The External Market effect: Evidence from 18th Century Britain

Syed Mohib Ali*

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Abstract

What was the contribution of autonomous exports to industrialization in Great Britain? How much did exports to the New World contribute to structural change and innovation in Britain and what would have happened to industrial growth without the export markets of the New World?. By linking occupational structure estimates at the county-level with exports of manufactures to different geographical destinations, I construct a measure of export-orientation of British counties to evaluate the impact of autonomous exports on industrialization and regional change. Using a dynamic panel data model that accounts for endogeneity, I show that the counties with higher American export exposure had higher shares of non-agricultural employment, and inventive activity. The expansion of the autonomous American export market through the 18th century was beneficial to British industrialization and structural change through a range of direct and indirect effects. At an immediate level, the research article contributes to a vast literature by estimating the 'vent for surplus' or the 'external market' effect for Britain in the 18th century.

*Preliminary draft. University of Siena, Email: s.aliahmed@student.unisi.it

1 Introduction

What was the contribution of exports to the industrial growth in Britain? How much did manufactured exports to the New World contribute to structural change and industrial output in Britain and what would have happened to industrial growth without the export markets of the New World?. In this essay, I try to show that the stimulus afforded by the export expansion in the 18th Century through the growth of the American market had significant effects on industrial output, non-agricultural employment and thus stimulated structural change and created the conditions for the British Industrial Revolution.

The role of overseas trade is highly contested within the historiography of the British Industrial revolution. The early cliometric literature downplayed the impact of overseas trade, and instead chose to emphasize the internal factors that fostered industrialization, primarily technological progress and the institutional reasons for such progress (Thomas and McCloskey, 1981)(Mokyr, 2018). The leading trade historian of the period Ralph Davis summarizes the dominant interpretation on the role of foreign trade in the Industrial Revolution as follows "I share the view that overseas trade did not have an important role either in bringing about the Industrial Revolution or in supporting the first stage of its progress.....The initiative came from the supply side, from technical change in the manufacture of cotton" (Davis, 1979, pp.9-10). In other words, there is no causal role for overseas trade, let alone external demand, as a factor in the industrialization of Britain.

More recently however, several authors have emphasized the dynamic gains accruing due to externalities and spillovers from overseas trade (Findlay, 1990)(O'Brien and Engerman, 1991). Britain was heavily dependent on foreign trade to secure its necessaries of food and raw materials and this helped her sustain higher wages thus escaping the Malthusian trap (Allen, 2011) (Clark et al., 2014) (Palma, 2016). The focus of these studies however has been on the gains from trade through supply-side mechanisms, such as augmented inputs, and do not pay attention to demand-side of the economy or the impact that an increase in foreign demand has for industrial output and the economy. In particular, the essay argues that it was the growth of the American export market in the 18th century which served as an autonomous increase in foreign demand for British industrial output and this had a significant impact on industrial output and non-agricultural employment in Britain. The External market effect, referring to autonomous sources of demand or markets external to the capitalist circuit of income, thus become necessary to absorb the surplus production of capitalist economies (Kalecki, 1967).

By the end of the 17th Century, the Atlantic economy was firmly in place and as more and more people emigrated to the Americas, England pulled itself out of a Malthusian trap and stimulated local manufacturing and provided employment at home (Davis, 1973)(Solow, 1991)(Zahedieh, 1994). The 'discovery' and gradual development of the America markets, on the one hand meant access to the vast acres of land which relaxed the constraint on food supply, while on the other hand it also meant an elastic market for British manufactures which would gainfully employ a growing population at home[1]. By the year 1700, 250,000 English people had transplanted themselves to the American Colonies and provided a vent for exports to the Home country to the extent of 100,000£ which supported 40% of industrial employment in London[2]

Through the course of the 18th century, overseas exports became of central importance to British producers. The volume of total exports (to all destinations) increased by a factor of 4.6 over the long 18th century and their incremental contribution to industrial output was 40%. The incremental contribution of colonial markets to the growth of British commodity exports between 1700-01 to 1772-73 was about 85%, the bulk of which went to North America and West Indies, but also to India (O'Brien and Engerman, 1991, pp.186,193). In other words, nearly 85% of the addition in manufactured exports in this period was due to protected, colonial markets where Britain reserved the exclusive right to trade for its citizens through Royal charters, and stifled export competition in these markets through high levels of investment in Naval power. The Americas contributed a substantial 60% increase to the growth in industrial exports. As Davis notes, the North American population rose tenfold during this period, and their income grew even faster, and thus they spent their earnings on a all kinds of British manufactures (Davis, 1979, p.13) Following a decline in exports during the American war of Independence (1775-1783), exports would re-surge after the Treaty of Paris in 1783, and the United States became a principal destination of British manufactured exports. The 18th century as a whole would thus see a realignment of British overseas trade, both in its commodity structure and geography, as Britain would move away from exporting Woollens to Europe to exporting miscellaneous manufactures and cotton to the Americas, Ireland and West Africa (Davis, 1962). Colonial demand from the Americas was thus an important supplement to the growth in domestic industry and helped build many branches of industry leading to cumulative technical change.

Export trade was critical to British industrialization in the 18th century. Export industries like cotton, metalwares, woollens and shipbuilding were among the leading sectors of the economy with

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[1] Adam Smith would emphasize the 'discoveries' of the 15th century stimulated 'division of labour', 'improvements in art' or technology which were not possible in the 'narrow circle of the ancient commerece' with Europe

[2] See Zahedieh (1994) who provides a snapshot of the colonial trade in 1686 based on London port books.

significant positive externalities for other industries and demand for downstream raw materials such as wool, flax, iron and coal (O'Brien and Engerman, 1991, p.190-192). The growth of exports 'widened the market' for Brtish manufactures and engendered an extensive division of labour. There is increasing, albeit unsystematic, evidence on the importance of foreign demand from the Americas for British Industrialization. Hudson and Berg (2021), Zahedieh (2010), O'Brien and Engerman (1991), Inikori (2002), Crafts (1985), Esteban (1997) emphasize the positive role exports had in stimulating important branches of the industry and accelerating structural change. The New Markets of North America and West Indies in the 17th and 18th centuries, protected by the Navigation acts, served to provide a new source of demand, thus stimulating production and diversification of manufactures[3]. The importance of the American market in utilizing slack resources is also documented by Zahedieh (2013) in the case of the copper industry. Not only did overseas markets afford an opportunity to diversify production, but they also created a 'market for inventive activity' through investment in research and development and amortization of R&D costs (Allen, 2011, p.370)(Zahedieh, 2013). In the case of the plantation based economy in colonial America, the burgeoning export market led to the development of skills and technological capabilities such as the Newcomens engine associated with the rise in copper industry (Zahedieh, 2013, p.815-817).

The expansion of manufacturing due to growing industrial exports also entailed the growth in non-agricultural employment and induced structural change by increasing the share of manufacturing in total output. The industry labour demand curve is a positive function of the demand for industrial output for a given wage rate. Between 1700-1800, the number of male workers in non-agricultural employment increased by 516,000 in England and Wales as total industrial output in Britain nearly trebled in the 18th century (Keibek, 2017, p.156)(Broadberry et al., 2015, p.139). Success in intercontinental trade with colonies in the early modern period meant that England achieved structural change early on, and was able to sustain relatively high wages (Allen, 2011). Recent evidence has shown that even as early as 1700 Britain was already industrialized with nearly 37% of its population in the secondary sector (Shaw-Taylor and Wrigley, 2014). If Britain was autarkic in the 18th century, then it would have been impossible for the domestic industries to absorb the nearly 40% of non-agricultural employment in the export-industries due to the enclosure movement, low elasticity of substitution of tropical groceries imported from the Americas and the lack of sufficient domestic demand due to income inequality (O'Brien and Engerman, 1991). Underlying the process of structural change in Britain was its successful proto-industrialization, a productive agriculture, and increasing specialization in the export of manufactures underpinned by the growth of an autonomous export market in the Americas that provided the opportunities for diversification (Wallis et al., 2018) (Crafts, 1985, pp131-133, p.151). Not only did overseas export markets stimulate industrial output and growth of non-agricultural employment, they also created a market for

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[3]Throughout this essay, the terms New Markets, Americas, and Atlantic Markets are used interchangeably. In the statistical analyses, Atlantic Market or the Americas refers to the geographical territory of North America, Latin America, West Indies, and Western Africa

inventive activity through investment in R&D geared towards the export markets (Zahedieh, 2021).

In this essay, I investigate the impact of the American external market for industrialization in Britain in the 18th century up until 1840. The present investigation is into one of the many mechanisms through which Britain benefited from foreign trade, namely through external demand. By using newly compiled data on occupational structure at the county level, I show that the positive demand stimulus afforded by the protected American external markets had significant impact on structural change and inventive activity across British counties. In section 2, I review the cliometric literature on the role of foreign trade and demand for the British Industrial Revolution. While most of the early literature had downplayed the role of foreign demand, recent scholarship has either focused on the supply-side gains from trade or has made growing exports dependent on domestic factors such as retained imports and rising productivity/falling costs. In this way, the literature denies any causal role to exports. In section 3, I provide descriptive evidence on the growth of exports, and focus especially on growing industrial exports to the New Markets of Americas and how these spurred various branches of industry. Using the descriptive evidence in Section 3, and other arguments from the literature, Section 4 argues why Industrial exports to the Americas should be considered as an autonomous and independent factor for Industrialization in Britain in the 18th century. Section 5 uses the American export exposure as an independent and exogenous variable, and shows that counties in England and Wales that were exposed to American exports witnessed an increase in the share of non-agricultural employment and inventive activity, and section 6 concludes.

2 Relevant Literature

The essay contributes to two distinct sets of literature. First, it contributes to recent work in quantitative economic history that finds an important causal role for overseas trade in the economic development of early modern Europe, particularly of Britain. Second, it contributes to the growing empirical literature in macrohistory, where demand matters beyond the short-run and has permanent effects on output.

2.1 Overseas trade and the industrial revolution:

A highly debated factor in the historiography of the industrial revolution is the role and importance of overseas trade[4]. The dominant understanding on this matter is articulated by Ralph

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[4]A long-standing debate in the historiography of the Industrial Revolution has taken the form of internal versus external causes. As the name suggests internal factors are those that are internal to Britain like agricultural productivity, or institutions. For an excellent survey on the historiography of the industrial revolution along these lines see

Davis who argues that overseas trade did not have an important direct role either in causing or supporting early industrialization. Instead, it was technical changes on the supply-side especially in the textile industry which lifted both the home and foreign markets (Davis, 1979, p.9-10). This understanding is echoed by other leading historians such as Mokyr (2018, p.47) who questions the importance of trade in causing the industrial revolution and notes that the growing dependence of industrial output was an *ex-post* phenomena and not a *cause* of industrialization[5]. Thus, for instance, Thomas and McCloskey (1981) noted that "Trade was the child of industry" and that growing commerce was the *effect* of rapid industrialization. The early cliometrics literature thus largely downplayed the importance of trade and external factors for the industrial revolution, and instead emphasized domestic factors such as geography and the availability of coal, the supply of technology, skills, changes in organization of production and the unique political institutions that England inherited from the Glorious Revolution in 1688 (Mokyr, 2018)

Recent work starting from the 1990's has come to emphasize the dynamic nature of gains from foreign trade such as positive externalities and scale economies in a general equilibrium framework (O'Brien and Engerman, 1991)(Findlay, 1990)(Clark et al., 2014). These dynamic spillovers would be drastically minimized by static comparisons of export revenues as a fraction of national income at different reference years since they do not capture the dynamic range of gains from trade. Following this shift in perspective, the new cliometric literature on this topic emphasizes the growing importance of intercontinental trade for Britain (Allen, 2003)(?)(Clark et al., 2014)(Palma, 2016). At the macroeconomic level, Allen (2003) highlights England's success in international trade as one of the *causa causans* for sustaining higher levels of wages and urbanization. The boom in international trade in the late 17th and 18th century induced the demand for labour, coal and inventions, and led to a unique wage-price structure that induced labour-saving technical progress. Findlay and O'rourke (2007, p.333) too emphasize that trade, and larger markets, mattered in sustaining the Industrial Revolution, by raising demand elasticties of individual firms as well as shifting the demand curve outside. An important conclusion in this stream of literature is that foreign trade had a significant role in alleviating the supply constraints of the economy by providing access to raw materials, 'ghost acres' and slave labour of the New World, thus allowing England to escape the Malthusian trap (Thomas and McCloskey, 1981)(Clark et al., 2014) (Palma, 2016). Although there are a few remarks that overseas markets afforded elastic demand and allowed a Smithian 'vent-for-surplus', most of this literature has emphasized the supply side gains from trade or the augmentation of land and labour for Britain[6]. This essay on the other hand, explicitly

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Inikori (2002)

[5]The early literature on growth assigned a crucial role to overseas trade and commercial revolution based on the decisive break-through in exports (and re-exports) in the last two decades of the 18th century (Deane and Habakkuk, 1963, p.77-78)(Berrill, 1960). However, recent work notably by Crafts (1985) has shown that the rate of growth of Britain was not all that high.

[6]A separate and voluminous literature exists on the importance of profits from the slave trade for accumulation in Britain starting from Williams (1944). The 'Williams hypothesis' has seen a revival following the work of (Solow,

highlights the demand aspect of foreign trade and the stimulus provided by external markets.

2.2 The role of (foreign) demand in the Industrial revolution:

A parallel but related debate has taken the form of demand versus supply factors in the Industrial revolution with a leading historian of the Industrial Revolution, Joel Mokyr, concluding that "Cost-reducing and factor-increasing changes occupy the center of the stage: supply rules supreme" and that demand (either home or foreign) fails to explain important aspects of the industrial revolution, which should instead be sought first and foremost in supply related processes (Mokyr, 1977, p.897)[7]. Thus, as Davis (1979) argues it was the increase in supply and the cheapening of manufactured goods, especially cotton, that led to the expansion in volumes of exports. As mentioned before, a classic internalist and supply-side view is by Thomas and McCloskey (1981) who argue against any causal role for trade or demand. In their argument foreign demand was substitutable with domestic demand and that the opportunity costs of labour employed in export industries ere negligible[8]. A more nuanced argument against the role of foreign demand is by Deane and Cole (1967) who highlight the importance of exports to the new markets of America yet conclude that they were dependent on, and limited by British imports of colonial products. They conclude that "it is difficult to see the expansion of British export trade as a largely exogenous factor which quickened the pace of industrial growth...it seems that the explanation of the higher rate of growth in the second half of the century should be sought at home rather than abroad" (ibid.,p.85). This accords with general presumption in the literature that locates the breakthrough in industrial production in domestic, supply-side factors such as technical innovation and organizational changes and neglects the role of demand.

While some scholars do consider a theoretical role for demand in the short-run through fluctuations in exports, they deny its importance as a source of growth with permanent effects on output and capital stock (Crafts, 1985)(Findlay and O'rourke, 2007). In considering the relative importance of export markets, and more generally sources of increased demand, (Crafts, 1985, p.134) notes that "Neo-classical models of growth process would .... find this an uninteresting argument because in such approaches growth is determined on the supply side of the economy and demand plays a passive role" and goes on to observe that "If, perhaps for shorter periods of analysis, demand is given and independent (Keynesian) role, then the key analytical question to be considered

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1991)(Inikori, 2002) recently.

[7] There is a long tradition that ascribes primacy to domestic demand in the historiography of the Industrial Revolution. Beginning with the article of Waterman Gilboy (1932), authors such as Eversley (1967) and John (1965) have emphasized domestic demand arising from the agricultural sector. More recently, Berg (2005) and De Vries (1994) have made a strong case for consumer demand, especially the demand for tropical groceries like tea, sugar, tobacco, as the driving force for the industrial revolution

[8] This entails an unlikely conclusion that that the 40% to 45% of non-agricultural workforce employed in the export industries could be easily re-absorbed in the domestic industries (O'Brien and Engerman, 1991, p.200-202)

is which increases to demand are taken to be exogenous". In a similar vein (Findlay and O'rourke, 2007, p.331) comments that the "Keynesian framework is designed to explain short-run fluctuations rather than long-run growth rates" and in the long-run it is easy to "dispose of the argument that an exogenous boost in demand pulled up British output during the late eighteenth and early nineteenth century" because the terms of trade were moving *against* Britain.

Three important arguments are found in the literature to support against the role of foreign demand. First, the declining net barter terms of trade of Britain with the rest of the world are interpreted as evidence that British supply grew faster than foreign demand (Thomas and McCloskey, 1981, p.101)(Crafts, 1985, p.147-148)(Findlay and O'rourke, 2007, p.332-333). Second, the declining share of industrial exports to gross industrial output through the course of the Industrial Revolution (after 1801) is interpreted as evidence against the role of exports as a cause, since this ratio should have increased and not decreased (Mokyr, 2018, p.46). Finally, if Britain's growth was pulled by growing exports, the question becomes where did this exogenous and autonomous source of demand or foreign income come from in a pre-industrial world? In other words, was foreign demand truly exogenous and autonomous to income in Britain, and mattered beyond short-run fluctuations to cause industrial development in Britain.

To summarize, the cliometric literature does not have a causal role for demand in the long-run and simply *assumes* supply-side mechanisms at work and locates the proximate and ultimate causes of the Industrial revolution in innovations, supply of technology and changes in organization. As Esteban (1997, p.899) notes that "alternatives to the hypothesis of demand-led growth are not demonstrably sounder...the more general presumptions from supply-side perspectives rest, not always explicitly, on a choice of neoclassical modelling in which demand cannot play but a passive role". The use of neoclassical growth theory, whether in its exogenous or endogenous versions, has inevitably entailed the relegation of aggregate demand to supply-side mechanisms, leading to the neglect of demand as a causal, long-run factor in the British Industrial revolution.

2.3   Modern Keynesian demand-led growth

In emphasizing the importance of demand beyond the short-run, a second set of literature that this essay speaks to is the post-Keynesian and macrohistory literature, which investigates the permanent effects of aggregate demand shocks in different or alternatively the long-run impacts of monetary policy (Jordà et al., 2020)(Palma, 2022)(Girardi et al., 2020). This set of literature shows how demand shocks, such as monetary policy shocks or fiscal consolidations, have long-term permanent effects on the economy typically relying on 'hysteresis' mechanisms. Starting from Nelson and Plosser (1982) Blanchard and Summers (1986) several authors have emphasized the perma-

nent effects of, typically recessions and unemployment, but also fiscal expansions more recently (Ball, 2014)(Fatás and Summers, 2018)(Girardi et al., 2020). In this view, the level of output and capital stock are permanently higher after a positive shock to aggregate demand, as firms adjust their productive capacity to the level of demand. The gradual opening up of the American market represented a persistent positive demand stimulus to British industry and let to higher levels of industrial output and manufacturing employment. The notion of growing aggregate demand, especially foreign demand, driving output has long been recognized in the history of economic thought (Thomas, 2021). Mercantilist writers readily perceived the need for an export surplus to promote employment and net product (Gomes, 1987). In the 20th century, the idea of foreign demand as necessary for accumulation finds mention in Hobson (1902) and Luxemburg (1951). Building on Luxemburg's 1913 *Accumulation of Capital*, Kalecki (1934)Kalecki (1967) emphasizes the dynamic importance of exports and government spending to overcome aggregate demand deficiency. Modern versions of this idea have been re-cast into a long-period framework showing that non-capacity creating autonomous expenditures such as exports drive long-run growth and have permanent level effects on output, employment and capital stock (McCombie and Thirlwall, 1994)(Blecker, 2013) (Blecker and Setterfield, 2019).

The essay is thus an empirical verification of Findlay (1990, p.22) observation that there is "little doubt that British growth in the eighteenth century was 'export-led' and that, among exports, manufactured goods to the New World and re-export of colonial produce from the New World led the way". As Esteban (1997, p.899) notes that it still remains to be shown whether late 18th century growth was not significantly related to the stimuli and reward of market expansion and was was driven by supply-side factors. The essay intends to make good this lacuna by using theoretical models that assign a significant role to demand in the long-run. In doing so, the importance of other causal mechanisms, especially of innovation and technological progress is neither denied nor is there any necessity ascribed to demand conditions.

3   The growth of exports

In this section, I outline some stylized facts regarding the growth of exports through the 18th century up until 1830 and the rising share of industrial exports, as well as the changes in occupational structure and inventive activity, to motivate the econometric analysis that follows. By the middle of the 18th Century, domestic exports in England were about 8.4£ million and had doubled from 4.4£ in 1700, and the 'Atlantic economy' had firmly replaced the continental trade with Europe. England was importing foodstuffs, raw cotton, tobacco and dyes from the New World and exporting its own manufactures (Davis, 1962)(Davis, 1979). The rate of growth of domestic British exports throughout the 18th Century was 1.5% per annum and the total value of exports
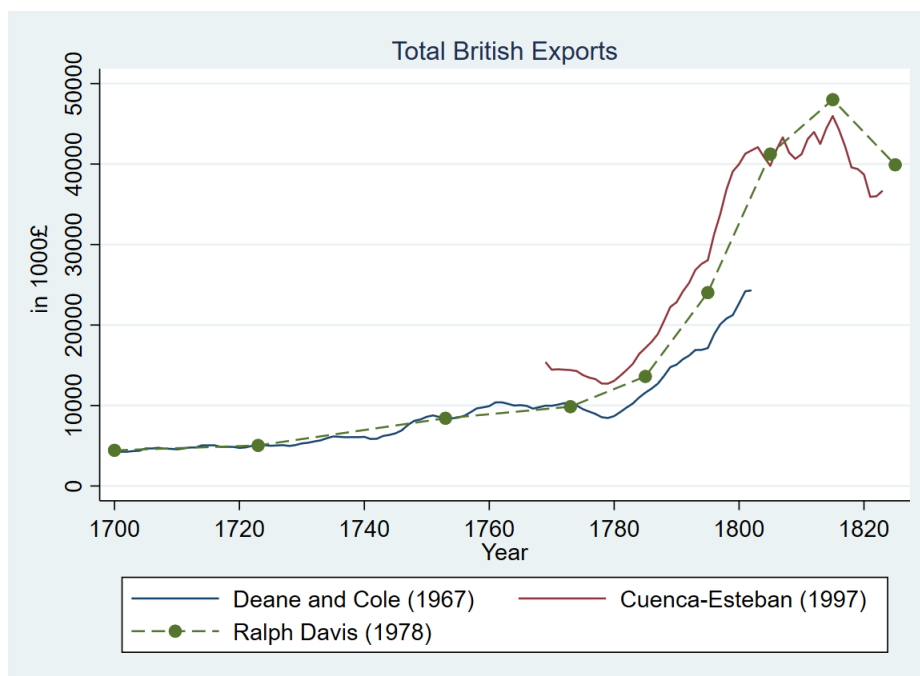
Figure 1: Total British Exports

Notes: The series by Deane and Cole (1967) consists of English exports until 1772 after which the series refers to Great Britain and is in constant prices of 1697. The series by Davis (1979)Davis (1962) and Esteban (1997) refers to Great Britain as a whole in real (or market values).

increased almost five-fold at constant prices, while the share of exports in national income increased three-fold (Deane and Cole, 1967, p.28)[9]. Figure 1 shows three alternative series on total British exports in the 18th century and beyond. The two alternative estimates of Deane and Cole (1967) and Davis (1962)Davis (1979) closely track each other, while the estimates of Esteban (1997) show a higher export volume from 1760 onwards.

Crouzet (1980, p.50) following (Deane and Cole, 1967) has identified distinct periods when there was an export boom based on the analysis of deviations from the trend rate of growth of exports. The period between 1781-1802 represents a definite, persistent export boom in the history of British exports[10] In the first long boom of domestic exports between 1783-1802, exports grew at 5.1% per annum. See table 1. In the period from 1781-1802 exports increased from 7.6£ million to 18.3£ million. Between the two five year averages; 1783/87 and 1788/92, exports increased 35%, while from 1788/1792 to 1793/97, they decreased by 9% following the outbreak of war with France. The five year average of exports would increase again by 45% between 1793/97 and 1798/1802.

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[9]Price levels in the 18th century remained fairly stable and the value of exports increased five-fold, computed either at the 1697-1698 official values or the 1796-98 constant prices. In the first decades of the 19th century, there is a divergence in volume and value trends due to the falling price of exports, especially of cotton yarn and cloth, and due to the rising share of cotton in U.K exports (Crouzet, 1980, p.58-59)

[10]Crouzet notes that the U.K can be characterized as a export-led economy proper, only following the second long export boom between 1847-1873

Mean rates of Growth of exports	
Years	%
1697-1714	2.8
1714-1744	0.9
1744-1760	3.0
1760-1781	-1.5
1781-1800	5.1
1802-1826	2.5
1826-1856	5.6
1856-1873	3.8

Table 1: Mean rates of growth of exports from England and Wales

Notes: Analysis of rates of growth from (Crouzet, 1980), with periodization suggested by deviations from trend. For the 18th century, exports are in official values of 1697 for England and Wales. Starting from 1802, values are in Imlah's volume series for the United Kingdom.

According to Crouzet "1790's and early 1800's are clearly a prolongation of the 1780's and. . . .these 20 years are one of the major leaps forward in the history of British exports". The forces behind this long boom include the rebound of trade after the American war of independence concluded with the Treaty of Paris in 1783, dislocations caused by the Napoleanic wars starting from 1793, and the impact of technical progress on cotton textile prices (O'Brien and Engerman, 1991, p.183).

The numbers shown here pertain to exports only. Re-exports are excluded due to their relatively small magnitudes and the additional problems they add in terms of analyzing the global flow of commodities. Since the focus of this essay is on the impact of autonomous exports to America on British Industrialization, re-exports do not necessarily constitute an autonomous demand shock. Reexports were about 10% of total exports throughout 18th century, and would come down to approximately 3% in the beginning of the 19th century[11]

3.1 The New Markets and the Geographical Distribution of British Exports

In the 18th century, three broad patterns in the geographical distribution of British exports can be observed. First, the share of exports that went to continental Europe reduced markedly. Second, exports to British colonies in America, especially North America, increased at a fast pace. Third, increase in exports to 'captive markets' i.e. Africa, East Indies and Ireland were not insignificant (Davis, 1962, pp.291-292)(Crouzet, 1980, p.69). This suggests that by the 1780's, there was a definite shift in the geographical distribution of exports and the New Markets of America,

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[11]The small share of re-exports should not mean that they were insignificant for Industrial Development in Britain. In fact, re-exports were a crucial part of Britain's Import-cum-Re-exports Substitution industrialization strategy (Inikori, 2002)(Berg, 2005, p.125). The imports from East India were sold in the Atlantic Markets, and the imports from Americas were sold on European markets. The latter were fundamental to the development of industries such as sugar refining, tobacco processing etc.

British Manufacturing Exports to Major Geographical regions
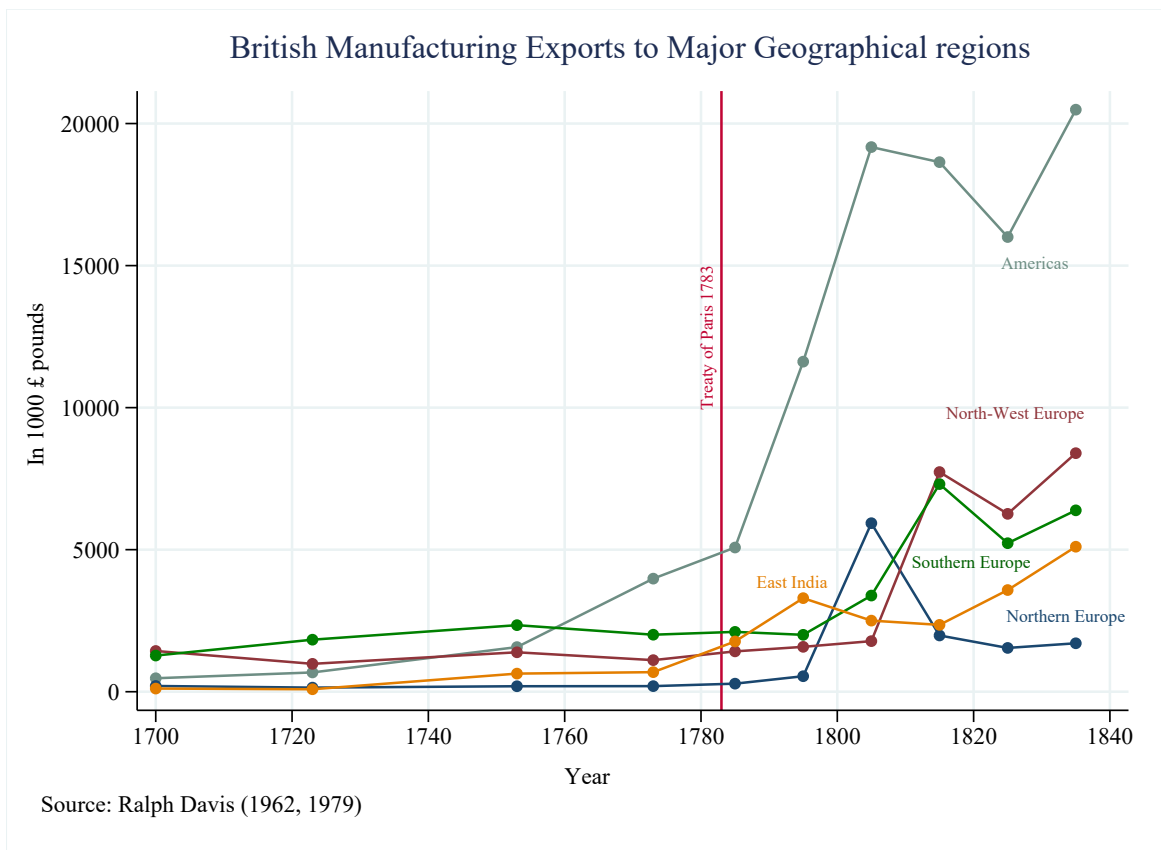
In 1000 £ pounds

Treaty of Paris 1783

Americas

North-West Europe

East India

Southern Europe

Northern Europe

Year

Source: Ralph Davis (1962, 1979)

Figure 2: The growing importance of the American external market

Destination of British Exports. in million £			
Years	Old Markets	New Markets/ America	New Markets including East India
1700	3.5	0.5	0.6
1723	3.8	0.7	0.9
1753	5.3	1.7	2.3
1773	3.9	4.1	4.9
1785	5.4	5.6	7.3
1795	5.5	12.6	16.1
1805	13.8	20.9	23.6
1815	21.3	20.3	23.1
1825	14.5	16.5	20.7
1835	18.9	21.7	27.2

Table 2: Geographical distribution of British Exports

Notes: Based on (Davis, 1979)(Davis, 1962). In current values. New markets or Americas includes Latin America, West Indies, North America and West Africa. Old markets include Northern Europe, North-Western Europe and Southern Europe. East India includes Asia, China and Australia.

and other colonial markets, had come to absorb large amounts of British exports (nearly 95%). The re-export trade of the late 17th century (re-exports of European and Asian goods to America) played a crucial role in creating the market for domestically produced British goods in the 18th century. Figure 2 shows the growing importance of the American external market over the course of the 18th century. Table 2 shows the geographical destination of British exports in absolute values until mid 19th century.

In the entire period under consideration (1700-1830), the new markets of America grew from an insignificant amount to out-numbering the old markets of Europe by 1774. Thus as table 2 shows by 1773, exports to the New Markets of America stood at 4.1 million£ compared to 3.9 million£ to the old markets of Europe. In the last two decades of the 18th century, exports to the Americas surged following the Peace of Paris in 1783. Thus, exports to New Markets would grow from 5.6 million£ in 1785 to 20.9 million£ in 1805. Reasons for this dramatic surge in exports to America include a rebound of trade after the American war of independence, trade dislocation caused by the Napoleanic wars and (self) blockade of the Continent, and the falling price of cotton. It was only after 1793 that exports would flood the markets of Europe based on price competitiveness.

On the other hand, the *incremental* contribution of New Markets to the growth of total exports between 1700-1785 was 60%, while that of the old markets of Europe was only 12%. After the peace of Paris, the incremental contribution of the America's remained strong, absorbing about

Incremental contribution to from major geographical areas			
Areas	1701-1785(%)	1785-1805 (%)	1805-1835 (%)
Northern Europe	1	23	31
Southern Europe	11	5	32
Total Europe	**12**	**28**	**63**
United States		28	-20
West Indies and Canada		24	-39
Latin America		0.4	84
Africa		2	-3
Total America	**60**	**56**	**16**
Australia		1.4	10
East Indies*	**21**	**2.9**	**17**

Table 3: Shares of the additional manufacturing exports to the main trading area as a % of the total additional manufacturing exports. Authors calculations.

Note: *East Indies includes all lands bordering on the Indian and Pacific ocean. Shares do not add up to 100 because of the exclusion of Ireland and other Channel Islands.

56% of British exports between 1785-1805[12]. Table 3 describes the incremental contribution of major geographical areas to British exports from 1700 to 1835. An alternative periodization for these 20 years using five year averages between 1783/87 - 1788/92, 1788/92 – 1793/97, and 1793/97 - 1797-1802 shows that the incremental contribution of the New Markets was 45.6%, 84.4%, and 48.7% respectively (Crouzet, 1980, p.70). For the 30-year period between 1782 to 1812, America's *cumulative, incremental* contribution to British exports was 59.8%, while that of Europe was only 22.7%. It is only after the Battle of Waterloo in 1815 that Europe's incremental contribution to British exports would rise, while the wars in Europe would open up the Latin American market for British exports after 1808.

Writing for the 18th century as a whole, O'Brien and Engerman (1991, p.193) note that "most (perhaps up to 85%) of the *increment* to exports sold overseas from 1697 to 1802 were absorbed by colonial or neocolonial markets (such as India or United States after 1783)" which for them "underlines the significance of sea power, imperial connections, slavery, and mercantilist regulation for the sale of British manufactures overseas" (ibid., p.186). The discovery and development of the new markets of America thus represents a definite, autonomous increase in exports and this has a significant impact on industrial output and structural change[13].

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[12]The cumulative incremental contribution to exports from a trading area (C_a) is the percentage share of the accumulated increments in exports to the trading area with respect to the total of accumulated incremental exports from all the areas in a specified period (t_0-t_1), where the incremental contribution of an area is $C_a = (X_a t_1 - X_a t_0)/(Xt_1 - Xt_0) * 100$

[13]If one considers the markets of Asia, over which Britain had monopoly trading rights, the value of autonomous exports becomes even larger

3.2 Commodity structure of exports

Anybody who thinks of the Industrial Revolution in Britain, thinks primarily of the cotton industry and the revolutionary changes taking place within it. Yet, in the early 17th century up until late 18th century, England exported Woollen manufactures as its principal manufacture (staple) to Europe. Beginning in the 18th century and coinciding with the geographical realignment of trade, England would come to export a variety of manufactured goods to America such as silk, linens, woollens, hats, glassware and more importantly a variety of small metalware items from buttons to nails and fine cutlery. The 18th century as a whole would see a realignment both in the geographical destination of English exports, and its commodity structure. The colonial demand from America would prove to be an important source of supplement for many branches of British industry fostering incremental technical innovation (Davis, 1979, p.14).

The conventional explanation of the rapid rise of manufactured exports, especially cottons, locates it in the changes in technology. However, the early exports of cotton goods from 1750 onwards went to the Americas, and did not make way into Europe until 1793. The growth in manufactured exports to America would precede the spectacular rise in productivity which led to a drastic fall in cotton prices as Britain's cotton exports reached every corner of the world. By 1773, the share of America (North and South America, West Indies and West Africa) in total manufactured exports was 46%. Nearly, 79% of total cotton goods and 92% and 63% of the total exports of linens and metalwares respectively went to the New Markets of America in 1773 (see Table 4. The picture (dominance of manufactured exports to America) would remain the same until 1795 when 56% of total manufactures went to America, with 76% of total cotton goods going there. It was only after the trade dislocations engendered by the Napoleanic wars that exports of cotton to Europe would start rising and its share would go upto 44% in 1805.

Composition of Manufactured exports and their destination			
Commodity	Total	Europe	New Markets
1700	**4433**	3598	539
Woollen	3045 (68%)	2745 (90%)	185 (6%)
Cotton etc.	20 (0.5%)	4 (20%)	16 (80%)
Other metalwares	114 (2.5%)	19 (16.6%)	73 (64%)
Other Manufactures	279 (6%)	100 (35%)	141 (50%)
1753	**8417**	5302	1707
Woollen	3930 (46%)	3279 (83%)	374 (9.5%)
Cotton etc.	83 (1%)	-	78 (93%)
Other metalwares	587 (7%)	144 (24%)	331 (56%)
Other manufactures	1131 (13.4%)	228 (20%)	480 (42%)
1773	**9852**		
Woollen	4186 (42%)	2630 (62.8%)	1148 (27.4%)
Cotton etc.	221 (2%)	44 (3.6%)	176 (79%)
Other metalwares	1198 (12%)	121 (10%)	755 (63%)
Other manufactures	1843 (18%)	360 (19.4%)	995 (54%)
1783	**13614**	5358	5465
Woollen	3882 (28%)	2510 (64%)	1013 (26%)
Cotton etc.	797 (5%)	310 (39%)	456 (57%)
Other metalwares	1691 (12%)	440 (26%)	892 (52%)
Other manufactures	3322 (24%)	363 (11%)	1583 (46%)
1803	**41241**	13721	20938
Woollen	6800 (16%)	1746 (25%)	3413 (50%)
Cotton etc.	16339 (39%)	7224 (44%)	8563 (52%)
Other metalwares	4584 (11%)	1026 (14%)	2663 (51%)
Other manufactures	5191 (12%)	739 (14%)	3143 (60%)

Table 4: Commodity structure of British Exports and their destination
Source: Davis (1962)Davis (1979). All absolute values are in 1000 £. The percentages in the second column show the composition of exports, while percentages in third and fourth column show the the geographical destination of exports for each commodity.

3.3 Industrial Output and National Income

The share of exports in *national* output fluctuated around 10 - 15% through most of the 18th century and in the last two decades of the 18th century Crafts (1985, p.131) estimates that exports as a share of national output was around 16%. The incremental contribution of exports to the increase in national output in these two decades was 40.3% (Crouzet, 1980, p.82)[14]. Inikori (1987, p.89) has argued that the external sector which also includes trade and transport, grew from about 7.2 million £or 29.9% of the total income in 1700 to 54.2 million £or 48% of the total income in 1811. Atlantic commerce affected the all the sectors of the economy by creating social overhead capital in transport infrastructure (waterworks, docks, canals etc.) and financial institutions such as clearing houses, county banking and insurance services Price (1989)Zahedieh (1999). Therefore, at a purely descriptive level there seems to be evidence to suggest that foreign demand contributed substantially to national income particularly in the period identified, and it seems plausible that foreign demand contributed to output through the growth of industrial exports [15].

Exports of industrial output to the Americas provided a vent for surplus and alleviated the problem of aggregate demand insufficiency. In conditions of weak domestic demand, it was foreign demand which ensured that British industries did not have a glut of commodities. Deane and Cole (1967, p.78) make the point that foreign demand grew at a factor of 5.44 while domestic demand grew at a factor of 1.52, emphasizing the importance of export markets for manufactures. The growth of English manufacture exports to America in the 18th century created a diversified base of industrial output and an expanded scale of industrial production providing a strong impetus and opportunity for sustained technical progress in industry. Export industries like textiles, metalwares etc. were the leading sectors in the economy and had significant spillover to other industries. It was these industries that demonstrated the possibility of technical change and sustained productivity increases to the rest of the economy.

The share of exports in total *industrial* output increased from 24.4% to 34.4% between 1700-1801 and came down again to 24.6% by 1851[16]. (See Table 5, column 4). For the 18th century as a

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[14]Crafts (1985, p.130) argues that Crouzet overestimates this ratio for the crucial 1780-1800 by using too high a value of output in current prices, and revises it downwards to 21%.

[15]The method of static comparison of 'small ratios' of export revenues between two benchmark period has come under criticism for not capturing the importance of exports to the economy accruing from a range of dynamic mechanisms

[16]The decline in the industrial exports to industrial output ratio led Mokyr (2018, p.46) to hastily conclude that "if export markets were more than just a trigger, their relative importance should have increased and not declined as the Industrial Revolution progressed"

whole, Crafts (1985, p.133) argues that nearly 36.8% of the addition to industrial output took the form of exports. Woollen goods, Cottons and Metalwares were the most dynamic industries and contributed most to exports in the 18th century. Between 1760-1780, exports contributed 46.2% to the increase in industrial output, but in the crucial 1780-1800 period this ratio declined to 10.9% (column 5). These estimates by Crafts have been questioned by Esteban (1997), who provides alternative estimates and argues that this share was rising and quite high throughout the industrial revolution i.e 1760-1810. Cuenca-Esteban argues that either Crafts' series of gross industrial output be revised upwards, or a relatively larger value of exports at constant prices be considered. Thus before 1760, the incremental contribution of total exports to increase in gross industrial output was 35.0% and was as high as 90% between 1780 and 1801 (see columns 6, 7). In the crucial period of 1780-1800, Cuenca-Esteban estimates that nearly 57% to 90% of additional industrial production was exported (ibid., p.885). This he concludes should lead to a more balanced perspective of supply *and* demand factors in the industrial revolution (ibid, p.901).

Based on the ex-post influence of different flows of expenditure on industrial and total output, (Crafts, 1985, p.130-144) conjectures that foreign demand was larger than home demand for industrial output, with the latter estimated at 28.6% in 18th century. In the total expenditures of an economy (consumption, investment, government and exports), it was exports which were the largest category in peacetime and "*could* be considered as exogenous demand stimuli". Even Mokyr who dismissed the role of foreign demand based on Craft's estimates of the declining share of industrial exports to industrial output admits the influence of exports in increasing industrial output, so long as there is underemployment (Mokyr, 2018, p.47). Sectors such as textiles, clothing, metalworks were regionally concentrated in the hinterlands of ports serving the growing American demand and had strong connections with the Atlantic market. These sectors were some of the most advanced sectors in Britain and led industrialization, either directly through the expansion of output or indirectly through innovation, which had effects on the entire economy. The following section argues why the American export market can be considered truly autonomous and exogenous to industrial development in Britain.

4   Autonomous exports to America

The basic question that arises for a demand-led explanation of growth and development is to establish the exogeneity and autonomy of aggregate demand since it is virtually the same as national income. Autonomous demand is defined as that part of expenditure that is independent of current income and does not create productive capacity. In other words, autonomous demand is that part of expenditure that is neither financed out of contractual incomes such as wages and profits, nor does it affect the productive capacity of the economy (Blecker and Setterfield, 2019, pp.353,387).

Exports and Industrial Output						
Years	Gross Industrial output (in current prices £million)	Industrial Exports (£ million)	Ratio of industrial exports to gross industrial output (in %)	Incremental contribution of industrial exports to increase in gross industrial output (in %)	Ratio of industrial exports to gross industrial output. in (%). Alternative estimates	Incremental contribution of industrial exports to increase in gross industrial output (in %). Alternative estimates
1700	15.6	3.8	24.4	56.3	14.0	-
1760	23.6	8.3	35.2	2.5	22.0	35.0
1780	39.9	8.7	21.8	46.2	22.0	22.0
1801	82.5	28.4	34.4	10.9	41.0	90.0
1831	178	38.9	21.8	29.9	48.0	53.0
1851	272.8	67.3	24.6	-	-	-

Table 5: Exports and Industrial output

Notes: Based on Crafts (1985, p.132) and Davis in current prices. Column 6 and 7 list alternative estimates of industrial exports and their incremental contribution by Esteban (1997) in constant prices.

Eligible candidates for autonomous demand thus defined are exports which are independent of domestic income and government expenditure since it is inherently discretionary.

The autonomy of demand is a question raised by Crafts (1985, p.134) in assessing the possibility of demand having a causal role in the Industrial Revolution. In other words, where did the autonomous demand for British exports come from? This question attains significance especially since Britain was the first country to industrialize and achieve modern economic growth while the Americas had low and negligible levels of income. Deane and Cole (1967, p.78) make the point that foreign demand grew at a factor of 5.44 while domestic demand grew at a factor of 1.52. However, they hypothesize that demand in the Americas for British exports was endogenous to the growth of domestic industry in Britain as it required growing imports of raw materials from the Americas (ibid. p.87). Thus, the exports of Britain to America were limited by the income of the New Markets of America, which itself was a result of exports of raw materials and colonial produce to Britain. Therefore, they argue that the cause for the growth of exports had to be located in the growth of domestic British industry.

Moreover the question of reverse causality between industrial exports and industrial development looms large. In other words, how do we know that it was not technological progress and industrialization in Britain which led to rising industrial exports by reducing costs and prices, especially

of cotton yarn. There are multiple arguments found in the literature supporting such a hypothesis specifically against the role of foreign demand. The strongest argument is that the terms of trade were moving against Britain and British supply was growing fast than foreign demand (Mokyr, 2018, p.69)(Findlay and O'rourke, 2007, p.332)(McCloskey, 1981)(Deane and Cole, 1967). In other words, it was the growth of domestic industry and its technological transformation that caused industrialization which then created a comparative advantage in the exports of manufactures.

There are multiple, interrelated points to be made against such purely supply-side arguments that ignore demand. First, much before Cotton exports, it was Metalwares and Other Manufactured exports to Americas that led industrialization between 1700 to 1783 (see Table 4). In the last two decades of the 18th century, exports to Americas grew despite the rising prices of Metalwares and Other Manufactures while cotton prices continued to fall, suggesting the autonomous nature of American export demand. Second, the decline in the net barter terms of trade, even if true for the 18th century, does not refute the possibility that exports to America was a combination of price and income effects, especially so since the American income elasticity of demand for British manufactures was quite high. Most of the literature showing declining terms of trade for Britain cite data from (Imlah, 1958). However, Imlah's series starts only from 1796, and there is evidence to show that through large parts of the 18th century up until 1790 the terms of trade increased indicating that the adverse terms of trade, succeeded not preceded industrial development in Britain (Clark et al., 2007, p.38).

Third and in relation to the autonomy of the American market, O'Brien and Engerman (1991) convincingly argue that in the later stages of British trade with America, "population growth, investments and improvements in productivity....as well as their expanding exports to non-British markets, rendered them....sufficiently *autonomous* to mature into an independent source of demand for domestic exports from the mother country" (emphasis mine, ibid.,p.195). Thus at the beginning of the 18th century (1698-1702), the share of exports per capita from the Thirteen Colonies (in North America) to Britain was 86%, while by 1768-1772, it was 55% suggesting that North America was earning its income by increasingly exporting to non-British areas (Shepherd and Walton, 1972, p.42). Between 1790 and 1814, exports to Spanish America and West-Indies were about 1/3rd of the total United States' exports (Coatsworth, 1967)[17]. Zahedieh, too emphasizes the autonomous nature of the Atlantic market, which grew by 120% between 1660 - 1700, even while English population, agricultural prices, and rents were stagnant underscoring the importance of the colonial sector Zahedieh (2010). Similarly, the West-Indies also traded with non-British areas, with Jamaica exporting 4% and Barbados exporting 23% of its commodities to North America

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[17]North (1961) notes that the main sources of expansion in the same period were wartime re-exports and carrying trades (ibid., p.18). The earnings from shipping services were as large as the earnings from commodity exports, nearly 427,000 £in 1770(McCusker and Menard, 2014, p.110)

(Eltis, 1995). In a study examining the causal relationship between British retained imports and exports over short-term cycles Hatton et al. (1983) find no evidence for retained imports in Britain preceding exports and conclude that "exports cannot be regarded as a purely passive element in eighteenth century trade" for Britain, thus casting doubt on Deane and Cole (1967) hypothesis that exports to America were a result of domestic industrial growth. North America i.e. the thirteen colonies grew rapidly in the early 18th century providing a source of external demand for Britain.

Finally, the growing demand from the New World seems even more plausible considering that Britain's naval power was used to prevent *potential* competition from the Continent so that Britain alone could take full advantage of American markets (Crouzet, 1980, pp.55-56). The promulgation of Navigation acts in 1651 ensured that England controlled the Atlantic trade by enforcing that colonial produce went to England only in English ships, thus restricting export competition in the Americas from other continental powers. Thus, as O'Brien and Engerman (1991, p.189) argue, for the 18th century "Foreign markets had ... been seized, created and protected by relatively high levels of investment in naval power". Autonomous exports or export demand that is autonomous of current incomes of the trading partner, was not given but had to be secured and created in the late stages of mercantilist England.

5   The Empirical Model: Structural Change and Patents

The primary question that this essay investigates is what impact did autonomous exports to America have on industrialization in England and Wales in the 18th Century? In other words the hypothesis that this essay investigates is that an increase in industrial exports to America led to a higher share of non-agricultural employment and patents across British counties. The process of industrialization is reflected in the structural transformation of the economy as the share of manufacturing in total output and non-agricultural employment increases and workers move from the low productivity, primary sector to the high productivity secondary sector. Structural transformation is one of the key indicators of economic development and the historical experience of England has informed subsequent theories of structural change and development. The empirical analysis follows the model of early modern European economic development by Allen (2003) who estimates the impact of intercontinental trade on real wages and urbanization. Instead of estimating a five, simultaneous equation model of development, I consider a model with two simultaneous equations to explain the share of non-agricultural employment and inventive activity. For measuring structural change, I use the data by Keibek (2017) who provides estimates of male workers across Primary, Secondary and Tertiary (PST) occupations at the level of individual counties in England

and Wales[18]. Unlike in Allen (2003) and Palma (2016), who use trade per capita for the entire country, I use American export exposure per male worker in a specific county in England and Wales as my main independent variable. Following Feenstra et al. (2019, p.49)David et al. (2013, p.2128), I first define American export exposure as the amount of industrial exports to America $X_{j,t}^A$ per male workers in county $L_{i,t}$, where industrial exports are apportioned to a county based on its share of the national industrial employment. Thus initial shares or weights of industrial output in each county are determined by the industrial workers in a county as a share of the total workers in that specific industry.

$$E_{i,t}^A = \sum_j \frac{L_{i,j,t}}{L_{j,t}} * \frac{X_{j,t}^A}{L_{i,t}}$$

The expression decomposes the American export exposure E^A in county i in time period t as the number of male, secondary sector workers in a county across j industries ($L_{i,j}$) as a share of total number of male workers employed in that national industry j (L_j) *and* British industrial exports to America $X_{j,t}^A$ per male industrial worker in county i (L_i) across j industries. The variation in $E_{i,t}^A$ stems from the variation in the local industry employment structure across counties, and the time variation in industrial exports to America.

The two main dependent variables used in this empirical exercise are the log of the share of non-agricultural employment[19], and the log of patents per capita in a county. The rising share of non-agricultural employment captures the underlying process of structural change in the economy and is intimately linked to the rise of proto-industrialization in the early modern period. Proto-industrialization refers to the rise of rural industry, such as woollen textiles, organized along traditional lines such as the putting-out system (and not the modern, factory system) and thus denoted an increase in manufacturing output (Mendels, 1972). Patents are used as a proxy for inventive activity and are intended to capture both product and process innovation. With respect to process innovation, patents also capture the changes in manufacturing productivity as several important sectors such as textiles, metallurgy etc. were transformed over the century.

The model by Allen (2003) is estimated for 10 benchmark periods with varying frequency between 1700 and 1841 i.e. for 1701, 1721, 1761, 1781, 1791, 1801, 1811, 1821, 1831, 1841, for 54 counties in England and Wales. I estimate the simultaneous equations for proto-industrialization and patents

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[18]Keibek (2017) PhD thesis builds on the work done by the *Cambridge Group for the History of Population and Social Structure* research centre and are visually described in Figure 4. I thank Dr. Sebastian Keibek for letting me use his data and several point of clarification.

[19]To avoid using the male working population as the denominator in both the left hand and the right hand side of the regression, I use the male working age population (ages 15-60) to normalize the American export exposure and male working population to normalize the share of non-agricultural employment
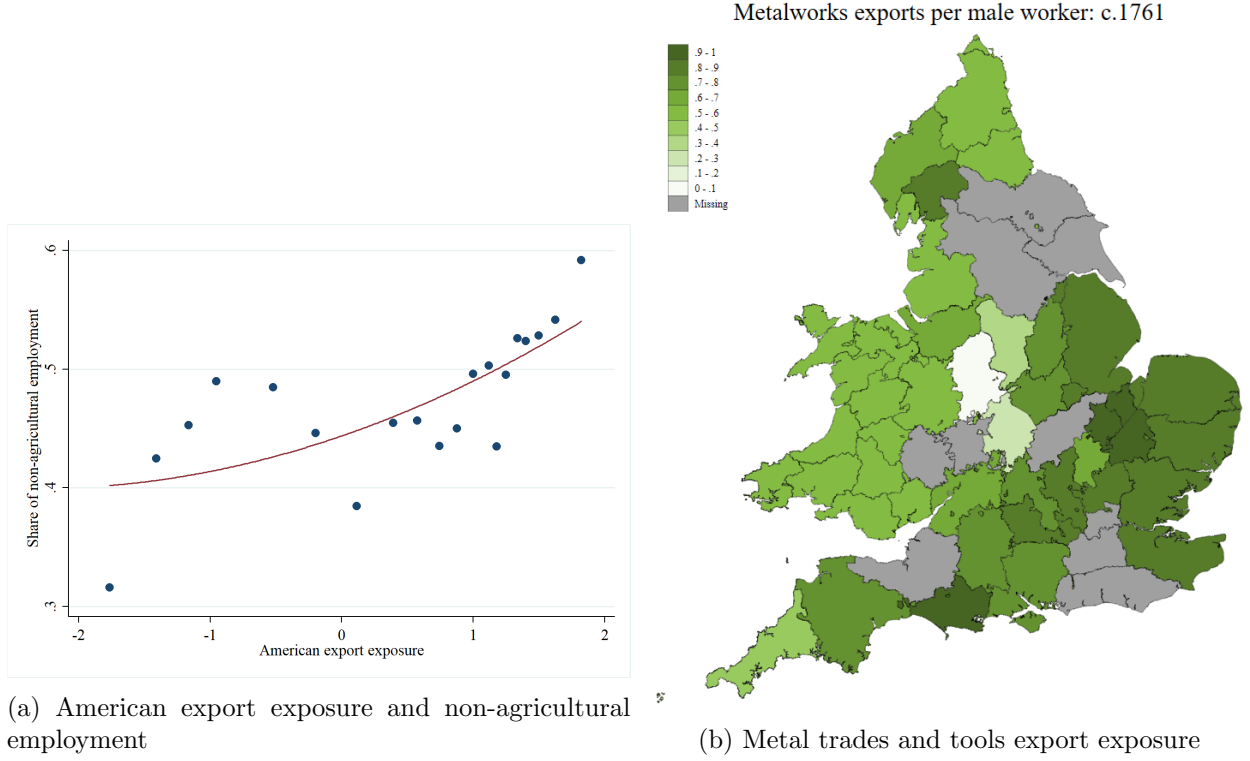
(a) American export exposure and non-agricultural employment

(b) Metal trades and tools export exposure

using alternative estimation methods, as in Palma (2016), taking the model as given with its exogenous variables and exclusion restrictions. In the model, intercontinental trade or trade with the colonies is *assumed* to be exogenous and is one of the *primum movens* of European economic development. Thus accordingly, industrial exports to America and the American export exposure are assumed to be exogenous to the share of non-agricultural employment in a given county. Further reasons for the autonomy of exports to America, and their statistical exogeneity are adduced in Section 4. Apart from the OLS and IV-2SLS estimations, dynamic panels of the type specified in equation 1 are estimated using the Arellano-Bond difference estimator. The Arellano-Bond estimator utilizes the panel structure of the data and also allows one to deal with endogeneity and persistence [20]

$$y_{i.t} = \alpha y_{i,t-1} + \beta E_{i,t}^A + \gamma X'_{i,t} + \epsilon_{i,t} \tag{1}$$

where $y_{i,t}$ is log share of male non-agricultural employment in county i, $y_{i,t-1}$ is the lagged share of male non-agricultural employment, $E_{i,t}^A$ is the American export exposure, $X'_{i,t}$ is a vector of covariates and $\epsilon_{i,t}$ is the structural error term.

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[20]Since the outcome variable depends on its previous values, using a static fixed effects estimator would lead to biased estimates. The crucial assumption for this estimator to work is that there is no autocorrelation in the idiosyncratic errors over time. In other words, as long as the county-specific unobserved errors are uncorrelated with each other and over time, the difference Arellano-Bond estimator generates instruments internal to the data to produce a unbiased estimate

5.1 Structural change or proto-industrialization

Table 6 shows the results from a regression with three different estimators and the share of male non-agricultural employment as the dependent variable. The OLS regression results in column 1 indicate only statistical correlations between variables and do not have any causal interpretation. Column 2 considers the IV-2SLS regressions with the instruments from Allen's model[21]. Column 3 shows results from the Arellano-Bond difference estimator. Since the variables are in natural logs, the coefficients can be interpreted as elasticities. Thus in the preferred Arellano-Bond difference estimator, a 1% increase in American export exposure increases the share of non-agricultural employment by 0.80% while the lagged share of non-agricultural employment has an effect of about 0.66% in a county. The magnitude of the American export exposure coefficient suggests that the employment elasticity of Atlantic demand was substantially high across British counties in the 18th century. This corroborates well with the descriptive evidence in Section 3.3 which shows how exports to the Atlantic markets transformed various regions and branches of industry, especially textiles and metalworks. In the absence of county-level data on agricultural and manufacturing productivity, one can assume that the share of enclosures and patents in each county serve as second-best proxies for agricultural and manufacturing productivity respectively. The results show that neither enclosures nor patents had any effect on the share of non-agricultural employment in a county. The negative sign on Enclosure coefficient, although insignificant, is instructive since it suggests that rising agricultural productivity in an open economy exporting manufactures would *ceteris paribus*, retard structural change. The land/labour ratio which is intended to capture the Malthusian pressure on land also does not have any effect on the share of male non-agricultural employment.

A further breakdown of American export exposure by specific industries shows the contribution of different industrial exports to structural change. The industry labour demand is a function of output for any given wage rate. Industries are matched to specific secondary sector employment as illustrated in Figure ??. Thus, the exports of commodities such as cottons, silks and linens are matched onto Clothing employment, while exports of hats, haberdashery and garments etc are matched onto Footwear employment. These together make up the entire textiles employment. Table 7 shows the regression results of specific industries from the preferred Arellano-Bond estimator. Column 5 shows the contribution of the respective industries that make up the American export exposure. In terms of specific industries, export exposure of the Textiles industries had the largest impact on the share of non-agricultural employment, followed by other manufacturing exports which is equally large. A 1% increase in Textiles exports to America increases the share of non-agricultural employment by .27%, while a 1% increase in the export of Other Manufactures increases

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[21]The first stage F-statistic from the IV-2SLS regression is also reported. The conventional F>10, holds true in the case of only one endogenous regressor. Nevertheless, the problem of a weak instrument cannot be ruled out and could be a result of low statistical power

Table 6: Proto-Industrialization or the share of non-agricultural employment

	OLS	2SLS	Arellano-Bond
Log lagged proto-industrial share	0.938***	0.96***	0.67***
	(0.059)	(0.038)	(0.168)
Log American export Exposure	0.822***	0.70***	0.80***
	(0.053)	(0.023)	(0.05)
Log land/labour ratio	0.023	0.006	0.40
	(0.069)	(0.043)	(0.23)
Enclosure	−0.012	−.016	−0.018
	(0.013)	(0.012)	(0.014)
Patents	0.000	0.015	0.008
	(0.002)	(0.010)	(0.006)
Intercept	0.05	−.14	
	(0.99)	(0.47)	
IV F-statistic		patents	
		(7)	
R^2	0.992	0.987	
N	155	182	111
Time fixed effects	✓	✓	✓

Note: Dependent Variable: log of the share of non-agricultural employment. Standard errors in parenthesis are clustered and robust. *** $p<0.01$, ** $p<0.05$, * $p<0.10$. The constant term is eliminated in the Arelland-Bond difference estimator

non-agricultural employment by about .24%. The exports of textiles had the largest employment elasticity where exports of a variety of cotton, woollen, linen and silk goods created employments such as weavers, carders, tailors, button-makers, tailors etc. Exports of other manufactured goods such as watches, buttons, jewellery, cutlery and a hundred other small items created substantial manufacturing employment in occupations such as leatherworkers, wheelwrights, paper-makers etc (Keibek, 2017, p.47). Surprisingly, metal exports per worker per county do not have any effect on non-agricultural employment and this could be a reflection of the fact that workers in the metal trades and tools were highly specialized and did not have much employment generating effect but instead had an effect on innovation[22].

Table 7: Manufacturing industries contribution to the share of non-agricultural employment

	(1)	(2)	(3)
Log lagged proto-industrial share	1.057***	0.901***	0.695***
	(0.15)	(0.11)	(0.137)
Enclosure	-0.043	-0.043	-0.028
	(0.030)	(0.024)	(0.017)
Patents	-0.013	-0.013	-0.004
	(0.010)	(0.008)	(0.004)
Log land/labour ratio	0.065	0.134	0.162
	(0.374)	(0.008)	(0.235)
Textiles	0.290**	0.262***	0.277***
	(0.100)	(0.073)	(0.057)
Metal Trades& Tools		0.387	0.089
		(0.0923)	(0.073)
Other manufactures			0.242***
			(0.057)
Observations	111	111	111
Time fixed effects	✓	✓	✓

Note: Dependent Variable: log of the share of non-agricultural employment. Standard errors in parenthesis are clustered and robust. *** p<0.01, ** p<0.05, * p<0.10. The constant term is eliminated in the Arellano-Bond difference estimator

The causes of structural change are numerous and sometimes work in opposite directions. Structural change was intimately linked to the rise of proto-industry in the early modern period and

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[22]Indeed, as expected simple linear regression of patents with different industry exposures shows that exports of metalworks had a significant effect on patents in a county.

growing export specialization during the peak Industrial Revolution period (Crafts, 1985). Although the *share* of non-agricultural employment did not grow much over the 18th century, (63.2% in 1700 to 67.3% in 1801), the *absolute* number of male non-agricultural employment increased by 516,000 workers. In this regard, England was an outlier in terms of its early transition out of agriculture and saw rapid structural change during the 17th century itself (Broadberry et al., 2015)(Wallis et al., 2018). As early as 1700 Britain was already industrialized with nearly 37% of its population in the secondary sector employment Shaw-Taylor and Wrigley (2014) while by 1720 nearly 40% of its rural population was employed in non-agricultural activities suggesting the crucial importance of proto-industrialization for England (Wallis et al., 2018, p.888). In Allen (2003, p.422), the causes of proto-industrialization are located in the growth of manufacturing productivity, especially in the expansion of the woollen textiles industry. Patents which are a proxy for innovation and manufacturing productivity, however, do not show any influence on non-agricultural employment. The only significant variable, as expected, is the American export exposure and the lagged share of non-agricultural employment. For Crafts (1985), the entire process of structural change through the Industrial revolution (1760-1830) was underwritten by Britain exploiting its relative comparative advantage in exporting manufactures[23]. Early industrialization meant not just a growth of industry, but also prompted a farm-to-factory transition, whereby unskilled agricultural workers moved to industrial counties which had pools of skilled workers (De Pleijt et al., 2020)[24] As exports 'widened the market', diversified and increased industrial output, the share of manufacturing employment in total employment increased and resources were fully utilized since labour demanded by an industry is a positive function of the demand for industrial output (O'Brien and Engerman, 1991)(Esteban, 1997)(Hudson and Berg, 2021)(Zahedieh, 2021). Even Mokyr (2018, p.47) notes that in the off-season when the opportunity cost of employment is low, an expansion of industrial output can be attributed to growing exports through the increased employment of workers. Thus, in the 18th century an increase in manufacturing exports to America caused a higher share of non-agricultural employment across English and Welsh counties[25].

Previous literature has found significant effects of foreign trade on different outcome variables with varying magnitudes. Crafts (1985, p.129) conjectured that if British imports from, and exports to all regions were reduced to the French levels in 1841, then the share of the labour force in agriculture would have been higher by about 3.5% due to the underlying loss in comparative advantage. For a panel of European countries, Allen (2003, p.422) finds that a 1% increase in

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[23]A necessary condition for industrialization to proceed is that capital accumulation and technical progress in agriculture should outweigh the diminishing returns in agriculture and increase the agricultural output per worker. It should be noted that Industrialization, thus defined, is possible while the absolute number of workers in agriculture keeps increasing and refers only to the *share* of workers in agriculture

[24]Structural change involves not just a reallocation of labour, but also a change in the composition of investment. However, Crafts (1985, p.123) estimates that agricultural savings financed only 1/5th of industrial investment

[25]While the dynamic panel data specification addresses endogeneity, it does not address reverse causality. However, the reasons adduced in Section 4 regarding the autonomy of exports to America and the evidence provided therein convincingly shows that reverse causality is not an issue

intercontinental trade increases the proto-industrial share of labour by .1%. With respect to the effect of intercontinental trade on urbanization, Palma (2016, p.140) estimates that trade with non-European countries increased urbanization in England by 2.5% in 1750 and 11.7% in 1800[26]. With respect to the effect of intercontinental trade on real wages, Palma (2016, p.140) estimates that trade with non-European countries increased real wages in England by 5.4% in 1750 and 18.4% in 1800 and allowed England to escape the Malthusian trap with a growing population. Similarly using a computable general equilibrium model, Clark et al. (2014) find that if Britain was autarkic, then the real wage would have been less by 14% in 1760 while in 1850 it would have been less by 33.5%. On the other hand preventing trade between Britain and North America would have reduced real wages by 4.3% in 1760 and 3.2% in 1850. They also find that restricting trade with North America would have reduced cotton output by only 1.1% in 1760, while in 1850 it would have reduced cotton output by 8% due to the disruption of cotton supplies from America indicating Britain's growing dependence on America's factor endowments. The estimates found in the present essay show that industrial exports to America had a .8% effect on the share of male, non-agricultural employment. An increase in industrial exports to America by about 100,000£ would create non-agricultural employment for about 769 male workers in 1761. An increase in 11.1 million £ worth of Industrial exports to America in the 18th century as a whole increased non-agricultural employment by 412,800 male workers in England and Wales. Industrial exports to America per worker per county also had a significant effect on agricultural wages by about .17% (see Table **??**) keeping in line with previous literature.

Regional patterns based show that between 1700 - 1760, secondary sector employment remained the main growth sector in nearly 1/3 of all counties, while the tertiary sector grew in 1/2 of all counties (Keibek, 2017, p.188). The coefficient of about 0.66% on the lagged share of non-agricultural employment in Table 6 shows the persistence of regional production as well as rapid regional transformation occurring in the 18th century which shifted industrial production and population growth to the North of Britain. Between 1760 and 1817 during which the industrial revolution was at its peak, only the north-west of England and West-Midlands show strong growth in labour force, while some counties in the south and south-east of England increased their labour share in agriculture. While urban growth in the 17th century was fastest in London and old historic regional towns like Norwich, Gloucester, the 18th century would see rapid urban growth in new manufacturing towns like Birmingham, Manchester etc. followed by port towns like Bristol, Liverpool, Glasgow etc (Wrigley, 1985, p.693)[27]. The counties with the highest export exposure during the 18th century were Lancashire, West Riding Yorkshire, Warwickshire, Leicestershire and

[26]Urbanization is commonly used as a proxy for pre-modern economic development and defined as more than 5000 inhabitants in a town, rural or urban. Assuming that the urban population was not engaged in farming, the proto-industrial population is equal to the total population minus the rural agricultural population and urbanization growth shows a similar trend as non-agricultural employment, although at a higher level

[27]The ports on the east coast like Great Yarmouth, Colchester were primarily oriented towards trade with Europe and ports like Hull and Newcastle were engaged in coastal trade with London, supplying it with coal

Staffordshire, all of whom were located in the catchment area of Atlantic ports such as Liverpool, Bristol and London and witnessed rapid structural change (Hudson and Berg, 2021, p.261,267). Counties such as Lancashire and Yorkshire had 2/3rd of their workforce already employed in the secondary sector by 1750. It was not just external trade, but also improvements in agriculture, transport infrastructure that were the principal dynamic behind rapid urbanization (Bogart et al., 2022).

5.2   Inventive activity

One of the key characteristics of the Industrial Revolution was the rapid pace of innovation and technological progress. The pace, pattern and diffusion of inventions was determined by the the growing demand and expansion of output and the availability of 'useful knowledge' embodied in skilled workers. The growing demand from the Americas for metalworks, other manufactured goods, and textiles created an induced demand for innovation. Overseas markets, particularly the protected plantation based colonies, not only afforded an opportunity to diversify production in manufactures, but they also created a 'market for inventive activity' through investment in research and development Zahedieh (2013). Inventors invested money in inventions only if they believed those inventions were useful and profitable, and an extended size of the market affected profitability by amortization of the R&D costs. It was only when the social benefits exceeded the costs of the invention, that an inventor with a enforceable patent would be able to recoup the R&D costs (Allen, 2011). Using the density of patents per county as a proxy for innovation, one can test the hypothesis of 'induced innovation' using Allen's model. Figure 4 shows the distribution of patents across English counties in three reference years; 1761, 1781 and 1801, based on B. Woodcroft's *Reference Index of English Patents of Invention, 1617-1852* and recently compiled and summarized by Dowey (2017).

In line with the 'induced innovation' hypothesis, one should expect that counties that were undergoing rapid structural change with a higher share of manufacturing output and employment should show higher inventive activity, since innovation is a function of output and demand. Table 8 shows the determinants of patents. The share of non-agricultural employment and the land-labour ratio are statistically significant determinants of inventive activity. In the preferred regression specification, using the IV-2SLS estimator in column 2 where the proto-industrial share of labour is instrumented by American export exposure, an increase in non-agricultural employment by 1% increases inventive activity by 1.45% showing that innovation is highly responsive to the growth in non-agricultural employment. Patents per capita which capture the density of innovation across English counties increased as the share of non-agricultural employment and output increased in response to American demand as inventors invested money in R&D to develop new products and processes. The stated purposes of the inventors such as product innovation, differentiation and de-
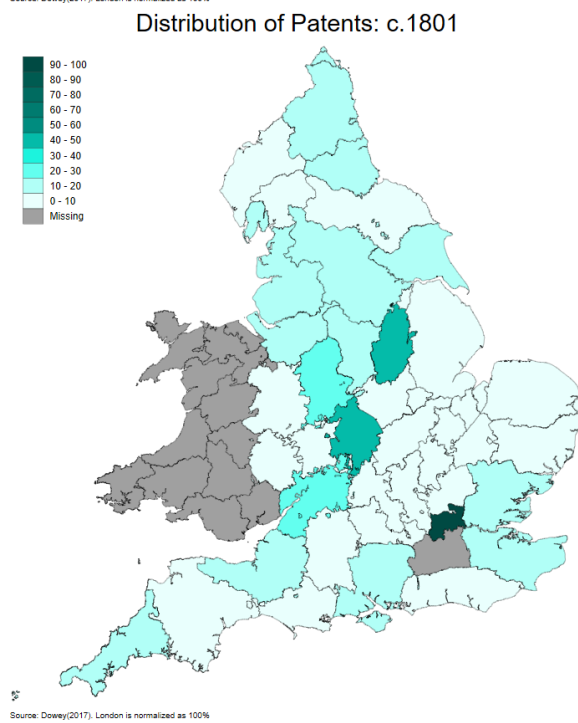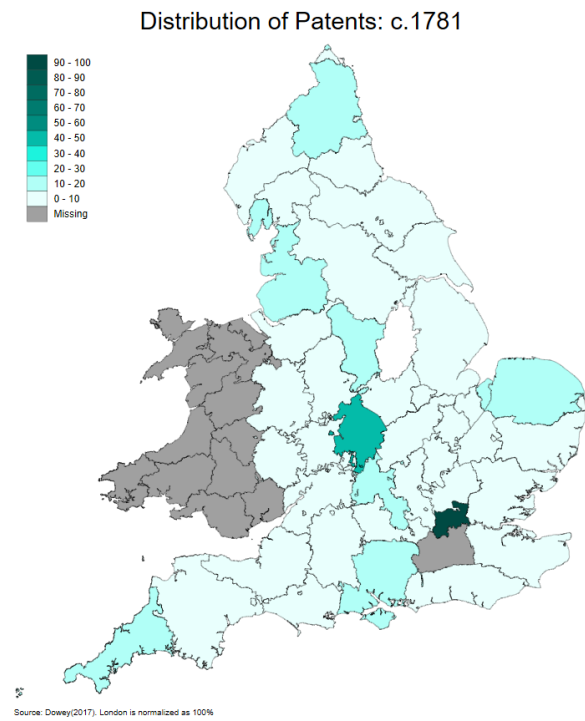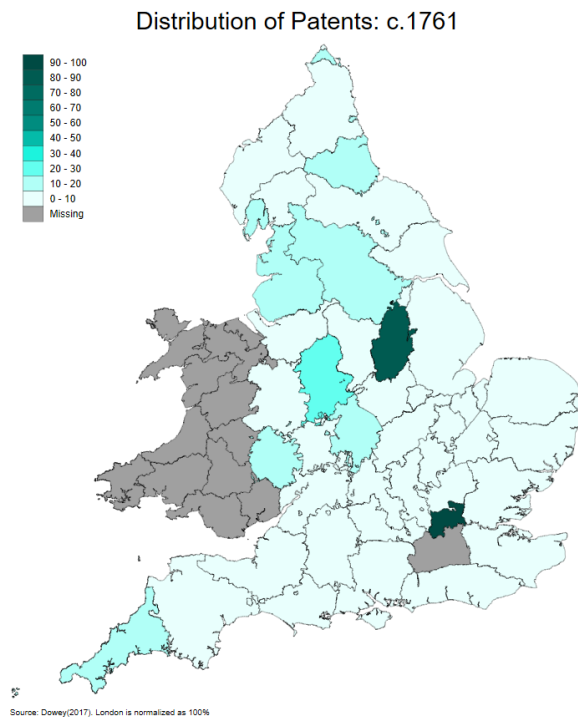
Figure 4: Distribution of Patents across England

velopment were primarily driven by serving a growing consumer demand abroad. Moreover, there is uni-directional causality going between the share of non-agricultural employment and patents lending increased support to the induced innovation hypothesis (Zahedieh, 2021)(Allen, 2011)(Hudson and Berg, 2021).

Table 8: Patents

	OLS	2SLS	Arellano-Bond
Log proto-industrial share	0.49	1.45***	1.45**
	(1.13)	(.38)	(0.65)
Log American export exposure	2.06***	−	−
	(.78)		
Log land/labour ratio	−.93	−.83***	−.83**
	(.20)	(.23)	(.31)
Enclosure	−.05	−.17	−.17
	(.30)	(0.30)	(.27)
Schools	−.20**	−.13**	−.13
	(0.75)	(0.64)	(.11)
Intercept	3.18***	3.61***	4.11
			(.37)
IV F-statistic		Proto-industrial share	
		(483)	
R^2	0.412	0.389	−
N	210	210	210
Time fixed effects	✓	✓	✓

Note: Dependent Variable: log of standardized patent counts. Standard errors in parenthesis are robust and clustered. *** $p<0.01$, ** $p<0.05$, * $p<0.10$. In the 2SLS regression, the proto-industrial share is instrumented by its own lag and the American export exposure.

Atlantic markets drove the rapid transformation of the metalworks industry in the late 17th and early 18th century, and the textiles industry starting from the third quarter of the 18th century. In the early 18th century, a large majority of patents were directed towards improvements in navigation, metallurgy, precision instruments, mining pumps etc with patents in textile industry less than 10% of the total patents (Zahedieh, 2021, p.291)[28]. A good example is Newcomens pump engine which was invented to solve the problem of drowned mines and was closely connected to the revival of the West Country and Cornish tin and copper mines in response to growing demand in the Americas (ibid, p.821)[29] The number of Steam Engines in the county of Cornwall increased

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[28]This is confirmed by a simple linear regression of patents on specific industries' export exposure. Only metalworks exposure is statistically significant among textiles, metalworks and other manufactures

[29]While documenting the role of a buoyant colonial demand, Zahedieh (2013, p.813-815) also acknowledges the role of useful knowledge a'la Mokyr, in reducing fuel costs of smelting

from 6 to 87 in the 18th century (Kanefsky and Robey, 1980). Patents in the textile industry would come to dominate inventive activity in the third and fourth quarter of the 18th century, as buoyant American demand for new woollens, lines and cottons would drive product revolution, and later process revolution in the Textiles industry (Hudson and Berg, 2021, p.269-270). Nearly 60% of the patents in the textiles industry had the stated purpose by inventors of product differentiation, development, and improvement, while it was only in the last decade of the 18th century, that the stated purpose of inventors was factor and material saving (Griffiths et al., 1992, p.892).

Overseas expansion in the Atlantic economy incentivized innovation and raised the returns on inventive activity and skilled workers in the metalworks and mechanical sector by enlarging the market (Zahedieh, 2021, p.291), and inventors responded to market activity temporally and spatially (Bottomley, 2014). The growth of the market and industrial output captured here through the growth of non-agricultural employment, had a positive impact in stimulating the demand for induced innovation. The importance of foreign demand has also led Mokyr (2018) to revise his position and concede that "microinventions that kept improving the quality and reducing the prices of goods produced may have been a function of output and and thus of the size of the market....insofar as export markets permitted expanded sales...they led to productivity increases and lower costs" (ibid., p.47). As Griffiths et al. (1992) note that explanation of technical change that trace their increase in the growth of industrial output due to exogenous shifts in foreign demand or better utilization of resources cannot be easily dismissed.

6 Conclusion

The significance of growth of the American market for structural change and industrialization in 18th century Britain has not been fully acknowledged in the historiography of the Industrial Revolution. This is in part due to the exclusive focus on factors internal to Britain, and in part due to choice of neoclassical modelling which cannot but assign a passive role to demand. The evidence systematized and presented in this essay has argued that foreign demand, far from being a passive factor in the Industrial revolution, was an important cause of structural change and laid the conditions for the subsequent Industrial Revolution. In particular, the autonomous export markets of the Americas provided an important stimulus for industrial output and the increase in non-agricultural employment (O'Brien and Engerman, 1991).

A reduced version of Allen (2003) multi-causal model of early modern European economic development is used to estimate the effect of growing industrial exports to America on Industrialization in Britain. Rising industrial exports per worker to the Americas turn out be an important factor for the share of non-agricultural employment across British counties. Not only did the growth of

a New Market stimulate industrial development, but it also led to a higher level of patents per capita, lending support to the induced innovation hypothesis. More crucially, there is evidence that it was the expansion of non-agricultural employment and output that led to an increase in inventive activity and innovation, and not the other way around. This should cast doubt on the purely supply-side explanations of industrial and technological development, and lead to a more balanced perspective on the role of external demand in explanations of the British Industrial Revolution. The importance of external demand accords well with the long-standing theme in the history of economic thought from the early mercantilists to modern macroeconomists who argue that the fundamental causes of economic development are to be found in the growth in the 'size of the market' and aggregate demand. It also accords well with the cliometric literature that argues that there was a strong demand for technology in the British Industrial Revolution (Allen, 2011).

The growth of the Atlantic economy was truly consequential for industrialization in Britain. In the *Wealth of Nations*, Adam Smith would presciently observe with reference to the Americas that;

> "By opening a new and inexhaustible market to all the commodities of Europe, it gave occasion to new divisions of labour and improvements of art, which, in the narrow circle of ancient commerce, could never have taken place for want of a market to take off the greater part of their produce"

The growth of autonomous exports to Americas were not just due to the 'colonial preference' to import tropical groceries in Britain, but also due to the relatively high investments in Naval power to protect export markets and reduce export competition. In the words of O'Brien and Engerman (1991) "Foreign markets had...been seized, created and protected" which underscores the importance of political economy of autonomous exports and the mutual interaction between power and plenty.

References

Allen, R. C. (2003). Progress and poverty in early modern europe. *The Economic History Review*, 56(3):403–443.

Allen, R. C. (2011). Why the industrial revolution was british: commerce, induced invention, and the scientific revolution 1. *The Economic History Review*, 64(2):357–384.

Ball, L. (2014). Long-term damage from the great recession in oecd countries. *European Journal of Economics and Economic Policies: Intervention*, 11(2):149–160.

Berg, M. (2005). *The age of manufactures, 1700-1820: Industry, innovation and work in Britain*. Routledge.

Berrill, K. (1960). International trade and the rate of economic growth. *The Economic History Review*, 12(3):351–359.

Blanchard, O. J. and Summers, L. H. (1986). Hysteresis in unemployment.

Blecker, R. A. (2013). Long-run growth in open economies. *The Oxford Handbook of Post-Keynesian Economics, Volume 1: Critiques and Methodology*, page 390.

Blecker, R. A. and Setterfield, M. (2019). *Heterodox macroeconomics: Models of demand, distribution and growth*. Edward Elgar Publishing.

Bogart, D., You, X., Alvarez-Palau, E. J., Satchell, M., and Shaw-Taylor, L. (2022). Railways, divergence, and structural change in 19th century england and wales. *Journal of Urban Economics*, 128:103390.

Bottomley, S. (2014). Patenting in england, scotland and ireland during the industrial revolution, 1700–1852. *Explorations in Economic History*, 54:48–63.

Broadberry, S., Campbell, B. M., Klein, A., Overton, M., and Van Leeuwen, B. (2015). *British economic growth, 1270–1870*. Cambridge University Press.

Clark, G. et al. (2007). What made britannia great? how much of the rise of britain to world dominance by 1850 does the industrial revolution explain? *The New Comparative Economic History: Essays in Honor of Jeffrey G. Williamson*, pages 33–57.

Clark, G., O'Rourke, K. H., and Taylor, A. M. (2014). The growing dependence of britain on trade during the industrial revolution. *Scandinavian Economic History Review*, 62(2):109–136.

Coatsworth, J. H. (1967). American trade with european colonies in the caribbean and south america, 1790-1812. *The William and Mary Quarterly: A Magazine of Early American History*, pages 243–266.

Crafts, N. (1985). *British economic growth during the industrial revolution.* Oxford: Clarendon Press; New York: Oxford University Press.

Crouzet, F. (1980). Toward an export economy: British exports during the industrial revolution. *Explorations in Economic History*, 17(1):48.

David, H., Dorn, D., and Hanson, G. H. (2013). The china syndrome: Local labor market effects of import competition in the united states. *American economic review*, 103(6):2121–68.

Davis, R. (1962). English foreign trade, 1700-1774. *The Economic History Review*, 15(2):285–303.

Davis, R. (1973). *The rise of the Atlantic economies*, volume 143. Cornell University Press.

Davis, R. (1979). *The industrial revolution and British overseas trade.* [Leicester]: Leicester University Press; Atlantic Highlands, NJ: Humanities Press.

De Pleijt, A., Nuvolari, A., and Weisdorf, J. (2020). Human capital formation during the first industrial revolution: evidence from the use of steam engines. *Journal of the European Economic Association*, 18(2):829–889.

De Vries, J. (1994). The industrial revolution and the industrious revolution. *The Journal of Economic History*, 54(2):249–270.

Deane, P. and Cole, W. (1967). *British economic growth, 1688-1959: trends and structure.* Cambridge University Press.

Deane, P. and Habakkuk, H. J. (1963). The take-off in britain. In *The Economics of Take-Off into Sustained Growth: Proceedings of a Conference held by the International Economic Association*, pages 63–82. Springer.

Dowey, J. (2017). *Mind over matter: access to knowledge and the British Industrial Revolution.* PhD thesis, London School of Economics and Political Science.

Eltis, D. (1995). New estimates of exports from barbados and jamaica, 1665-1701. *The William and Mary Quarterly*, 52(4):631–648.

Esteban, J. C. (1997). The rising share of british industrial exports in industrial output, 1700–1851. *The Journal of Economic History*, 57(4):879–906.

Eversley, D. (1967). The home market and economic growth in england, 1750-1800. In *Land, Labour and Population in the Industrial Revolution*, pages 209–252. Edward Arnold, London.

Fatás, A. and Summers, L. H. (2018). The permanent effects of fiscal consolidations. *Journal of International Economics*, 112:238–250.

Feenstra, R. C., Ma, H., and Xu, Y. (2019). Us exports and employment. *Journal of International Economics*, 120:46–58.

Findlay, R. (1990). The "triangular trade" and the atlantic economy of the eighteenth century: a simple general-equilibrium model.

Findlay, R. and O'rourke, K. H. (2007). *Power and plenty: Trade, war and the world economy in the second millenium.* Princeton University Press.

Girardi, D., Paternesi Meloni, W., and Stirati, A. (2020). Reverse hysteresis? persistent effects of autonomous demand expansions. *Cambridge Journal of Economics*, 44(4):835–869.

Gomes, L. (1987). *Foreign trade and the national economy: mercantilist and classical perspectives.* Springer.

Griffiths, T., Hunt, P. A., and O'Brien, P. K. (1992). Inventive activity in the british textile industry, 1700–1800. *The Journal of Economic History*, 52(4):881–906.

Hatton, T. J., Lyons, J. S., and Satchell, S. (1983). Eighteenth-century british trade: Homespun or empire made? *Explorations in Economic History*, 20(2):163.

Hobson, J. A. (1902). *Imperialism: a study.* Spokesman Books.

Hudson, P. and Berg, M. (2021). Slavery, atlantic trade and skills: a response to mokyr's' holy land of industrialism'. *Journal of the British Academy*, 9:259–281.

Imlah, A. H. (1958). *Economic elements in the Pax Britannica: Studies in British foreign trade in the nineteenth century.* Harvard University Press.

Inikori, J. E. (1987). Slavery and the development of industrial capitalism in england. *The Journal of Interdisciplinary History*, 17(4):771–793.

Inikori, J. E. (2002). *Africans and the Industrial Revolution in Britain.* Cambridge University Press.

John, A. H. (1965). Agricultural productivity and economic growth in england, 1700–1760. *The Journal of Economic History*, 25(1):19–34.

Jordà, Ò., Singh, S. R., and Taylor, A. M. (2020). The long-run effects of monetary policy. Technical report, National Bureau of Economic Research.

Kalecki, M. (1934). On foreign trade and 'domestic exports'. In *Selected Essays on the Dynamics of the Capitalist Economy 1933-1970*, pages 15–25. Cambridge University Press.

Kalecki, M. (1967). The problem of effective demand with tugan-baranowski and rosa luxemburg. In *Selected Essays on the Dynamics of the Capitalist Economy 1933-1970*, pages 146–155. Cambridge University Press.

Kanefsky, J. and Robey, J. (1980). Steam engines in 18th-century britain: a quantitative assessment. *Technology and Culture*, 21(2):161–186.

Keibek, S. (2017). *The male occupational structure of England and Wales, 1600-1850.* PhD thesis, University of Cambridge.

Luxemburg, R. (1951). *The Accumulation of Capital.* Routledge.

McCloskey, D. (1981). *(1981) Enterprise and Trade in Victorian Britain: Essays in Historical Economics.* Allen & Unwin.

McCombie, J. and Thirlwall, A. (1994). Export-led growth and the balance-of-payments constraint. In *Economic Growth and the Balance-of-Payments Constraint*, pages 421–456. Springer.

McCusker, J. J. and Menard, R. R. (2014). *The Economy of British America, 1607-1789.* UNC Press Books.

Mendels, F. F. (1972). Proto-industrialization: the first phase of the industrialization process. *The journal of economic history*, 32(1):241–261.

Mokyr, J. (1977). Demand vs. supply in the industrial revolution. *The Journal of Economic History*, 37(4):981–1008.

Mokyr, J. (2018). Editor's introduction: The new economic history and the industrial revolution. In *The British industrial revolution*, pages 1–127. Routledge.

Nelson, C. R. and Plosser, C. R. (1982). Trends and random walks in macroeconmic time series: some evidence and implications. *Journal of monetary economics*, 10(2):139–162.

North, D. C. (1961). *The economic growth of the United States 1790-1860.* Prentice-Hall.

O'Brien, P. K. and Engerman, S. L. (1991). Exports and the growth of the british economy from the glorious revolution to the peace of amiens. In *Slavery and the Rise of the Atlantic System*, pages 177–209. Cambridge University Press.

Palma, N. (2016). Sailing away from malthus: Intercontinental trade and european economic growth, 1500–1800. *Cliometrica*, 10(2):129–149.

Palma, N. (2022). The real effects of monetary expansions: evidence from a large-scale historical experiment. *The Review of Economic Studies*, 89(3):1593–1627.

Price, J. M. (1989). What did merchants do? reflections on british overseas trade, 1660–1790. *The journal of economic history*, 49(2):267–284.

Shaw-Taylor, L. and Wrigley, E. A. (2014). Occupational structure and population change. In *The Cambridge economic history of modern Britain*, volume 1, pages 53–88. Cambridge University Press Cambridge.

Shepherd, J. F. and Walton, G. M. (1972). *Shipping, maritime trade and the economic development of colonial North America.* Cambridge University Press.

Solow, B. L. (1991). Introduction. In *Slavery and the Rise of the Atlantic System*, pages 1–20. Cambridge University Press.

Thomas, A. M. (2021). On "effectual demand" and the "extent of the market" in adam smith and david ricardo. *The European Journal of the History of Economic Thought*, 28(3):305–323.

Thomas, R. P. and McCloskey, D. N. (1981). Overseas trade and empire 1700–1860. In *The economic history of Britain since 1700*, volume 2, pages 87–102. Cambridge University Press.

Wallis, P., Colson, J., and Chilosi, D. (2018). Structural change and economic growth in the british economy before the industrial revolution, 1500–1800. *The Journal of Economic History*, 78(3):862–903.

Waterman Gilboy, E. (1932). Demand as a factor in the industrial revolution. In *Facts and factors in economic history: Articles by former students of Edwin Francis Gay*, pages 620–639. Harvard University Press.

Williams, E. (1944). *Capitalism and slavery.* The University of North Carolina Press.

Wrigley, E. A. (1985). Urban growth and agricultural change: England and the continent in the early modern period. *The Journal of Interdisciplinary History*, 15(4):683–728.

Zahedieh, N. (1994). London and the colonial consumer in the late seventeenth century. *Economic History Review*, pages 239–261.

Zahedieh, N. (1999). Making mercantilism work: London merchants and atlantic trade in the seventeenth century. *Transactions of the Royal Historical Society*, 9:143–158.

Zahedieh, N. (2010). *The Capital and the Colonies: London and the Atlantic Economy 1660-1700.* Cambridge University Press.

Zahedieh, N. (2013). Colonies, copper, and the market for inventive activity in england and wales, 1680–1730. *The Economic History Review*, 66(3):805–825.

Zahedieh, N. (2021). Britain's atlantic slave economy, the market for knowledge and skills, and early industrialisation: a response to joel mokyr's 'holy land of industrialism'. *Journal of the British Academy*, 9:283–293.