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Bruno, L. C. (2023). Natural resources and economic growth: comparing nineteenth century Scandinavia and twentieth century Southeast Asia. Scandinavian Economic History Review, 71(1), 58-79.

https://doi.org/10.1080/03585522.2021.1984298

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Natural resources and economic growth: Comparing 19th century Scandinavia and 20th century Southeast Asia

Abstract

This paper aims to bridge part of the gap that exists between the resource curse literature and economic historical research on natural resources by analysing four resource-abundant countries. The study proposes that at the sectoral level, the determinants of growth in resource-based industries were mostly similar in the late 19th and late 20th centuries. However, we also argue that the relative contribution of natural resources to economic growth might have been declining during the late 20th century. The evidence comes from an analysis of the forestry sector in Finland and Sweden between 1860 and 1910 and the palm oil industry in Indonesia and Malaysia between 1970 and 2016.

Keywords: Natural resources, forestry, palm oil, Finland, Sweden, East Asia
Subject classification codes: N10, N50, Q1, Q2, O13

1. Introduction

Economists and other scholars have extensively researched the impact of natural resources, both economically and politically.[1] For analytical purposes, these studies can be divided into three (often overlapping) categories. The first investigates whether natural resources harm economic growth (Sachs & Warner, 1995; Brunnschweiler, 2008; James, 2015). In other words, this category tests whether there is a 'natural resource curse'; the results thus far are mixed. The second category explores the economic effects of natural resources, often through Dutch disease models.[2] The final category explores the political effects of natural resources, often focusing on the effects of oil on democracy (Ross, 2001; Collier & Hoeffler, 2009). The studies mentioned above have one thing in common; they investigate the contemporary period – the post-1950 era.

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[1] For recent literature surveys see Gilberthorpe & Papyrakis (2015), Venables (2016), van der Ploeg & Poelhekke (2017) and Badeeb et al. (2017). The present study defines natural resource similarly as Badeeb et al. (2017) as the natural assets that can be used for economic gains, which includes materials, minerals, forests, water and fertile land.

[2] For instance, a real appreciation of the exchange rate (Corden & Neary, 1982) and reduced learning by doing (van Wijnbergen, 1984), decreased investment in human capital (Gylfason, 2001) and increased productivity (Bjørnland et al., 2019).

Compared to the contemporary period, the impact of natural resources on pre-1950 economies has been less explored. Economic historians have traditionally explored the importance of natural resources for industrialisation, as a lack of proper natural resources is argued to have been a barrier to industrialisation in the pre-1914 period (Pollard, 1981; Wrigley, 1990; Landes, 2003; Clark & Jacks, 2007). Recently, economic historians have focused more on similar topics such as research on the contemporary period. Two economic historians, Gavin Wright and Edward Barbier, have attempted to compare the pre-1914 and the post-1950 era. Wright claimed that natural resources, in general, promoted economic growth in both the pre-1914 and post-1950 periods, and called the 'resource curse' a myth (Wright & Czelusta, 2004). Wright argued that the mineral sector is more knowledge-intensive than commonly recognised in traditional Dutch disease models, and exhibits increasing returns (David & Wright, 1997). However, Barbier (2007) claimed that the economic significance of natural resources has changed over time. He argued that the 'golden age' of resource-led growth was in the 1870-1914 period, and that economies post 1950 generally failed to benefit from their natural resources.

The central question this paper addresses is whether natural resources had a different economic impact in the 1860-1910 period relative to the 1970-2016 period. Our study aims to answer this research question by comparing Barbier's and Wright's viewpoints. The paper's aim is not to provide a definitive answer, but rather to partly bridge the gap between the research traditions of the contemporary period with economic history studies. This paper compares two countries in the 1860-1910 period (Finland and Sweden) with two countries in the 1970-2016 period (Indonesia and Malaysia), using a two-pronged analytical approach. First, following a sectoral focus common in economic historical studies, this paper investigates sectoral development in the forestry sector (1860-1910) and the palm oil sector (1970-2016) as these sectors share many similar characteristics. Second, following a more macroeconomic focus common in many studies on the contemporary period, the paper applies an empirical model to investigate how natural resources, in general, affect economic growth. Using both approaches will allow for a better understanding of whether natural resources have had a different impact on economic growth in the four countries considered.

The four countries mentioned have similar characteristics, making a comparison fitting.[3] First, and most obvious, all four countries were resource-abundant and are considered

[3] The paper title hinted at Scandinavia; however, Denmark and Norway are not included in this study. The omission of Denmark is due to its lack of a similar forestry sector, whilst Norway is omitted as the forestry sector was already in decline by the 1850s due to supply problems as many forests already had been exploited.

"successful" in terms of economic growth. As is shown in table 1, the economic growth rate in all four economies was higher than the world average. Second, all four countries are "developing countries" in the era in which they are being studied, meaning that in terms of GDP per capita, they are not on par with the leaders at the time as shown in table 1. To highlight the importance of resource-abundance and table 2 presents the share of wood-related exports for Finland and Sweden over the period of analysis, and shows the resource-abundant exports for Indonesia and Malaysia.[4] Even though these figures are difficult to compare directly as the trade classifications for the 19th century differ from those in the 20th century, it is still clear that natural resources are important features for all four economies. The similar characteristics will allow for a better understanding of how the economic effect of natural resources has changed over time.

INSERT TABLE 1 HERE

INSERT TABLE 2 HERE

The 19th and the 20th century pairs also have some similarities that allow for a more in-depth analysis. Finland and Sweden share a similar culture, climate and economic structure, and both have a large forestry sector that played an important role in their economies in the 1860-1910 period. Sweden has been more successful than Finland in terms of economic growth and resource-led development. Similarly, Indonesia and Malaysia share a similar culture, climate and economic structure, and both countries had a large palm oil sector in the 1970-2016 period. As in the Finland-Sweden case, Malaysia was more successful than Indonesia. The inclusion of Finland and Indonesia allows us to analyse why these countries lagged behind Sweden and Malaysia, respectively.

This paper adds to the literature in several ways. First, most historical economic studies on the impact of natural resources have focused on minerals and the US in the 1870-1930 period. This study expands our view by focusing on two types of renewable natural resources (forestry and palm oil).[5] Second, to the best of our knowledge, this study is the first that uses

[4] The reason for not exclusively taking the palm oil related trade figures is twofold. First, Indonesia and Malaysia were resource-abundant in many different natural resources meaning that taking all natural resources gives a better picture. Second, it is hard to know which manufacturing sectors were intensive in palm oil exclusively, as most resource-intensive manufacturing sectors were intensive in multiple natural resources.

[5] One topic not considered in this paper is the difference between renewable and non-renewable resources in terms of resource depletion. For historical research in this vain see for instance Lindmark and Acar (2013).

an empirical model to investigate the impact of natural resources in the late 19th century and compare the results to a similar model for the late 20th century.

2. The effect of natural resources across time

The literature on the contemporary period provides two insights for the pre-1914 period. First, good institutions and policies matter. The argument is that good quality (exogenous) institutions are crucial in determining whether natural resources become a curse or a blessing.[6] Likewise, good policies (avoiding economic mismanagement) could turn resource revenues into a blessing.[7] Not surprisingly, economic historians agree that both institutions and policies play an essential role in the economic effect of natural resources.

Second, one must differentiate between resource dependence and resource abundance. Resource abundance relates to a country's natural endowments. Resource dependence relates to a country's dependence on resource revenues (Brunnschweiler & Bulte, 2008).[8] This difference is illustrated in Table 3, which shows the ten most resource-dependent and abundant countries measured by total resource rents. Only half the countries feature in both rankings.[9] Therefore, some resource-abundant countries are not resource-dependent. Likewise, some resource-dependent countries might not necessarily be resource-abundant as a high share of resource rents might indicate a lack of other competitive industries. Empirical studies using resource dependence as a proxy for natural resources generally find a negative effect, while studies using resource abundance as a proxy have more mixed results, often finding a positive effect.[10]

INSERT TABLE 3 HERE

The literature on the contemporary period often applies Dutch disease models that assume natural resources are exogenous and generate windfall profits. Additionally, traditional

[6] Mehlum et al. (2006), Torvik (2009), Mavrotas et al. (2011), Sarmidi et al. (2014). Institutions, however, need not be exogenous, as resource rents in combination with corruption might reduce institutional quality over time. The term "Political Dutch Disease" is often used to describe the negative effects of rent-seeking. Studies have explored how rent-seeking might increase corruption, political conflicts and income inequality. It can also isolate non-democratic regimes and decrease institutional quality (Hodler, 2006; Frankel, 2010; Sala-i-Martin & Subramanian, 2013; Bodea et al., 2016). These mechanisms are, however, outside the scope of the present paper.

[7] Iimi (2007), Ross (2007), Sachs (2007).

[8] There many different ways in which the literature has defined both resource dependence and abundance. Resource dependence measures include primary exports over GDP, rents from natural resources over GDP, share of natural capital in national wealth. Resource abundance measures include total natural capital and mineral resource assets in USD per capita, total resource production per capita in USD per capita subsoil wealth. For examples of usages of these measures see Badeeb et al.(2017 tables 1, 2 and 3).

[9] Obviously, these measures are not independent of each other, as the Spearman Rho correlation is 0.81, whilst the Pearson correlation coefficient is 0.55.

[10] For studies using measures of resource dependence see for instance Sachs & Warner (1995) and Gylfason (2001). Studies that use resource abundance measures include Brunnschweiler & Bulte (2008) and Alexeev & Conrad (2009).

Dutch disease models often assume natural resource sectors exhibit no learning by doing, while the tradable sector does (Corden & Neary, 1982; van Wijnbergen, 1984). An increase in resource rents would, therefore, lead to more labour and capital towards the natural resource sectors, resulting in less production in the tradeable sector and less learning by doing. These models predict that the presence of natural resources can reduce learning by doing, and therefore can lead to less economic growth.

Gavin Wright and co-authors, criticise this line of thinking.[11] Wright is especially critical of the notion of natural resources as exogenous, and that resources affect the economy primarily through rents. Instead, Wright argues that minerals depend on search activity and, therefore, are endogenous. In addition, Wright criticises the often-implicit assumption that the natural resource sectors comprise low-tech industries that exhibit little learning by doing. Instead, Wright claims that the mineral sectors comprise high-tech industries that garner increasing returns. His arguments are based mainly on the historical example of the US (1870-1929), as its mineral sector had much research activity and increased linkages with the manufacturing sectors and that estimated reserves increased with search activity.

For several resource-abundant countries, the evidence suggests these mechanisms were present in the post-1950 period as well. Norway's petroleum sector is a high-tech industry with strong linkages to its supply chain.[12] Australia is another example of resource-led growth in the post-1950 period, with the mineral sector being highly knowledge intensive.[13] Even the US post-1950 provides evidence of how the natural resource sectors have had a crowding-in effect, rather than the crowding-out effect predicted by traditional Dutch disease models at the state level.[14] A more recent Dutch disease model tries to reconcile these observations by allowing a learning effect in the supply industries, moving the model closer to the mechanisms proposed by Gavin Wright (Bjørnland et al., 2019). In short, there is evidence that for some resource-abundant countries, the mechanisms proposed by Wright were present in the post-1950 period, especially for developed countries that had high-quality institutions.

This evidence must be weighed up against the many resource-abundant countries, often developing countries that exhibited low economic growth. Barbier (2007) argues that, in general, natural resources were less important for economic growth in the post-1950 period than in the pre-1914 period. He argues that there are three differences between these periods. First, frontier expansion in the post-1950 period was often in tropical and marginal land, which had

[11] Wright (1990), David & Wright (1997) and Wright & Czelusta (2004).
[12] Engen (2009), Holden (2013), Bjørnland et al. (2019), Ville et al. (2019).
[13] Wright & Czelusta (2004), Ville et al. (2019).
[14] Weber (2012), Gilje et al. (2016), Allcott & Keniston (2017) and Feyrer et al. (2017).

low productivity, leading in turn to the low productivity of the resource sectors. Second, natural resources were traded more in the post-1950 period due to globalisation. This increased trade, in turn, decreased the importance of the locality of natural resources for industrialisation and decreased the rents of natural resources. Finally, as mentioned above, many resource-abundant countries suffered from both institutional and policy failures, which in turn inhibited economic growth.[15] It is therefore plausible that many resource-abundant countries, especially developing ones, lacked the necessary traits to be successful.

Wright and Barbier have increased our knowledge about how natural resources affect economies across periods, but there are still gaps. Both authors have relied on multiple case studies to provide evidence for their arguments, but no empirical models have tested these relationships. In fact, to the best of our knowledge, no study has attempted to measure the economic effect of natural resources across these periods. There is still insufficient differentiation between the effects of resource abundance relative to resource dependence. This paper attempts to make a first step in filling these gaps.

3. Case studies and methodology

To best capture the economic effects of natural resources, this study applies two different approaches. Economic historians have generally used case studies at the sectoral level to examine the effect of natural resources. On the other hand, economists have often applied empirical models relying on cross-country observations at the macro level. This study combines both approaches by utilising a two-step approach that analyses (i) the natural resource sectors at the sectoral level; and (ii) the macroeconomic impact of natural resources.

3.1 A model for the analysis at the sectoral level: Forestry and palm oil

This sectoral analysis focuses on the forestry sector in Finland and Sweden (1860-1910) and the palm oil sector in Indonesia and Malaysia (1970-2016). The reason for choosing forestry and palm oil lies in several comparable characteristics between the sectors. First, under proper management, both sectors produce potentially renewable products. Second, these sectors allow large companies to exploit economies of scale, but are also open for small-scale production. Finally, both sectors allow for potential resource-based manufacturing as wood and palm oil can be used as inputs in various manufacturing sectors. The common characteristics of the sectors allow for a better understanding of how these processes evolve.

[15] The third mechanism is also Wright & Czelusta's (2004) main argument for the failure of many resource-abundant countries in the post-1950 period.

To explore whether similar mechanisms were present in the four countries mentioned above, we apply the model used by Ville et al. (2019). In this model, shown in Figure 1, the enabling sector consists of knowledge-intensive firms and education and research institutions that facilitate innovation in the natural resource industries. The analysis describes how innovation capabilities develop during each phase of the industry life cycle and how public policies affect collaboration between sectors. The model differentiates between three phases;

(i) Establishment: Transferring and using existing capabilities are important in establishing the initial industry and innovation systems. More firms become involved in the production systems as some key functions are outsourced.

(ii) Growth and transformation: As the industry matures, the domestic capabilities are increasingly focused on problem-solving activities. Increasingly supporting industries that support these processes emerges such as the production of capital goods, engineering services, business services, education and research and development institutions.

(iii) Internationalisation: The natural resource firms enter foreign markets through exports and foreign direct investments, and the domestic capability can be utilized across borders.

In our analysis, only the first two phases will be emphasised, as the internationalisation of resource-based firms is beyond the scope of the present paper. This model is in line with the arguments made by Gavin Wright, namely that successful resource-led growth requires that natural resource industries transform into knowledge-intensive production along similar lines as the US in the late 19th century (Wright, 1990; David & Wright, 1997).

INSERT FIGURE 1 HERE

3.2 Macroeconomic level

3.2.1 Empirical model

For each of the four countries, two empirical models are estimated to measure the overall impact of natural resources on economic growth. The first model measures the effect of natural resource dependence, while the second measures the effect of resource abundance.

Before estimating these models, we must first establish whether a long-run relationship exists for the countries in question through co-integration tests. These tests require us to know the level of integration of the relevant variables. We initially test each series through the

Augmented Dickey-Fuller and Phillip-Peron tests using the Akaike Information Criterion (AIC) for lag selection.[16] However, a common criticism of these tests is that they are overpowered in favour of the null hypothesis of non-stationarity. If the series has a structural break, this might lead to a false acceptance of the null hypothesis of non-stationarity. To control for the possibility of a structural break, the analysis is extended by implementing the Zivot & Andrews (2002) test for an endogenous break. In this test, one must choose to test for a break in the intercept, the trend or both; we have chosen to take both for completeness. All variables considered were found to be either I(0) or I(1).[17]

Following the unit root tests, two ARDL models are constructed:

$$\Delta GDP_t = \alpha_0 + \alpha_1 T + \theta_1 GDP_{t-1} + \theta_2 NATSHARE_{t-1} + \boldsymbol{\delta x}_{t-1} + \sum_{i=1}^{p} \gamma_i \, \Delta GDP_{t-i} + \sum_{i=0}^{q} \beta_i \, \Delta NATSHARE_{t-i} + \sum_{i=0}^{r} \emptyset_i' \Delta \boldsymbol{x}_{t-i} + \varepsilon_t \tag{1}$$

$$\Delta GDP_t = \alpha_0 + \alpha_1 T + \theta_1 GDP_{t-1} + \theta_2 NATPROD_{t-1} + \boldsymbol{\delta x}_{t-1} + \sum_{i=1}^{p} \gamma_i \, \Delta GDP_{t-i} + \sum_{i=0}^{q} \beta_i \, \Delta NATPROD_{t-i} + \sum_{i=0}^{r} \emptyset_i' \Delta \boldsymbol{x}_{t-i} + \varepsilon_t \tag{2}$$

where the dependent variable ΔGDP is the change in the natural logarithm of gross domestic product per capita (GDP), in effect economic growth. The main independent variable in model 1 is $NATSHARE$, which measures the value-added of the natural resource sectors as a share of GDP. $NATSHARE$ is the main indicator of resource dependence. The main independent variable in model 2 is $NATPROD$, which measures the natural logarithm of value added of the natural resource sectors per capita.[18] $NATPROD$ is the indicator of resource abundance. The optimal lag structure is determined using the AIC. T is a linear time trend, GDP

[16] The Augmented Dickey-Fuller and the Phillip-Peron tests are standard tests for stationarity. The AIC is commonly used as a selection criteria for models. See for instance Gujarati (2015).
[17] For some variables the different unit root tests gave conflicting results. However, no series was found to be I(2), regardless of the unit root test used.
[18] $NATPROD$ is derived by multiplying the $NATSHARE$ with gross domestic product per capita and then taking the natural logarithm.

is the logarithm of the level of GDP per capita, and $\boldsymbol{x}$ is a vector of control variables. The control variables and the sources of the data are discussed below.

The ARDL representation is in the error-correction form for both models (1) and (2). This means the coefficients for the level variables, θ_1, θ_2 and $\boldsymbol{\delta}$ are the long-run effects, while the coefficient for the first-differences γ_i, β_i and $\emptyset_i'$ represent the short-run effects. For each model, the Bounds test is conducted to test whether a long-run relationship exists. The null hypothesis in the Bounds test is that $\theta_1 = \theta_2 = \boldsymbol{\delta} = 0$, rejecting the null means a long-run relationship exists.[19] The critical values of the F- statistics and t-statistics are derived from Kripfganz & Schneider (2018).

INSERT TABLE 4 HERE

Table 4 shows the results of the Bounds test. To reject the null hypothesis, both the critical F- and t-statistic must exceed the critical value. Sweden was the only country that provided evidence of a long-term relationship. To test whether this long-term relationship was due to natural resources and not the control variables, an additional Bounds test was run with only natural resources, and we failed to reject the null hypothesis for both resource abundance and dependence. These results mean that we did find sufficient evidence of a long-run relationship for Sweden. Therefore, only the short-run effects are estimates, meaning $\theta_1 = \theta_2 = \boldsymbol{\delta}$ are set to zero in both model 1 and 2 for all four countries.

We also check each regression for autocorrelation in the error term, structural breaks and parameter stability. To check for autocorrelation, we use the Breusch-Godfrey test up until five lags, but for the sake of brevity, we only report the p-value for the first lag. The null hypothesis of the Breusch-Godfrey test is that the model has no autocorrelation in the error term. To test for structural breaks, we first use the Quandt-Andrews test for an unknown break date in which the null hypothesis is no structural break in the coefficient β_i showing the effect of natural resources. If a structural break is present, a slope dummy is introduced to take this into account. Finally, we also use the cumulative sum test for parameter stability to test whether the coefficient in each model is stable over time. The null hypothesis is that the parameters are stable. For each regression, the p-value or test statistic for each of these tests is reported.

3.2.2 Data

[19] For the ARDL Bounds test to be valid, the variables can be either I(0) or I(1), but not I(2) (Pesaran et al., 2001).

To measure economic growth, we use the same source for all four countries, namely real GDP per capita in fixed 2011 USD prices from the Maddison Project Database computed by Bolt et al. (2018). To make sure the measurement is consistent with other sources used, the correlation coefficient was computed in each case.[20]

Measuring natural resources in two different periods is difficult, partly because the natural resources in question differ. To overcome this problem, the empirical literature often uses natural resource rents, but this measure is not available for the 19th century.[21] Instead, we use the value-added figures as a proxy for rents. One difference is that domestic rather than world market prices are used. If the goods in question are exported, such a difference is not crucial. Another difference is that the opportunity costs are not included in the value-added figures. Given the uncertainty of the actual size of the opportunity cost, this omission is not considered crucial. The sources used are the U.N. National Accounts for Indonesia and Malaysia, Hjerppe (1989) for Finland and Schön & Krantz (2012). For all four countries, the value-added for the natural resource sectors comprises national account data using ISIC A, B and C.[22] The value-added share of GDP for all the countries are shown in figure 2 below. Structural change appears to have faster in Indonesia and Malaysia, something the comparison in section 6 will comment upon further.

INSERT FIGURE 2 HERE

The three control variables used in the empirical models are standard in the literature. The control variables are government consumption, investment and trade (export plus imports), all as a share of GDP.[23] The control variables chosen had to be comparable across time, which limited the variables available. The source of the data for the control variables is the same as for the value-added data.

4. Finland and Sweden 1860-1910

4.1 Forestry at the sectoral level

[20] The Pearson correlation coefficient between the Maddison data was 99.96 per cent for Finland (using Hjerppe, 1989 figures for GDP per capita), 97.46 per cent for Sweden (using Schön & Krantz, 2012 figures for GDP per capita), 99.76 per cent for Indonesia and 99.96 per cent for Malaysia (using the United Nations National Accounts, 2020).

[21] Lindmark and Acar (2013) did construct rent data for Sweden 1850-200, but we do not have similar data for Finland.

[22] ISIC A, B and C comprise agriculture, hunting, forestry, fishing and mining.

[23] For similar control variables see Alexeev & Conrad (2009) and Bjorvatn & Farzanegan (2013). One control variable not included in the study was an institutional indicator, which would be natural given the literature on the resource curse. However, few indicators on institutions cover both periods, meaning that a meaningful comparison cannot be made. The few indicators that do cover both periods, for instance the Polity IV indicator for democracy, have little variation over time, meaning that little information can be derived using time-series techniques.

The forestry sector, though present in both Finland and Sweden for many centuries, first became important in promoting modern economic growth in the 19th century. This change happened earlier in Sweden as the increase in economic growth in the 1850s coincided with a large increase in timber exports. Finland did not see a similar increase before the 1890s, with growth being short-lived, given the turbulent times following 1914.

Sweden's growth in the forestry and related sectors is illustrated in Figure 3. The value-added per capita for forestry increased steadily until the end of the 19th century before supply shortages meant value-added fell. In wood manufacturing, i.e. manufacturing sectors that use wood as a major input for such commodities as furniture and paper, there was a steady increase in the value-added per capita, apart from the 1875-1885 period, which coincided with the long depression.

INSERT FIGURE 3 HERE

INSERT FIGURE 4 HERE

Finnish growth is illustrated in Figure 4. Forestry per capita value-added was stagnant until the end of the 1880s, but has since experienced an increasing trend. The same is true for wood manufactures, which have experienced an even more dramatic increase since the 1890s.

4.1.1 Phase 1: Forestry sector's initial high growth

There were several favourable international conditions for the forestry sector in the 1850s. These included (i) An increase in wood prices as British demand increased; (ii) Decreasing British trade barriers; and (iii) Supply problems in the Norwegian forestry sector.[24] Sweden was able to benefit from these conditions, while Finland did not. The main difference between Finland and Sweden lay in their institutional set-up and economic policies.

First, institutional reforms that were important for economic growth were conducted earlier in Sweden than in Finland. Sweden had implemented these institutional reforms in the first decades of the 19th century.[25] Among them was the strengthening of property rights to

[24] Söderlund (1953), Björklund (1984).

[25] The key difference between Finland and Sweden were the institutional reforms in the first half of the 19th century, and was most likely a key factor in determining the differences in resource-led growth. While Swedish institutions increasingly became more market-oriented, Finland retained many mercantile institutions up until the mid-19th century. One example is the development of the financial system, which came earlier in Sweden, and played an important role in financing the forestry and related industries following 1870. For the emergence of the Swedish banking sector, see for instance Sandberg (1978) and Adams et al. (2005); and for the emergence of the Finnish banking sector, see for instance Palo (2004). The Finnish Diet did

forests by transferring these rights to farmers during the 1820s (Söderlund, 1951). In contrast to Sweden, Finnish property rights were still weak in the 1850s. The consequence was that Finnish forests in practice were open-access forests, which led to some common problems, such as a lack of incentive to promote the long-term economic value of forests.[26] This lag in institutional reforms naturally contributed to the lower growth in Finland.

Second, Swedish economic policy started to abolish restrictions on the sawmill industry earlier than in Finland.[27] In 1841, the export tax on sawn timber was abolished, and in 1842, the start-up privileges of sawmills were also abolished (Söderlund, 1951; Schön, 2000). These abolitions gave way to near unrestricted exploitation of forests for the sawmill industry. In Finland, however, these restrictions had stayed in place following the Finnish annexation into the Russian empire in 1809.[28] Attempts to ease restrictions proved difficult (Söderlund, 1951; Kaukiainen, 2006). The Forestry Act of 1851 continued to put restrictions on sawmills, including yearly production quotas and a ban on steam-powered sawmills (Michelsen, 1995). The rationale behind continued restrictions was a general scepticism toward the sawmill industry and a fear of deforestation. These restrictions were only gradually lifted in the late 1850s and early 1860s; for instance, the ban on steam-power sawmills was lifted in 1858. However, the establishment of sawmills still required an application to the Senate for official permission (Michelsen, 1995). The earlier removal of the restrictions in Sweden gave it an advantage over Finland.

In contrast to Finland, Sweden experienced earlier technological improvements that increased its existing capabilities, partly as a consequence of its institutions and policies. One of the most important advances was the introduction of steam-powered sawmills (Söderlund, 1951; Bergman, 2010). This technological improvement allowed for increased productivity, which was important for the initial expansion of Swedish exports. Such improvements in technology also happened in Finland, but not before the 1880s. The first large steam-powered sawmills were not constructed before the early 1870s (Hjerppe, 1989).

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not meet in the first half of the 19th century, and first started to assemble from the 1860s and onwards (Ojala and Karonen, 2006 p.103). The lack of an active political body meant that reforms were not enacted before.

[26] The lack of property rights was especially prevalent in Eastern, Western and Northern Finland (Michelsen, 1995; Palo et al., 1999). By 1900, the demarcation of property rights was mostly completed (Palo et al., 1999).

[27] Swedish restrictions on forestry had existed since the 18th century. These restrictions were in place to protect the mining industry. However, the invention of the Bessemer process in the early 19th century led to the abolition of restrictions on the use of forests, as access to forests was less important for the mining industry. The Bessemer process allowed for the production of steel without the use of wood, meaning the forests were no longer of strategic importance to the Swedish mining industry.

[28] The Russian emperor allowed the Finns semi-autonomous rule, and the Swedish laws simply remained in effect during a transition period into the Russian empire that lasted until the mid-19th century. As Finland had few mines, these restrictions were largely redundant.

4.1.2 Phase 2: Expansion of the forestry sector

The Swedish forestry sector and its related industries did experience expansion through the increase in domestic capabilities over time. This mechanism is in line with Ville et al.'s (2019) model. Industrialised forestry, which aimed to maintain a sustainable high yield, was a priority for leading members within the industry. This was achieved partly through a strong connection between the forestry sector, research and educational institutions. For instance, the first forestry college was established as early as 1830, and technical colleges were established in four cities (Malmö, Borås, Örebro and Norrköping) during the 1850s (Ahlström, 1992). In addition, a modern state forestry administration was in place in 1838 (Palo, 2005).[29] The Swedish forestry sector experienced increased technological advancement and increased economies of scale over time.

Ahlström (1992, 1993) argues that by the middle of the 19th century, a network already existed among technical institutions, industry and the government, and this contributed significantly to the success of Swedish industrialisation. The networks were of central importance for the development of industry, especially after the 1880s, when products became more differentiated and higher value-added products became increasingly more important (Blomstrom & Kokko, 2007). One example is the growth of pulp and paper production and exports for which the production technology required is more research-intensive than for sawmilling.[30] Whilst the growth of the Swedish paper industry was generally high in the second half of the 19th century; this growth increased even further after 1890.[31]

Two other features were important in the expansion of the Swedish forestry sector. The first was the increased maturity of the industry as the market structure evolved from many producers towards a more oligopolistic structure (Glete, 1989). This transformation was partly a response to a crisis in the 1870s. Companies increasingly owned the entire value chain, leading to increased economies of scale and more efficient production of the higher value-added products.

A second important feature was the high degree of state support for the Swedish forestry sector. One example is how the Swedish state pursued an active industrial policy to promote the pulp and paper industry, which started to emerge in the 1850s in Southern Sweden. These ventures generally proved unprofitable, even as late as the 1890s and therefore needed state

[29] In addition, a number of vocational training schools were set up in the country, and the number grew from 35 at the end of the 19th century to 66 in 1908-09 Ahlström (1992, p.7).

[30] The first chemical pulp mills were established in the 1870s, and by 1913 Sweden was the largest pulp exporter in the world (Blomstrom & Kokko, 2007).

[31] Järvinen et al. (2012).

support (Glete, 1989). One method of promoting higher value-added production was the imposition of high tariffs on the import of high value-added products in which wood was a major input (Bohlin, 2005). This protection led to higher profits, which led to increased investment and expansion of production in wood manufacturing and the paper industry in Sweden.

These features were less present in Finland prior to 1890. Michelsen (1995) has written at length about the problems facing not only the sawmill sector but also state institutions that attempted to support the forestry industry. The State Forestry Board was responsible for establishing a professional set of foresters to oversee and administer the forests but, for the most part, the Forestry Board was on the receiving end of critics opposing a professional forest administration (Palo, 2005). The Evo Forestry Institute was established in 1858 to be a source of forestry education and research, but because of a lack of funding and lack of political support, it was not able to fill any effective role before the 1880s. Nykänen (2018) provides a broad overview of other research and training efforts made in the Finnish forestry industry during this period, including the establishment of various technical schools. Despite attempts to establish a network similar to that which prevailed in Sweden, efforts in Finland largely failed before 1890.

After 1890, the Finnish forestry sector started to expand more rapidly. One example is the increased growth in the Finnish paper industry which experienced a more than ten-fold increase in production of both pulp and paper from 1890 to 1913.[32] This expansion was interrupted by subsequent wars. The true expansion of the Finnish forestry sector started after 1918, taking on a crucial role for the Finnish economy.[33] The development path resembles that of Sweden, with an increased focus on research and training.[34]

4.2 Macro level impact of natural resources in Finland and Sweden

Table 4 shows the results of the two empirical models for all natural resources. The short-run effect of natural resources is relatively similar in both countries. Resource dependence and abundance are both found to have a positive short-run effect on economic growth. These effects are found to be statistically significant at the one per cent level.

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[32] Järvinen et al. (2012).
[33] Skippari et al. (2005), Lamberg & Ojala (2006) and Järvinen et al. (2012).
[34] Palo et al. (1999), Palo (2005) and Nykänen (2018)

INSERT TABLE 5 HERE

These findings support the general perception among economic historians that natural resources, measured as dependence or abundance, made a positive contribution to economic growth in both countries. At the same time, however, this evidence is seemingly at odds with macroeconomic studies on the relationship between resource dependence and economic growth for the post-1970 period, indicating that a difference might exist.[35] The results concerning the effect of resource abundance is more in line with the results on the contemporary period.[36]

5. Indonesia and Malaysia 1970-2015

5.1 Palm oil at the sectoral level

Indonesia and Malaysia have both been producing palm oil since colonial times, but the modern palm oil sector first started emerging in Malaysia in the early 1960s.[37] Figure 4 shows palm oil production and exports in both countries, and it is clear that the initial expansion was far larger in Malaysia than in Indonesia. Malaysia was the leading palm oil exporter for nearly 40 years, and at its peak it produced 70 per cent of all palm oil exports. Since the mid-1980s, both production and exports have expanded more rapidly in Indonesia, which eventually overtook Malaysia as the major palm oil producer and exporter in the 2000s.

INSERT FIGURE 5 HERE

The expansion of palm oil came from a general growing demand for oils and fats. Table 5 shows that from 1965 to 2015, the overall trade in oils and fats increased more than 17-fold. During the same period, palm oil became the dominant oil, increasing its share from 11.8 per cent in 1965 to 52.5 per cent in 2015.

INSERT TABLE 6 HERE

5.1.1 Phase 1: Palm oil initial high growth

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[35] Sachs & Warner (1995) and Gylfason (2001).
[36] Brunnschweiler & Bulte (2008) and Alexeev & Conrad (2009).
[37] The palm oil tree was imported from its indigenous West Africa, and the first commercial production was in 1911 for Indonesia and from 1917 in Malaysia (Moll, 1987).

Increased international demand was important for palm oil, and both Indonesia and Malaysia had two other advantages as well. First was the climatic and soil conditions, which are highly favourable for palm oil cultivation (Moll, 1987). Second, was the vast land resources available for increasing production. The reason why Malaysia's palm oil sector was initially more successful than Indonesia's lay in three key differences.

First, Malaysia started to encourage palm oil exports much earlier than Indonesia. Malaysia changed its policy towards the palm oil sector from import substitution to export promotion in 1968 with the Investment Incentives Act. Malaysia's main resource exports up until the 1960s had been natural rubber and tin, both of which faced decreasing demand. Palm oil became one of the promising new sectors that were promoted to increase export diversification. One of the main advantages for palm oil was that there already was an existing plantation structure for natural rubber, which easily could be converted to palm oil (Moll, 1987). In Indonesia, the focus on import substitution remained far longer. Private firms were not allowed to export crude palm oil before 1991. Malaysia's encouragement of palm oil exports, therefore, preceded Indonesia by over two decades.

Second, while Malaysia encouraged private ownership of palm oil plantations, Indonesia only started following suite in the late 1980s. The expansion of Malaysian exports, first from crude and later processed palm oil, was driven mainly by large private firms. Most of the production expansion came from these large palm oil plantations, which had considerable economies of scale.[38] In Indonesia, large, privately owned estates were discouraged before 1988. In fact, from 1968 to 1988, growth in palm oil production came primarily from state-owned plantations (Rasiah & Shahrin, 2006). Following a transition phase, private plantations were supported from 1995 onwards following deregulation and privatisation to increase private sector investments and allow for foreign direct investment. The rapid expansion in Indonesian palm oil exports once private plantations were allowed in 1988 strengthens the argument that Malaysia's private plantations were a vital contributor to the country's palm oil expansion after the 1960s.

Finally, several technological breakthroughs in Malaysia allowed the country to get a vital head start. Malaysia invested heavily in palm oil research and development from the 1960s onwards. In 1962, the Oil Palm Genetics Laboratory had been established to increase research and development (Kajisa et al., 1997). The Malaysian Department of Agriculture also launched a research exchange programme with West Africa (Gopal, 2001). These efforts led to several

[38] Government-owned plantations did exist. The FELDA programme granted land to landless people.

technological improvements, with the introduction of new species as one of the most important outcomes. The DxP variety was introduced in the late 1960s and 1970s and quickly replaced less efficient palm oil species. As a consequence, the palm oil yield (in metric tonnes per hectare) increased dramatically from 1950 to 1970 as research increased. [39] In Indonesia, there were no similar investments in research.

5.1.2 Phase 2: Expansion of the palm oil sector

The Malaysian palm oil sector and its related industries increased its domestic capabilities over time, not unlike the Swedish forestry sector. Again, the model by Ville et al. (2019) fits this process adequately. One manner in which capabilities increased was through the sector's strong connections with public research institutions (Gopal, 2001; Rasiah, 2006). We have already mentioned the importance of new plant species during the initial phase. After the 1960s, public palm oil research increased gradually. In 1969 the Malaysian Agriculture Research and Development Institute was established, followed by the Palm Oil Research Institute of Malaysia (PORIM) in 1979. Much research was also conducted through large private palm oil companies, often in co-operation with government agencies. Like the Swedish forestry sector, the palm oil sector experienced technological advancements and increased economies of scale over time.

The palm oil sector became part of a network linking the industry, research institutions and the government. This network led to the development of new technologies and higher value-added products.[40] From 1976, the government promoted the local processing of crude palm oil through refineries into the higher value-added processed palm oil. From the mid-1980s onwards several downstream linkages were promoted for oleochemicals, speciality fats and palm kernel oil. The government's emphasis was to increase the integration of value chains and complementary products (Rasiah, 2006). The development of the network was crucial for the growth path of the palm oil industry over time.

One crucial factor that needs emphasising is the huge role of the state in the Malaysian palm oil sector, even when disregarding the abovementioned features. The state also initiated a transfer of ownership from foreign-owned to domestically owned plantations in the 1970s.[41] In

[39] Bruno (2017, p.37) indicates that the yearly yield of crude palm oil per hectare increased from 1.43 metric tonnes in 1950 to 3.05 metric tonnes in 1970.

[40] Rasiah (2006), on the basis of interviews with 50 palm oil companies, concludes that the role of PORIM was critical in training and encouraged new-product development.

[41] In 1968, non-Malaysians controlled 78.2 per cent of all plantation land (Bruno 2017, p.10). Foreign- owned plantations disagreed with the government policies of promoting Malaysian refineries, preferring instead to have the oil processed in Europe. By 1983, non-Malaysians owned only 8.6 per cent of all planted plantation land. The state purchased most of the foreign-owned palm oil plantations to increase the equity share of indigenous ownership (Pletcher, 1991, pp.630–631). Among

addition, the state-supported the palm oil industry through tax and export incentives, which were crucial for the investment decisions made by palm oil companies (Gopal, 2001). Finally, the state also provided several supporting institutions (Rasiah, 2006). One example is the Palm Oil Regulatory and Licensing Association (PORLA), which was responsible for setting quality standards for the oil exported.[42] Another example is the Malaysian Palm Oil Promotion Council, a registered private company owned by the government, which was responsible for promoting market expansion, including market penetration in new export markets. In sum, the role of the state has been an essential aspect of the growth of the Malaysian palm oil sector.

Indonesia, with its abundance of labour and land, has developed as a low-cost producer rather than the industry's technological leader. In part, this has been caused by a lack of policies designed to promote private sector agricultural research (Rasiah & Shahrin, 2006). In addition, Indonesian institutional support and the strengths of the networks are not considered as strong as they are in Malaysia. For instance, the Indonesian counterpart to PORIM is the Indonesian Oil Palm Research Institute, which is a non-profit research institute funded by the government. The institute has weak and fragmented connections with private palm oil plantations (Fuglie, 1999). However, there are signs that the Indonesian palm oil sector has recently expanded its range of downstream products as in Malaysia (Santosa, 2008). In all, the palm sector in Indonesia has thus far lacked a network and industrial policy as strong as those in Malaysia.

5.2 Macro level impact of natural resources in Indonesia and Malaysia

Table 6 shows the macroeconomic analysis of the impact of natural resources by running models 1 and 2 for Indonesia. Before interpreting these results, it is important to remember that the natural resource variable includes all natural resources, and not just palm oil. For both Indonesia and Malaysia, petroleum has been an important export commodity. The differences in how these two countries have handled petroleum mirrors the development in palm oil, with Malaysia being more successful in establishing a state-owned oil company than Indonesia.[43]

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the most well known examples are the takeovers of Sime Darby in 1976 and Guthrie in 1981 (Martin, 2005, p.255). Although the takeovers were not achieved through expropriation, they were still aggressive.

[42] In 1998, PORLA merged with PORIM to form the Malaysian Palm Oil Board.

[43] Malaysia established the state-owned oil company, Petronas, in 1974. Since its establishment, Petronas has expanded into upstream activities as well as some downstream projects. From the 1990s onwards, the company became an important international oil company, with overseas operations in 35 countries. The company also invested in shipping and became the world's largest single owner-operator of LNG vessels (von der Mehden & Troner, 2007). Petronas' growing market share and ability to enter new markets gave the company a reputation of being a relatively efficient oil company. Indonesia established its state-owned company, Pertamina, in 1968. However, Pertamina experienced little technological learning from foreign companies, resulting in high exploration costs for oil. Following the transition to democracy in 1998, Pertamina lost its monopoly power in upstream activities in the domestic Indonesian market. Since the company lacked a competitive environment prior to 1998, it was unable to compete with foreign competitors coming into the Indonesian market, among them Petronas. The low efficiency and, thus, lack of competiveness has resulted in decreasing market shares and political influence

INSERT TABLE 7 HERE

The results for resource dependence show little evidence of any short- or long-term relationship with economic growth. For Indonesia, resource dependence was only significant at the 10 per cent level, and the slope dummy was negative and statistically significant at the 1 per cent level. These results can be explained by the fact that both countries had a high economic growth rate and increased industrialisation during this time, meaning that the share of natural resource production was decreasing. These results support the argument presented by Barbier (2007) that successful resource-led growth requires diversification over time.

The results indicate that resource abundance had a positive short-term impact, even though the Bounds test rejected any long-term impact on economic growth. These results are mostly in line with previous research on the effect of resource abundance. However, they do contradict Isham et al. (2005) who claim that point resources (oil, minerals and plantation crops) are the cause of the resource curse, rather than diffuse resources (agriculture and forestry). In both Indonesia and Malaysia, petroleum and palm oil, a plantation crop, are the most dominant resource exports, and these economies have still managed high economic growth.[44]

6. Discussion and concluding remarks

Based on the results from the previous sections, some features are the same for both periods. First, and the least surprising, it is that the initial lag of the Finnish forestry sector (relative to Sweden), and the Indonesian palm oil sector (relative to Malaysia) lay primarily in the lack of supporting institutions and policy restrictions. This argument is supported by the fact that once institutions became increasingly supportive and the policy restrictions were lessened, growth in Finland and Indonesia improved. A second common feature is the importance of research and innovation in the Swedish forestry and Malaysian palm oil sector, as the processes in these sectors are more similar than dissimilar. Both sectors, within their respective periods, developed downstream and complementary industries and were able to establish strong networks. A final common feature worth noting is that resource abundance in all four countries had a positive short-term impact on economic growth. The size of the coefficient is difficult to compare directly between periods, but the empirical models indicate similar positive effects. In all, most

(Hertzmark, 2007). Pertamina is an example of how excessive protection and a lack of incentives for technological upgrading can hurt a company long-term when the economic environment changes.

[44] In fact, Isham et al. (2005 p.164) wrongly characterize Malaysia has having diffuse, rather than point resources.

of these findings are in line with the arguments made by Wright & Czelusta (2004), in that successful resource sectors emphasise technological upgrading, are research-intensive and develop linkages to other sectors.

One important difference between the periods is that state involvement in the Malaysian palm oil sector was far more extensive than for the Swedish forestry sector. This difference might be explained through the concept of ‘economic backwardness’ proposed by Alexander Gerschenkron (1962). He argued that more backward economies might need to rely more heavily on public investments, and Malaysia in 1970 was more backward (relative to the US) than Sweden in 1860 (relative to the UK). Another potential explanation might be that the barriers to entry in the international market were higher in the 20th century (Cramer, 1999). One example is the entry-barriers erected by already existing resource-based firms from developed economies that dominated production and marketing chains. To overcome these entry barriers, some development economists argue that industrial policies in the form of infant industry protection were necessary (Chang, 2002). A final potential explanation is that the *zeitgeist* was different. The middle of the 19th century was a period of liberal economic policies and *laissez-faire*, while the period 1950-1980 had a greater acceptance of state-led development, especially in developing countries. It is difficult to determine the exact cause of the difference without broadening the scope of the study and exploring more countries.

Another important difference between the periods was that resource dependence had a positive short-run impact on economic growth in the late 19th century, but not for the late 20th century. These results, coupled with the results for resource abundance, suggest that natural resources were more important for economic growth in the late 19th century than the late 20th century. While this study only reviewed four case studies, the lack of a positive correlation between natural resource dependence and economic growth is supported by the resource curse literature in general. These results also seemingly match the conclusion of Barbier (2007) that natural resources were less important for economic growth in the post-1950 period.

Barbier's (2007) arguments as to why the periods differ, however, do not match what happened in Indonesia and Malaysia. Barbier (2007) claimed that as the frontier expansion was mainly in tropical areas, the land was of lesser quality than that in temperate areas. In the particular case of palm oil, this argument is simply untrue; the success of the industry was because of, not despite, the expansion in tropical areas. Another argument by Barbier (2007) was that policy and institutions failures were to blame for why many resource-abundant countries failed to achieve growth in the post-1950 period. This argument is probably true; however, it is not clear why the argument applies only to the post-1950 period, as the policy and institutions argument is equally applicable to the pre-1914 period, as the case of Finland illustrated. While Barbier's conclusion might be correct, the exact mechanisms to explain the difference in the effect of the natural resources are less straightforward.

Other differences between the periods might yield equally plausible explanations; we can briefly mention three of these although the list is far from exhaustive. The first is the structure of world trade. Primary exports constituted a larger share and were more stable in the 1860-1910 period than the 1970-2016 period.[45] Greater export potential in natural resource trade might have been a key factor in explaining why natural resources might have been a more significant contributor to economic growth in the late 19th century. The second difference is the level of technology, which was more advanced in the late 20th century. The potential for learning and catching up, especially in the manufacturing sectors, was higher in the later period. From the 1980s onwards, both Indonesia and Malaysia started to promote export-oriented foreign direct investment in non-resource-based manufacturing.[46] This process led to larger structural changes in a similar time-span in 20th century Indonesia and Malaysia, than in 19th century Finland and Sweden, see Figure 2. Finally, the monetary regimes in the two periods consider vary greatly as the period from the late 19th century until the outbreak of World War I was marked by the Gold Standard, and thereby fixed exchange rates. The period from 1973 onwards was instead marked by flexible exchange rates. Determining whether these differences are the cause of a potential changing effect of natural resources requires more study, as we cannot determine this based on the four case studies explored alone.

In conclusion, this paper has asked whether natural resources had a different economic impact in the 1860-1910 period relative to the 1970-2016 period. Based on two case studies from each period, the answer is both 'yes' and 'no'.

In absolute terms, there were few differences between the periods. Natural resource sectors did make a positive contribution to economic growth in all four cases. In addition, the most successful natural resource sectors showed signs of being dynamic sectors with a heavy emphasis on research, innovation and increased linkages. These findings are in line with the claims by Wright & Czelusta (2004) that natural resource sectors still contributed to economic growth in the post-1950 period.

In relative terms, however, the differences between periods grow larger. In the 1860-1910 period, resource dependence correlated positively with economic growth for both Finland

[45] The average share of primary products as a share of world merchandise exports for the 1870-1910 period was 62 per cent, only dropping by 3 per cent from 1860 to 1910 (Federico & Tena-Junguito, 2016). The corresponding primary product share for the 1970-2016 period was an average 31 per cent, dropping by more than 10 per cent from 1970 to 2016 (WDI, 2020).

[46] Hill (2000); Felker et al. (2013).

and Sweden in the short-run. In the 1970-2016 period, we find no evidence of a similar positive correlation. These results are in line with the main findings of the resource curse literature, showing no positive correlation between resource dependence (through different measures) and economic growth for the post-1970 period. This conclusion supports the claims made by Barbier (2007) in that the contribution of natural resources to economic growth was less for the post-1950 period than the pre-1914 period, even though the reasons for this require further study.

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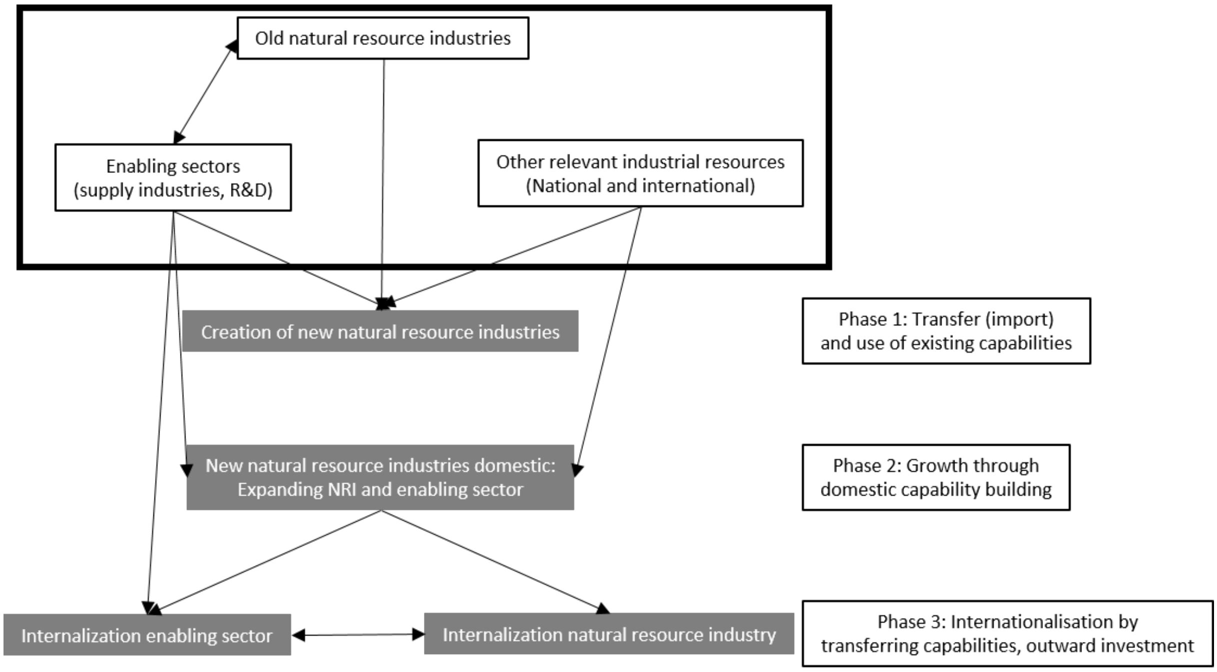

Figure 1. Model of dynamic evolution in natural resource industries.

Source: Ville et al. (2019 p.94)

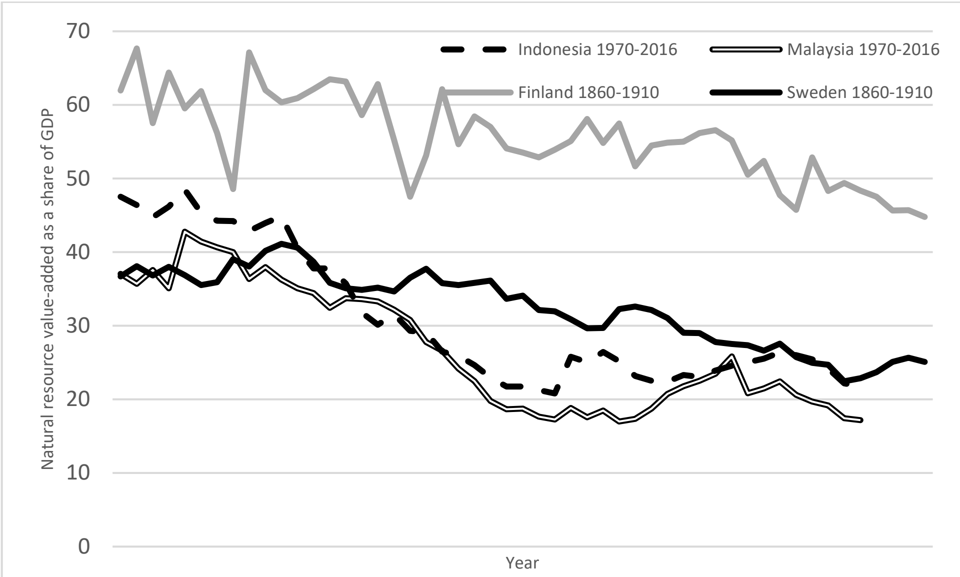

Figure 2: Finland, Indonesia, Malaysia and Sweden Natural resource value-added as a share of GDP

Source: Hjerppe (1989), Schön & Krantz (2012) and U.N. National Accounts (2020)

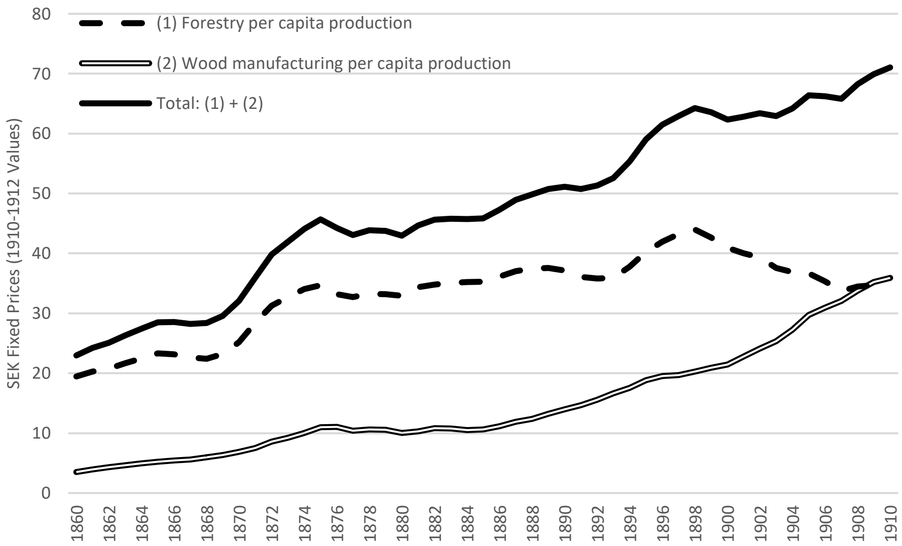

Figure 3: Sweden Forestry and Wood Manufacturing Value-Added per Capita (SEK 1910-1912) 1860-1910 (Five-Year Moving Average)

Source: Own calculations based on Edvinsson (2005) and Smits *et al.* (2009)

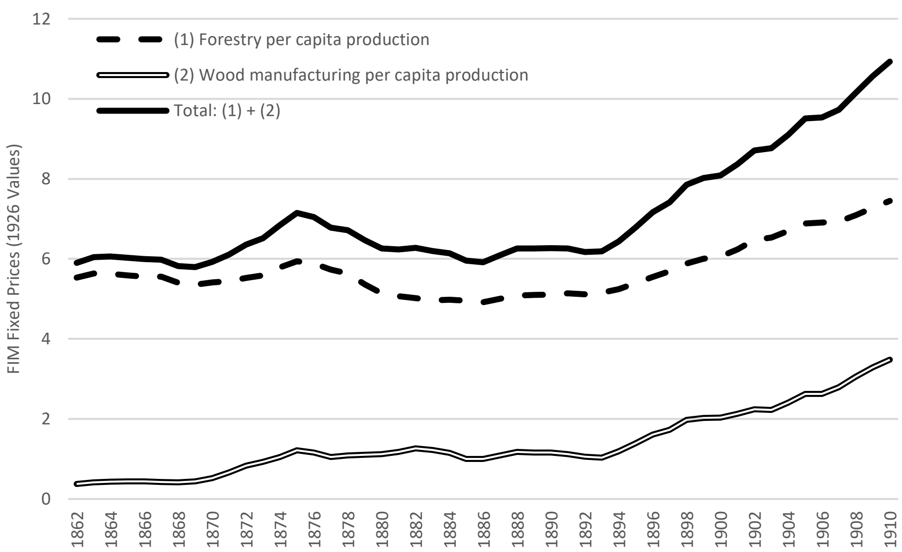

Figure 4: Finland Forestry and Wood Manufacturing Value-Added per Capita (1926 FIM prices) 1862-1910 (Five-Year Moving Average)

Source: Own calculations based on Hjerppe (1996) and Smits *et al.* (2009)

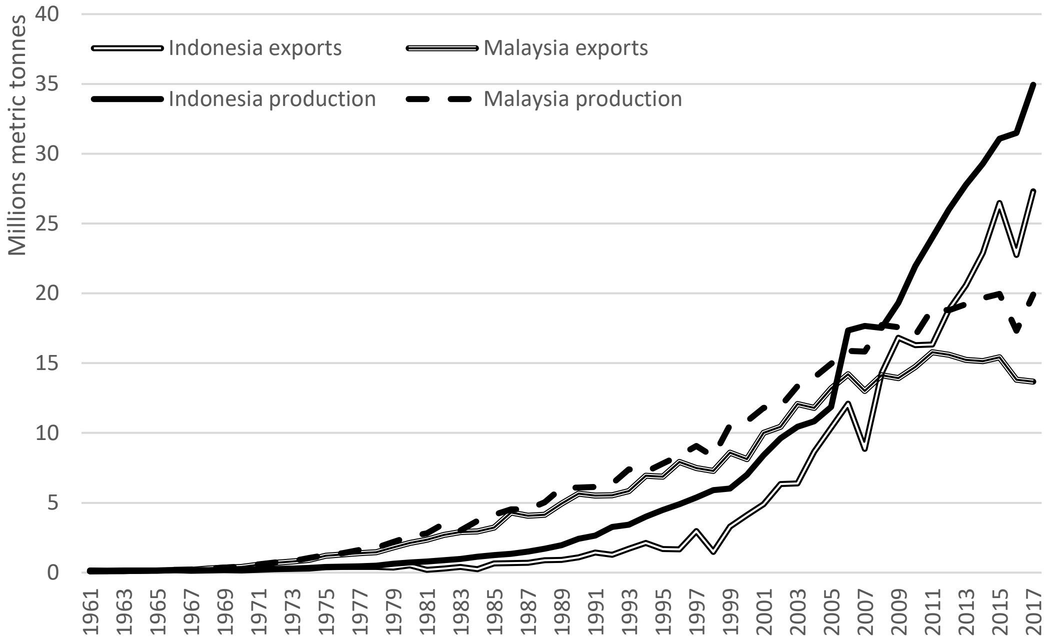

Figure 5: Pam oil production and exports in million metric tonnes for Indonesia and Malaysia 1961-2017

Source: FAOSTAT (2020)

Table 1. Economic growth and share of leading country's GDP per capita

	Finland 1860-1910	Sweden 1860-1910	Indonesia 1970-2016	Malaysia 1970-2016
Annual growth GDP per capita	1.39 %	1.48 %	3.68 %	3.96 %
Annual growth world GDP per capita	1.28 %	1.28 %	1.65 %	1.65 %

	Finland 1860	Sweden 1860	Indonesia 1970	Malaysia 1970
Share of UK GDP per capita	31 %	49 %		
Share of US GDP per capita			6 %	15 %

Note: All GDP figures are based on real GDP per capita in 2011US$ (Maddison Project Database, version 2018)
To calculate the annual growth of world GDP, only the countries with observations the entire period were included
In 1860 the leading country was the UK and in 1970 the leading country was the USA

Table 2. Export structure

Wood-intensive exports as a share of total merchandise exports			
	1870	1890	1910
Finland	34.3 %	49.6 %	73.4 %
Sweden	39.4 %	49.9 %	50.1 %

Resource-intensive exports as a share of total merchandise exports			
	1980	2000	2015
Indonesia	97.6 %	43.3 %	55.9 %
Malaysia	81.0 %	18.9 %	33.3 %

Note: Wood-intensive exports defined as exports from the forestry, wood industry or paper industry. Data on Finland from Hjerppe (1996) and on Sweden from Statistics Sweden (1972). Resource-intensive exports follows the Mayer and Wood (2001) definition of resource-intensive exports with data on both Indonesia and Malaysia from COMTRADE (2020)

Table 3. Resource dependence relative to resource abundance

Resource dependence 2000-2015			Resource abundance 2000-2015		
Rank	**Country**	**Rents (% of GDP)**	**Rank**	**Country**	**Rents per capita (2010 US$)**
1	Libya	51	1	Qatar	22,687
2	Iraq	50	2	Kuwait	20,783
3	Kuwait	50	3	UAE	10,593
4	Turkmenistan	50	4	Brunei	9,909
5	Congo, Rep.	47	5	Norway	8,404
6	Eq. Guinea	45	6	Saudi Arabia	8,342
7	Saudi Arabia	43	7	Oman	7,408
8	Oman	41	8	Eq. Guinea	7,083
9	Timor-Leste	38	9	Libya	4,923
10	Angola	37	10	Australia	3,304

Note: Rents are measured as the total natural resources rents (% of GDP), and rents per capita are calculated by multiplying these figures by GDP per capita (constant 2010 US$). All figures are averages for the 2000-2015 period. Source: WDI (2020)

Table 4. Results ARDL Bounds test

Model 1: Resource dependence on economic growth								
Country	**Finland**		**Sweden**		**Indonesia**		**Malaysia**	
Period	**1860-1910**		**1860-1910**		**1970-2016**		**1970-2016**	
F-statistic	23.255***	1.226	4.131	9.473***	2.264	5.342**	4.622	2.617
t-statistic	-3.273	-1.510	-2.638	-5.483***	-2.128	-1.740	-2.980	-3.505
Linear trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control var.	No	Yes	No	Yes	No	Yes	No	Yes
Model 2: Resource abundance on economic growth								
Country	**Finland**		**Sweden**		**Indonesia**		**Malaysia**	
Period	**1860-1910**		**1860-1910**		**1970-2016**		**1970-2016**	
F-statistic	5.948	1.113	3.442	6.994***	1.881	5.505**	4.095	2.434
t-statistic	-2.236	-1.434	-2.572	-4.974***	-1.926	-1.848	-2.829	-3.341
Linear trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control var.	No	Yes	No	Yes	No	Yes	No	Yes

Note: ***, ** and * indicate that the null hypothesis is rejected at the 1%, 5% and 10% levels, respectively. The Bounds test was conducted both with and without a linear trend and control variables; only the results with control variables are shown for the sake of brevity.

Table 5. Results for Finland and Sweden

	Finland Model 1 ΔGDP_t	Finland Model 2 ΔGDP_t	Sweden Model 1 ΔGDP_t	Sweden Model 2 ΔGDP_t
Short-run effects				
ΔGDP_{t-1}	0.0317	0.0671	0.0956	0.113
	(0.22)	(0.74)	(0.65)	(1.59)
$\Delta NATSHARE_t$	0.00570***		0.00361***	
	(3.48)		(2.77)	
$\Delta NATPROD_t$		0.386***		0.485***
		(9.37)		(8.27)
Observation	49	49	49	49
R-squared	0.587	0.808	0.562	0.833
Adjusted R-squared	0.528	0.780	0.499	0.805
Structural break	None	None	None	None
Cusum test statistic	0.4589	0.4834	0.5591	0.6405
Breusch-Godfrey AR(1) p-value	0.5990	0.9832	0.6635	0.1404

Notes: ***, ** and * indicate that the null hypothesis is rejected at the 1%, 5% and 10% levels, respectively. The t-statistic for each slope coefficient is reported with the t-values being White. The results for the control variables and the constant term are not shown for the sake of brevity.

Table 6. World export quantity and relative shares of major vegetable oils for 1965, 1990 and 2015

	1965		1990		2015	
	Tonnes (1000s)	Share	Tonnes (1000s)	Share	Tonnes (1000s)	Share
Coconut oil	460	8.8 %	1,656	6.9 %	2,195	2.4 %
Cottonseed oil	353	6.7 %	309	1.3 %	162	0.2 %
Groundnut oil	429	8.2 %	348	1.5 %	262	0.3 %
Linseed oil	303	5.8 %	219	0.9 %	185	0.2 %
Palm oil	618	11.8 %	8,072	33.7 %	47,233	52.5 %
Rapeseed oil	95	1.8 %	1,969	8.2 %	7,484	8.3 %
Soybean oil	691	13.2 %	3,739	15.6 %	12,785	14.2 %
Sunflower oil	316	6.0 %	2,651	11.1 %	9,373	10.4 %
Other	506	9.7 %	2,333	9.8 %	7,321	8.1 %
Total vegetable oils	3,771	72.0 %	21,295	89.0 %	87,001	96.8 %
Total animal oils	1,466	28.0 %	2,628	11.0 %	2,922	3.2 %
Total oils and fat	5,236	100 %	23,923	100 %	89,924	100 %

Note: The export quantity is in metric tonnes, and the shares are calculated based on total oils and fat that year. The category “Other” is the sum of all vegetable oils that did not have a share higher than 5% in any of the years reported.

Source: FAOSTAT (2020)

Table 7. Results for Indonesia and Malaysia

	Indonesia Model 1 ΔGDP_t	Indonesia Model 2 ΔGDP_t	Malaysia Model 1 ΔGDP_t	Malaysia Model 2 ΔGDP_t
Short-run effects				
ΔGDP_{t-1}	0.194	0.379***	-0.209*	-0.225*
	(1.46)	(3.61)	(-1.86)	(-1.93)
$\Delta NATSHARE_t$	0.0114*		-0.00100	
	(1.78)		(-0.74)	
$\Delta NATPROD_t$		0.680***		0.121**
		(6.18)		(2.61)
$\Delta NATPROD_{t-1}$		-0.148**		
		(-2.31)		
$\Delta NATSHARE_t \cdot Break\ dummy$	-0.0211***		0.0109***	
	(-2.78)		(5.31)	
$\Delta NATPROD_t \cdot Break\ dummy$		-0.446***		
		(-3.75)		
Observation	45	45	45	45
R-squared	0.485	0.701	0.711	0.705
Adjusted R-squared	0.387	0.645	0.666	0.667
Structural break	Yes (1987) **	Yes (1984) **	Yes (2007) **	None
Cusum test statistic	0.7195	0.4436	0.1697	0.4085
Breusch-Godfrey AR(1) p-value	0.6328	0.9511	0.9696	0.6537

Notes: ***, ** and * indicate that the null hypothesis is rejected at the 1%, 5% and 10% levels, respectively. The t-statistic for each slope coefficient is reported, with the t-values being White. The break dummy is a slope dummy that has the value of 1 for all years from the breakpoint onwards. The results for the control variables and the constant term are not shown for the sake of brevity.