly the semiconductor industry, and thus Malaysia's GDP growth (Okposin and Ming, 2000).

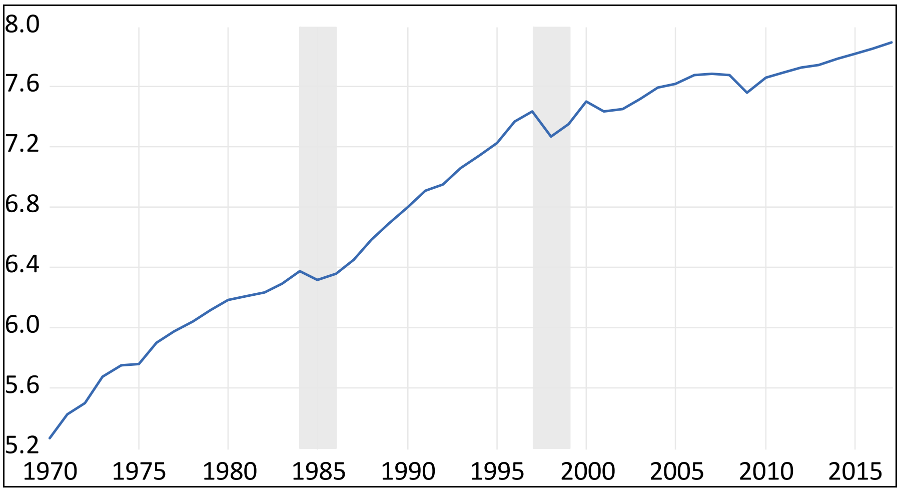

Figure 2: Manufacturing, value added (natural log of constant 2010 US$)
Source: World Bank World Development Indicators (WDI), 2020

the optimal lag length (zero, one or two) for each variable. Panel A of Table 3 presents the Bayer and Hanck (2013) test results. These indicate there is a cointegrating relation between the variables.

Moving to residual-based Gregory–Hansen cointegration tests, results are shown in Panel B of Table 3. We find that the modified ADF* and Z_t^* tests reject the null of no cointegration at the 1% significance level for all models. The Gregory-Hansen tests are thus consistent with a long-run cointegrating relationship among the variables, but a relationship that changed between two regimes during the period of study. That long term relationship under the two regimes, including the key OR and OR squared terms, is presented in Table 4.

A likelihood ratio linearity test proposed by Davies (1977) indicates that a two-state Markov switching specification with shifts in the intercept and the slope coefficient of both OR and OR squared is more appropriate than a linear specification without regime change. These results are also confirmed by AIC, HQ, and SC values that favor the nonlinear model. In addition,

Table 3: Results of Cointegration Tests

Model	Optimal lag	F-statistics		Cointegration
Panel A: Bayer and Hanck (2013) Combined Cointegration				
		EG-JOH	**EG-JOH-BO-Ba**	
Y_{mnf} I OR OR^2 K L TO	2	55.301***	56.799***	Yes
		Fisher's (1932) Critical Values		
	1%	16.26	31.17	
	5%	10.419	19.88	
	10%	8.363	16.10	
Panel B: Gregory–Hansen Structural Break Cointegration Test				
Y_{mnf} I OR OR^2 K L TO	ADF*	Z_t^*	Z_α^*	Structural Break
	-5.61* [5.56]	-5.70*[5.56]	34.89 [-59.40]	2004

Note: ***and * denotes the significance at 1% and 10% level respectively. Numbers in brackets are critical values at 5% level GH (1996, pp 599).

Table 4: Estimation of the long-term relationship with Markov shifts.

Variable	Parameter	Y_{mnf}				
		Linear			Markov switching	
		Coeff	SE		Coeff	SE
Intercept	μ_1	7.910***	0.020	S1	-18.918***	0.749
	μ_2	-		S2	-19.341***	0.195
OR	β_1^1	6.458***	0.817	S1	-0.220	0.797
	β_1^2	-		S2	0.026***	0.007
OR^2	β_2^1	-1.593***	0.292	S1	0.039	0.216
	β_2^2			S2	-0.006**	0.003
K	β_3	0.714	1.043		-0.096***	0.013
L	β_4	2.093	1.965		1.629***	0.013
TO	β_5	-0.827	1.140		0.553***	0.040
Turning point	TP	-		S2	$TP = (-\beta_1^2 / 2\beta_2^2)$ =	2.084 (EXP: 8%)
Sigma	σ	-			0.038***	0.123
Log likelihood	LL	64.944			77.873	
LR test	LR				$LR=2\times(LL_{MS}-LL_{Linear})$= 25.859**	
SC criterion		-2.158			-2.277	
AIC criterion		-2.476			-2.745	
HQ criterion		-2.357			-2.568	
RCM					1.945	

Note: ***, ** denote significance at the 1% and 5% levels, respectively.

the regime classification measure (RCM) is close to zero, indicating this regime classification is well-supported.[4]

Focusing on our key variables, the estimated long-term relationship indicates that in the "first regime" years the coefficients on OR and OR squared are negative and positive, respectively, but neither are significant. In contrast, in the "second regime" years, the OR and OR squared coefficients are positive and negative, respectively, and both significant at the 1% level. In other words, the relationship between oil rent dependence and manufacturing levels appears U-shaped but not significant in regime-1, and instead inverted U-shaped and significant in regime 2. Below we provide a summary of these key results, with standard errors in parentheses:

Regime-1:

$$Y_{mnf_t} = -18.918 - 0.219 OR_t + 0.0388 OR_t^2 - 0.0959 K_t + 1.629 L_t + 0.553 TO_t + \varepsilon_t$$

(0.749) (0.797) (0.216) (0.0134) (0.0131) (0.0396)

Regime-2:

$$Y_{mnf_t} = -19.341 + 0.0263 OR_t - 0.00631 OR_t^2 - 0.0959 K_t + 1.629 L_t + 0.553 TO_t + \varepsilon_t$$

(0.195) (0.0069) (0.00288) (0.0134) (0.0131) (0.0396)

For insights into regime duration, we move to the matrix of transition probabilities in Table 5. These reveal that the persistence probability of regime 2 is much greater than that of regime1. The expected duration of regime 2 is an average of 17 years and 9 months, compared to 4 years and 4 months for regime 1.[5]

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[4] The RCM for a Markov Switching model is given by: $RCM = 400 * \frac{1}{T}\sum_{t=1}^{T} P_t(1 - P_t)$.

[5] Under the Markov Switching model, the expected durations of regime 1 (D1) and regime 2 (D2) are calculated as D1=1/(1-p_{11}) and D2= 1/(1-p_{22}).

Table 5: Markov Transition Probabilities and Expected Duration

	Regime 1	Regime 2
Regime 1	0.773 (p_{11})	0.228 (p_{21})
Regime 2	0.0559 (p_{12})	0.944 (p_{22})
Expected duration		
	4.4 Years	17.9 Years

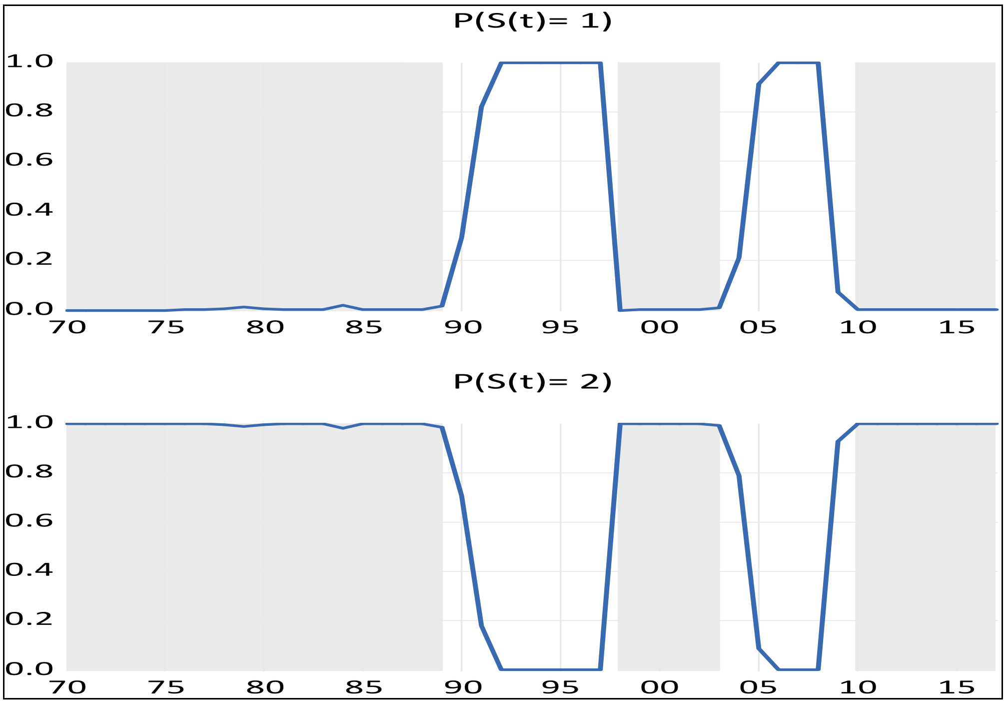

Figure 3: Markov Switching Smoothed Regime Probabilities

To estimate specific regime years, Figure 3 reports the estimated persistence probabilities using smoothing based on our full sample. Probabilities estimated with smoothing confirm that the second regime is far more enduring than the first, covering the periods 1970 to 1991, 1998 to 2004, and 2008 to 2018. In contrast, the first regime covers only 1992 to 1997, and 2005 to 2008. In regime 2 years, increases in oil rent dependence below a threshold level of ($-\beta_1^2/\ 2\beta_2^2 =$) 8% stimulates manufacturing output, whereas increases from above that threshold decrease it. This

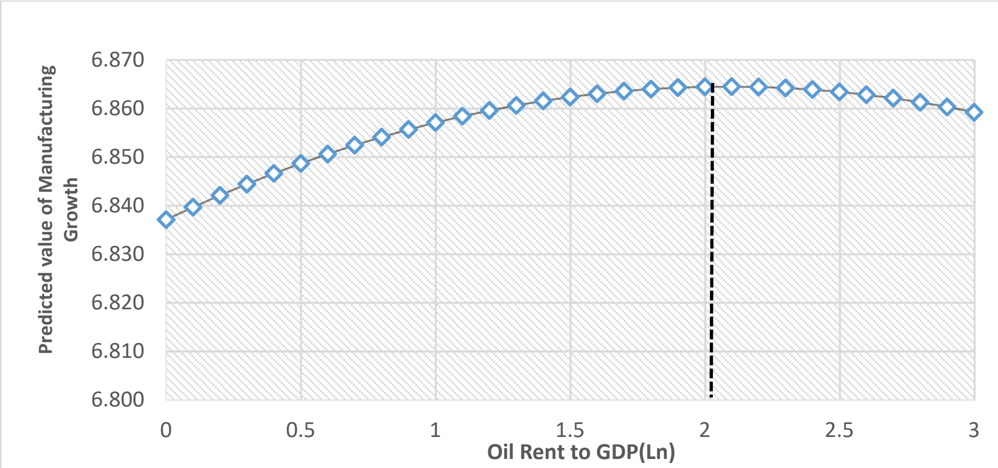

Figure 4: Turning point in the relation between oil rent dependence and manufacturing growth (Regime-2)[6]

is illustrated in Figure 4. This 8% threshold value lies well within the sample range of oil rent dependence experienced by Malaysia, and is exceeded for 14 of our 47 year sample. Since regime 2 covers most of the sample period, this means there were periods in Malaysia's recent history where oil rent dependence was sufficiently high to discourage manufacturing output.

The inverted U relationship between oil rent dependence and manufacturing levels during Regime 2 years is illustrated in Figure 5, where the two series are compared for years where oil rent dependence is below 8%, vs. for years where it is above. Do these (data-driven) findings regarding the years of regime change correspond to what we know of Malaysia's recent history, and the inverted U relationship between oil rents and manufacturing under regime 2 to Mehrara's (2009) and Shahbaz et al.'s (2019) findings?

Regarding regime shifts, our results suggest that the Malaysian manufacturing sector was not significantly affected by oil rent dependence during regime 1 years (1992-1997, 2005-2008).

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[6] The figure is drawn based on estimated regression equation of Regime 2. Oil rent ranges from 0 to 3 while we hold other explanatory variables at their sample means.

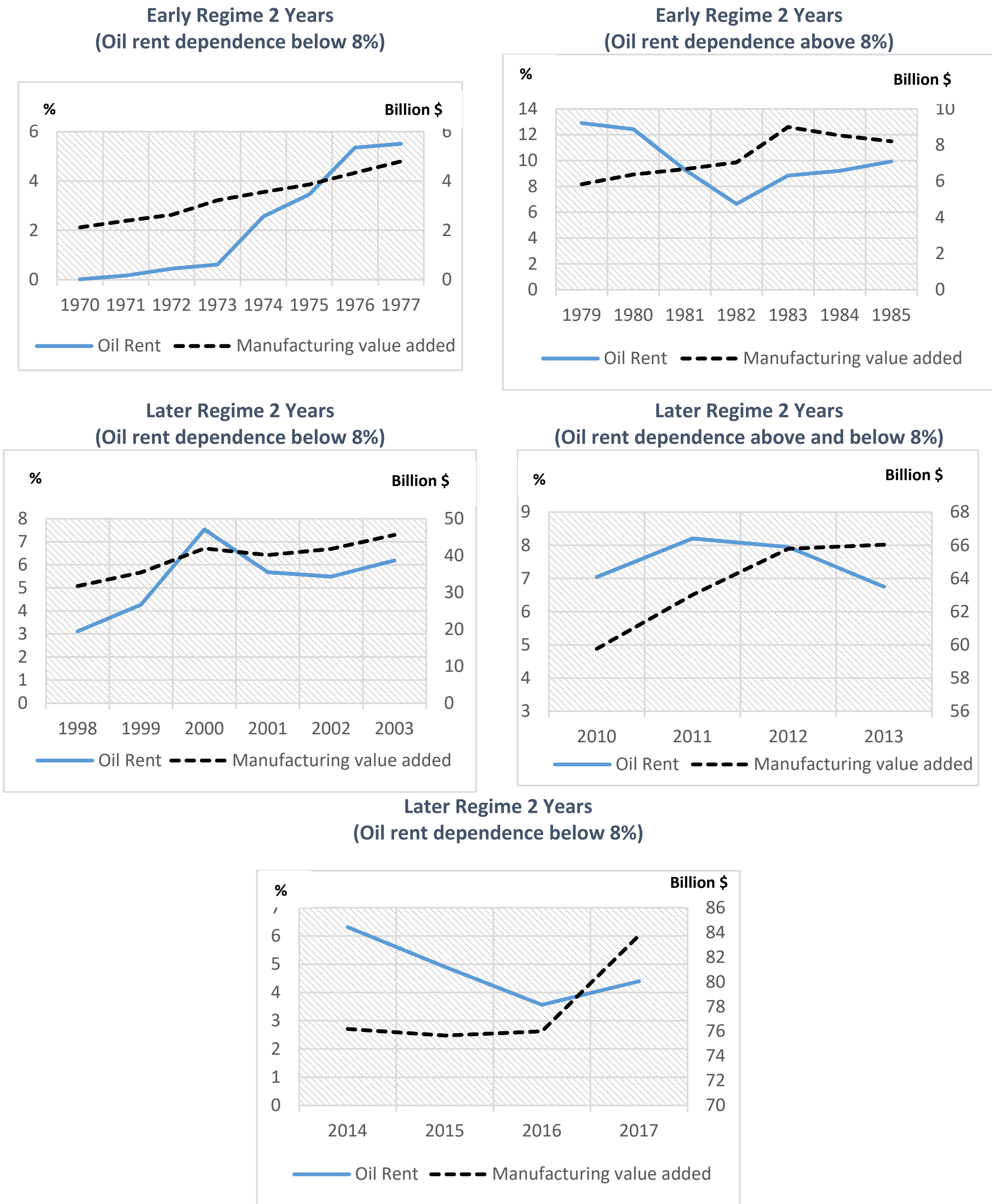

Figure 5: Oil Rent Dependence and Manufacturing Levels In Regime 2 Years

Source: World Bank World Development Indicators (WDI), 2020

We note first that both periods coincided with periods of activist diversification policies towards manufacturing by the Malaysian government, and that both periods ended with sharp negative exogenous demand shocks - the 1997 Asian financial crisis, and 2008 global financial crisis. In particular, as explained in Section 1 in the early 1990's the government tried to diversify away from resource production based on its Industrial Master Plan for 1986 to 1995. It pursued diversification by privatizing state-owned manufacturing enterprises, liberalizing exports, and encouraging foreign direct investment. As Figure 1 illustrated, the resulting rapid growth rate in manufacturing output in the 1990's abruptly shifted down with the 1997 Asian financial crisis, and never resumed its former growth path. It appears that the manufacturing sector returned to being vulnerable to high levels of oil rents thereafter.

There was a similar pattern in the early 2000's of an activist government diversification strategy that promoted knowledge-intensive manufacturing and exports that saw manufacturing de-sensitized to oil rent dependence by 2005-2008. Once again, this de-sensitization seemed to end in 2008, the year of the GFC with its contraction of investment and manufacturing exports.

In contrast, for most of Malaysia's recent 47-year history, including during the early development of the manufacturing sector in the 1970's and 1980's, the sector benefited from increases in oil rents from a modest base. It seems likely that such rents helped fund government stimulus packages that supported small and medium-scale enterprises, as well as tax relief that benefitted manufacturing output. However, when oil rent dependence exceeded certain levels, it spurred appreciation of the Malaysian ringgit, causing a contraction in manufacturing exports.

Separately, the inverted U relationship we find for most of our sample years between oil rent dependence and manufacturing is consistent with Mehrara's (2009) cross country findings, and Shahbaz et al.'s (2019) United States-based findings between real oil revenues and GDP. The inverted U is also in line with Rasiah (2011) and Doraisami (2015) who both note that Malaysia has been facing deindustrialization since 2000, with a downtrend in manufacturing value-added, trade performance, and productivity. Doraisami (2015) in particular argues that Malaysia may not have escaped an oil curse after all.

Looking briefly at the other explanatory variables in Table 4, both the size of labor force and trade openness have a positive and significant effect on manufacturing. A 10% increase in the labor force increases manufacturing output by 16%, while a 10% increase in trade openness increases manufacturing output by 6%. The latter is not surprising, as 73.9% of manufacturing output is exported (Ministry of Finance Economic Report, 2017/2018), and openness increases firms' access to foreign technology and production techniques. More surprisingly, Table 4 suggests a 10% increase in (public plus private) investment is associated with a decrease in manufacturing of 0.5%. The negative impact of total investment on manufacturing is however consistent with previous findings and arguments of Ang and McKibbin (2008), Ibrahim (2000), Menon (2012), and Badeeb et al. (2016). Menon (2012) of the Asian Development Bank, and Ibrahim (2000), suggest that public investment in particular has been unproductive in Malaysia over recent decades because of the persistence of government-linked (owned) corporations who exercise significant market power, preferential treatment, and create barriers to competition or entry which discourage private investment. Badeeb et al. further argue that investment funds in Malaysia are often channeled into non-productive shares and real estate, rather than productive activities. This has led to bubbles in the property sector and triggered speculative activity in the share market prior to the financial crisis of 1997–98 (Ang and McKibbin, 2007).

5.1 Robustness check of data frequency

Finally, we check the robustness of our findings by interpolating a finer data frequency by transforming our observations from annual to quarterly using the quadratic-match-sum method as in Shahbaz et al. (2018, 2019).[7] We also try using government expenditures in place of trade openness as a control variable. The results are generally similar to what we find in our original analysis. First, the relationship between oil rent dependence and manufacturing output again varies over time, with one regime predominant. Second, the relationship between oil rent and manufacturing value-added has an inverted U shape in the predominant regime (85 quarters ≈ 21 years). These periods correspond with those in our original analysis. Finally, dependence threshold estimates with quarterly data are only slightly lower at 7.2% than with annual data. See Appendix Tables X and Y for detail.

An interesting auxiliary finding from our rubustness check regards the sign of investment. With government expenditures controlled for rather than trade openness, the sign of investment turns from negative to (significantly) positive, while the sign of government expenditure is negative and significant. We interpret this as providing additional evidence that the negative impact of investment on manufacturing in our main analysis was due to unproductive public investment.

6. Policy implications

Malaysia joins other oil-rich countries in seeking to diversify economic activity from non-renewable resource extraction. Manufacturing has long been viewed as a promising target sector

[7] This option in Eviews creates a polynomial by taking sets of three adjacent points from a variable's annual series and fitting a quadratic such that the average or sum of quarterly points matches the annual points actually observed. It thus generates a smoothed or averaged interpolation of quarterly data.

because of its positive spillovers, economies of scale, and scope for technological progress (Hausmann et al. 2007, Berg et al. 2012, and Jarreau and Poncet 2012). It is therefore important for policy makers to understand any relationship that exists between oil (or other resource) rents and manufacturing outcomes. Researchers who seek to estimate that relationship should take into account structural changes taking place in the countries at issue. Our study provides an example of how structural changes regarding privatization, trade liberalization and external exogenous shocks may affect the impact of oil rent dependence on manufacturing, and can be tested for.

We divide the policy implications of our findings into those related to 1) the manufacturing sector, 2) oil rent management, and finally 3) other policies based on our control variables.

6.1. Policies related to manufacturing:

We found that oil rent dependence had no significant impact on the manufacturing sector during periods (1992-1997 and 2005-2008) when the sector benefitted from government support and development relating to partial privatization and trade liberalization. This might suggest that the government should continue its effort to improve the competitiveness of the manufacturing sector with attempts to boost productivity and encourage the adoption of technological change. For instance, in line with the "industrial revolution 4.0", the government could encourage the manufacturing sector to produce higher-value, more diverse and knowledge-based products. This could include intensifying efforts to alleviate obstacles to competitiveness for manufacturing firms to export to international markets. To promote knowledge-based production, the government could support technology diffusion and adoption for small and medium enterprises (SME's). This could help SME's create strong production networks and collaborations with larger firms.

In addition, reducing the manufacturing sector's reliance on non-critical subsidies and linking financial support to productivity outcomes could reposition the sector to higher value-added segments of the value chain. The government could also provide funding opportunities to encourage firms to adopt new technologies and invest in research and development.

6.2. Policies related to oil rent management

One of the challenges for policymakers in oil-based economies is managing the volatile stream of oil rents that track exogenous changes in world oil prices. They must balance short-term needs for current spending (i.e., wages, subsidies) against long-term investment (i.e. health, education, and infrastructure). As other resource curse scholars have recommended, governments should introduce clear, transparent plans for allocating oil wealth between consumption and investment, and across generations. Savings should take oil price volatility into account through a wise counter-cyclical investment strategy.

A more specific recommendation from our findings, however, is that policymakers seeking to diversify from oil extraction to manufacturing should limit their GDP's dependence on oil rents below moderate levels (here, 8%), as this facilitates such rents having a beneficial or neutral effect. This requires developing new production sectors to raise the denominator. Strong private investment should be enhanced as the main growth motor as it can raise the share of GDP from non-oil revenues. A diversified export sector also helps preserve the sustainability of the current account and provides a stable source of accumulated reserves. In addition, the government should further implement renewable energy and energy efficiency programs, working with non-government agencies to coordinate and promote energy generation based on renewable resources. This could include completing an inventory of renewable sources, identifying suitable technologies, and creating incentives for appropriate practical application.

As this diversification and transformation may take time, policymakers could also in the short term try to limit oil rent dependence by copying resource success cases like Norway by investing oil rents in foreign assets. This would serve the three-fold purpose of providing income from the return on the assets, avoiding low productivity additional public investments domestically, and avoiding inflation. Funding government current expenditures by such capital income from financial investments may also improve economic efficiency compared to financing them from alternative sources (e.g. taxation).

6.3. Other policies:

Among our control variables, this study confirmed a positive impact on manufacturing of the size of labor force. The productivity of Malaysia's labour force (for manufacturing) might be increased further by raising the number of high-skilled graduates entering Malaysia's workforce relative to the entry of low-skilled workers. This would require increased public investment in education and re-training.

Other than that, government policy should focus on raising trade openness by lowering tariffs and non tariff barriers to imports and pursuing trade agreements with other countries. On the one hand, exports of manufactured goods have been a key driver of economic growth in Malaysia. On the other hand, reducing restrictions on imports of machinery is important for acquiring embedded technologies and know-how. Movements to greater openness could be selective, focusing particularly on broad areas of comparative advantage within the manufacturing sector. This would require a disaggregated analysis of the effects of greater openness on different manufacturing areas. While advocating for more open trade policies in general, we join Rodrik (2001) in stressing that '…no country has developed simply by opening itself up to foreign trade and investment'. However, a conducive macroeconomic environment with greater trade openness in targeted areas could stimulate the productivity of domestic manufacturing.

Finally, the negative association we found between the level of total (public and private) investment and manufacturing may imply that not only investment size, but also composition plays a significant role in economic development. In other words, the structure of investment and its relative efficiencies across economic activities matters (Tvaronavičius and Tvaronavičiene, 2008). As Badeeb et al. (2016) argue, a high dependence on oil rents can increase the dominant role of government in total investment at the expense of private investment. Because private investment tends to be more efficient than public, this crowding out may lower growth more generally (see also Banerjee et al. 2011). For Malaysia, reviving private investment, particularly in knowledge-based manufacturing, should be prioritized, and may accelerate technological progress and enhanced sector productivity.

7. Conclusion

This paper has studied the effects of oil rent dependence on the manufacturing sector for Malaysia, a large oil-producing nation of South East Asia, for the years 1970 to 2017. It has done so allowing that the relationship could be non-linear, and could change over time due to structural changes brought on by trade liberalization, major changes to industrial policy, and external shocks.

We constructed a two regime Markov Switching Model that allows for shifts in the intercept and slope coefficients of the linear and squared oil rent dependence variables. This approach uses the data to identify the years of structural breaks between the two regimes. The results confirmed that the relationship between oil rent dependence and manufacturing output varied over time, though with the second regime predominant (1970-1991, 1998-2004, and 2008-2017 vs. 1992-1997 and 2005-2008.)

Oil rent dependence had no significant effect on manufacturing in the rarer first regime, but a significant inverted U-shaped relationship during the predominant second regime, similar to that found by other oil-curse researchers who have allowed for non-linear effects (Mehrara (2009) and Shahbaz et al. (2019)). We find an estimated threshold of 8% beyond which additional dependence lowered manufacturing output. Our results confirm the importance of allowing for changes to the structural relationship between oil rents and output, and could provide one explanation for the profoundly mixed evidence regarding the resource curse, and the candidate causal explanation of a Dutch disease – type crowding out of traded sectors such as manufacturing. Based on our results, we also proposed three main directions to improve Malaysian manufacturing and neutralize the negative impact of oil rents as part of an economic diversification strategy. These three directions were 1) continued plans to raise manufacturing sector competitiveness and productivity, 2) constraining the oil rent to GDP dependence ration by pursuing further economic diversification, and 3) broader policies of improving labour force skills, enhancing trade openness, and fostering private investment.

One limitation of our study was imposing a maximum of two regimes in the relationship between oil rents and manufacturing. This was driven by our short (47 year, annual) period of study. A possible extension of this paper would be to pursue less accessible quarterly data, which might permit a greater allowable number of regimes. Another possible extension would be to examine the effects of oil rent dependence on disaggregated components of manufacturing, since areas differ in degree of export. Finally, it might also be possible to add exchange rates or institutional variables as controls to distinguish whether the impact of oil stems from Dutch disease or institutional channels as suggested in the resource curse literature.

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Appendix Table 1: Estimation of the long-term relationship with Markov shifts (Quarterly Data).

Variable	Parameter			Y_{mnf} Markov switching Coeff	SE
Intercept	μ_1		S1	-17.9712***	0.2804
	μ_2		S2	-18.673***	0.3107
OR	β_1^1		S1	0.0135***	0.0033
	β_1^2		S2	0.2611	0.2179
OR²	β_2^1		S1	-0.0034***	0.0011
	β_2^2		S2	0.0007	0.0615
K	β_3			0.1960***	0.0101
L	β_4			1.3499***	0.0184
GOV	β_5			-0.4253***	0.0541
Turning point	TP	-	S2	$TP = (-\beta_1^2 / 2\beta_2^2)$ =	1.981 (EXP: 7.2%)
Sigma	σ	-		0.038***	0.054
Log likelihood	LL			338.50	
SC criterion				-3.1975	
AIC criterion				-3.4011	
HQ criterion				-3.3186	
RCM				0.3389	

Note: ***, ** denote significance at the 1% and 5% levels, respectively.

Appendix Table 2: Markov Transition Probabilities and Expected Duration (Quarterly Data).

	Regime 1	Regime 2
Regime 1	0.9883 (p_{11})	0.0117 (p_{21})
Regime 2	0.0291 (p_{12})	0.97090 (p_{22})
Expected duration		
	85.2 Quarter	34.37 Quarter