Calvinism, Huguenots and the Industrial Revolution

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Abstract

In this paper, we argue that the industrial revolution in 18th century Great Britain had its origins in Calvinism as expressed by/in the 50,000 French Protestant refugees that landed on the shores of England and Ireland in the 16th and 17th centuries. Unlike most theories that are essentially unidimensional (Moykr’s “Republic of Letters” and McCloskey’s “Bourgeois Dignity”), ours is multidimensional, involving both pull and push factors. The pull factor was the migration, after the revocation of the Edict of Nantes in 1685, of thousands of Huguenot merchants to England and Ireland. The latter arrived with the intention of plying their trade within a new, expanded network, namely that of late 17th century Britain augmented by what John F. Bosher refers to as the Protestant International, the trade network that resulted from the diaspora of Huguenots throughout the world. This we argue increased the demand for tradeables which in turn spurred invention and innovation both among Huguenot refugees (push factor) and their descendants as well as in the local, predominantly Calvinist population. Our theory provides a structuring framework for the many competing hypotheses of the origins of the industrial revolution, rationalizing them as parts of a greater whole.

Keywords: Calvinism, Huguenots, Industrial Revolution.
1 Introduction

In this paper, we argue that the industrial revolution in 18th century Great Britain had its origins in Calvinism as expressed by/in the 50,000 French Protestant refugees that landed on the shores of England and Ireland in the 16th and 17th centuries. Unlike most causes that are essentially unidimensional (Moykr’s “Republic of Letters” and McCloskey’s “Bourgeois Dignity”), ours is multidimensional (Gilboy 1932), involving both pull and push factors. The pull factor was the migration, after the revocation of the Edict of Nantes in 1685, of thousands of Huguenot merchants to England and Ireland. The latter arrived with the intention/hope of plying their trade/activity within a new, wider trade network, namely that of late 17th century Britain augmented by what John F. Bosher refers to as the Protestant International, the trade network that resulted from the diaspora of Huguenots throughout the World (including post-Edict of Nantes France). This we argue increased the demand for tradeables which spurred invention and innovation both among Huguenot refugees and their descendants as well as in the local population. The propensity to innovate or to tinker (push factor) was greatest in Calvinistic communities (Presbyterian, Baptist and Reformed Protestant) consistent with the Merton thesis (Merton 1938).

It is important to point out that in our view neither of these two factors could independently have caused the industrial revolution (Moykr 1977), but rather that the combination/joint presence of the two is what did. A doubling of merchants in Britain could not alone have resulted in the industrial revolution, much in the same way as an increase in the number of Calvinist “tinkerers” could not have. Instead, these two factors were self-reinforcing. The non-negligible

\footnote{A tinkerer is defined as an individual who engages in non-scientific process-related or product-related research and development. In the majority of cases, the person in question will lack any formal training in the natural sciences (i.e. natural philosophy).}
increase in refugee merchants after the revocation of the Edict of Nantes increased the demand for objects with which to engage in trade (i.e. tradeables), putting a premium on new, productivity and output increasing techniques. Throughout the early 18th century, Huguenot and non-Huguenot “tinkerers” responded—often times, in response to the demands of Huguenot merchants—with new, innovative technologies, increasing the supply of tradeables (textiles, clothing, iron and copper manufactures). What differentiated these “tinkerers” from those on the continent was the presence in England of an “excess supply” or “surplus” of refugee merchants, wanting and willing to engage in commerce. Both of these factors were self-reinforcing. More merchants spurred more innovation and more innovation spurred more merchants, resulting in a manifold increase in output and trade.

Ultimately, the industrial revolution can be attributed to a surge in Calvinism as manifested by the arrival of 50,000 Huguenot refugees, and its defining feature, predestination, that was given full reign in Britain. The latter not only fostered creativity, it encouraged trade and commerce as manifestations/revelations of the property/state of being in God’s grace, of being among God’s chosen. Whereas accumulating wealth was seen as sinful/usurious in papal Europe, it was seen by Calvinists as a reflection of God’s grace. Traditional Roman Catholic doctrines as manifested in Ultra-Montanism, advocated piety and rurality as the keys to eternal salvation, in stark contrast with Calvinism. In many regards, our theory is a refinement of Max Weber’s protestant work ethic to the spheres of science, innovation and commerce. Similarly, it is an extension of Richard Merton’s work on the role of Calvinism and the rise of modern science (from Calvinist Francis Bacon onward), which had its original impetus in a suggestion Weber raised at the end of The Protestant Ethic and the Spirit of Capitalism, namely that future studies might investigate connections between Protestantism and “the development of philosophical and scientific empiricism (Weber 2002 [1905], p. 122). In the 1930s, Robert K. Merton took up

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2 As specified, we avoid the circular reasoning that characterized Gilboy’s original work (Mokyr 1977).

Contrary to the dominant warfare narrative of the historians of the time, the Merton Thesis proposed that certain dominant cultural values expressed in Puritanism contributed to the rise of science. At the social-psychological level, Puritanism provided external motivation and promoted a particular style of scientific practice through its expression of cultural values such as the glorification of God, diligence and industry, choice of vocation, “blessed reason, “profitable education, empiricism rather than rationality, and experimentation over idle contemplation. At the social structural level, the emerging social institution of science drew on religion for legitimacy until it could establish itself as an autonomous domain. As Merton put it, religion “consecrated science as to make it a highly respectable.” (Evans and Evans 2001, 94)

The key to our theory, and the thing that differentiates it from previous theories, is its joint nature. It was neither the presence of Calvinist “tinkerers” nor the presence of Calvinist—mostly Huguenot—merchants, but their joint presence and interaction that led to the industrial revolution. Successful innovation requires, an outlet, a buyer—in short, a market. In fact, one could go as far as to extend Adam Smith’s adage that “the extent of specialization is determined by the size of the market,” to “the extent of the tinkering and innovation is determined by the extent of the market,” (Desmet and Parente 2010) One often times hears stories of simultaneous discovery of products and processes, or previous discoveries that were forgotten. As a general rule, only when an innovation can be brought to market will it be successful. In the case that concerns us, the presence of zealous, eager refugee Huguenot merchants in the port cities of England and Ireland with access to the Protestant International acted as a powerful impetus for the changes in technique that together define the industrial revolution.

The paper is organized as follows. To begin with, we present a cursory review of the literature

3In this regard, our theory falls into all of Joel Mokyr’s three categories of theories of the industrial revolution, exogenous growth, multiple equilibrium and endogenous growth.
on the origins of the industrial revolution organized around the question of causality, specifically around uni-causal versus multi-causal theories. This is followed by a detailed description of the Huguenot/Calvinist tinkerers whose innovations defined the industrial revolution. This is then followed by a detailed description of the Huguenot diaspora and what John F. Bosher referred to as Protestant International, a trade network that spanned the globe. To help structure the argument, we present a AD-AS-like macro model of 18th century British output where the shock is the arrival of 50,000 Huguenot refugees on the shores of Britain. The predictions of the model are then cross-checked with the evidence. We conclude with a discussion of our results in the context of the debate over the origins of the industrial revolution. We argue that our theory, in addition to addressing the question at hand, namely the causes of the industrial revolution, is structuring in nature in the sense that it provides a framework in which to "structure, organize and rationalize" the set of causes identified in the literature.

2 Literature Review

The literature on the causes of the industrial revolution is, not surprisingly, extensive (for an exhaustive survey, see van Neuss (2015)). However, despite its breadth, important questions remain, over two centuries after the event. According to Clark (2012), "The Industrial Revolution is the key break in world history, the event that defines our lives. No episode is more important. Yet the timing, location and cause of the Industrial Revolution are unsolved puzzles (Clark 2012, p.85)." For our purposes, we will structure our review around two themes, namely unidimensional versus multidimensional theories, and secondly, in the case of multidimensional theories, around the question of the simultaneity of causes. Unicausal theories attribute the industrial revolution to a single cause. For example, a number of writers have pointed to the steam engine as being the ultimate cause. Still, others have pointed to multiple causes. For
example, Allen (2009) points to the joint occurrence of the steam engine against a background of entrepreneurship and market size. In other words, like our work which includes push and pull factors, he attributes it to technological change in what was a very “fertile” setting.

Joel Mokyr (2004) points to advances in science and technology (i.e. the Baconian Programme), what he refers to as the Enlightenment. In other words, the 18th century reaped the benefits of the “Republic of Letters,” a pan-European network of scholars and scientists. Deirdre McCloskey, in her trilogy on the emergence of the bourgeoisie in England, pointed to the role of cultural values, specifically to the emergence of bourgeois values, virtues and equality. In other words, attitudes towards business and technology had changed, resulting ultimately in the industrial revolution. Our theory is somewhat similar in spirit, as it involves not so much the emergence of new values (i.e. Calvinism), but rather a surge in the number of Calvinists in Britain.

As Gregory Clark has pointed out (Clark 2012), these theories all suffer from problems, some more serious than others. The problem with Mokyr’s “Republic of Letters” is one of timing and localization. Why did the industrial revolution occur in England and not France, in the late 18th century and not the 17th century? As for McCloskey’s view that a change in cultural values spurred on innovation and growth (i.e. Bourgeois values, culture and equality), there is the problem of why in England, and why in the 18th century. Other countries and regions (Genoa and Venice) had adopted similar values without prompting an industrial revolution.

Like all other fields where the questions are not settled and there is a lack of both evidence and/or a consensus, the question of the origins of the industrial revolution is one in which there is much overlap between competing explanations. For example, Mokyr’s “Republic of Letters” is consistent with Allen’s view which focuses on the steam engine. After all, they are saying the

\footnote{It is worthwhile to note that one of his chief protagonists, Francis Bacon himself was a Calvinist.}
Table 1: Theories of the Cause(s) of the Industrial Revolution

<table>
<thead>
<tr>
<th>Authors</th>
<th>Cause(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North and Weingast (1989)</td>
<td>Glorious Revolution-Based Property Rights</td>
</tr>
<tr>
<td>Galor (2005)</td>
<td>Institutional, demographic, and cultural factors, trade patterns,</td>
</tr>
<tr>
<td></td>
<td>colonial status, and public policy</td>
</tr>
<tr>
<td>de Vries (1994,2008)</td>
<td>Increased Industriousness-Higher Per-Capita Income</td>
</tr>
<tr>
<td>Broadberry and Gupta (2009)</td>
<td>High wages, relative to India.</td>
</tr>
<tr>
<td>Wrigley (2010)</td>
<td>Energy-related innovations</td>
</tr>
</tbody>
</table>

same thing, but in a different way.

The relevant question, it then follows, is there one ultimate (or deciding) cause. As the “Republic of Letters” was pan-European, and bourgeois values co-existed (and in many instances, earlier in time) in other European countries, what was the deciding factor? This is where our work fits in. In keeping with the growth and real business cycle literatures, we attribute the industrial revolution to a shock, namely the revocation of the Edict of Nantes, which resulted in the Huguenot diaspora, the arrrival of 50,000 refugees in England, the subsequent development of new techniques and technologies by what were “tinkerers” and not scientists, and the creation of the Protestant International, a vast, extensive trade network that would change England and the World.5

5It is our view that the “triangular trade” of 17th and 18th century Britain was also the result of the Huguenot Refugees and the Protestant International. It bears reminding that some of the most prominent slave traders were either Huguenots or descendants of Huguenots, including Samuel Touchet, James Laroche and Henry Laurens. One could argue that Calvinism was more accepting of slavery than Catholicism, or its British manifestation, Anglicanism, owing to the idea of predestination. Specifically, Calvinists believed that Black Africans were the descendants of Ham—that is, not chosen. Furthermore, the arrival of Huguenot merchants in England (and the granting of the Asiento to Britain in the Treaty of Utrecht) opened up the West Coast of Africa that had been the exclusive reserve of the Spanish, Portuguese and French. For example, in Senegal in West Africa, the French began to establish trading posts along the coast in 1624.
3 Calvinist/Huguenot/Presbyterian Tinkerers

The industrial revolution has been described as a series of process and product innovations that led to the manifold increase in the level and standard of living in late 18th/early 19th century Great Britain. By far, the most significant and important of these was the development of the Watt steam engine (and the Boulton-Watt rotary steam engine) which allowed Great Britain to exploit the power/force/energy contained in its abundant supplies of coal (Beaudreau 1998, Allen 2009, Wrigley 2010). As work/value added/wealth is a product of force/energy, it stands to reason that the steam engine, more than any other innovation, increased the potential for wealth. However, before this potential could be realized, a number of other sector-specific innovations, applied in nature, would need to occur—typically in the development of energy transmission technologies. An energy transmitting technology is, by definition, a technology for transmitting say Boulton-Watt reciprocating force to accomplish a specific task. A good example of this is the carding and spinning machines, which allowed for the application of force/energy to the task at hand.

And in this regard, the four individuals/tinkerers responsible for this development were Huguenot Denis Papin, Huguenot descendant Thomas Savery, Baptist Thomas Newcommen, and Presbyterian James Watt.

Among the key non-power technology-related innovations were the development of the card-

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6 It is our view that the Watt external condenser steam engine was the key development, without which the industrial revolution as we know it, would have not occurred. Our point is while Watt was not himself a Huguenot nor a descendant of a Huguenot family, he was part of the process that had been set off by the 50,000 Huguenot refugees in Britain.

7 It is our view that tinkering was consistent with Calvinism, more specifically with the individualism that underlies the quest for salvation. Salvation is achieved through self-realization and self-actualization, far removed from the papal structures and hierarchy.
ing machine by Louis Paul, the son of a Huguenot in 1732, the development of the Spinning Jenny by John Kay, and the development of the power loom by Richard Hargreaves, the development of the Fourdrinier paper making process by Huguenot descendant Henry Fourdrinier, the development of the Bessemer steel making process by Huguenot descendant, Henry Bessemer. Other notable innovations include the development of optics by Huguenot descendant John Dollond, the development of the London Stock Market by Huguenot John Castaing, the creation of the Bank of England and the Bank of Ireland presided by (and founded by) Huguenots John Houblon and David Latouche, respectively.8

4 Merchants

While the arrival of 50,000 Huguenots may not, at first glance, appear to be significant, given England’s population of five million at the time, it need be pointed out that (i) most if not all were not laborers/farmers and thus contributed to the swelling of the population of cities, (ii) most, if not all were engaged in merchant and artisanal/industrial activities in urban areas, typically in port cities, and (iii) as a result, in their respective cities and industries, the arrival of the Huguenots was far from insignificant.9 For one, the number of merchants in some towns

8One could argue that a third factor (or set of conditions) was also at work, fostering the industrial revolution, namely the financial deepening that resulted from the establishment, by William of Orange, of the Bank of England in 1694, which led to the multiplication and growth of trade credit, along with development of the London Stock Exchange. It bears reminding that Huguenots were involved in both, with Huguenots John Houblon and Peter De Cane being among the founders and first governors of the Bank of England, and Huguenot John Castaing being the founder of the London Stock Exchange. Thus, cheap, easy credit—via bills of exchange—was conducive to greater colonial trade, which in turn was conducive to greater tinkering through better access to financing what would today be considered process and product development.

9It has been estimated that translated into today’s numbers, the 50,000 Huguenots would be equivalent to the arrival of 600,000 immigrants in England, which is significant given that most would find their way into industry
<table>
<thead>
<tr>
<th>Name</th>
<th>Period</th>
<th>Religion</th>
<th>Latin</th>
<th>Father’s Profession</th>
<th>Huguenot Descent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Technology</strong></td>
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</tr>
<tr>
<td>Denys Papin</td>
<td>1647-1713</td>
<td>Reformed Protestant</td>
<td>Yes</td>
<td>n/a</td>
<td>Yes</td>
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<tr>
<td>Thomas Savery</td>
<td>1650-1715</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Yes</td>
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<tr>
<td>Thomas Newcommen</td>
<td>1664-1729</td>
<td>Baptist</td>
<td>No</td>
<td>Merchant</td>
<td>No</td>
</tr>
<tr>
<td>James Watt</td>
<td>1736-1819</td>
<td>Presbyterian</td>
<td>Yes</td>
<td>Shipwright</td>
<td>No</td>
</tr>
<tr>
<td>Jean Thophile Desaguliers</td>
<td>1683-1744</td>
<td>Reformed Protestant</td>
<td>Yes</td>
<td>Pastor</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Carding and Spinning</strong></td>
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<tr>
<td>Lewis Paul</td>
<td>?-1759</td>
<td>Reformed Protestant</td>
<td>No</td>
<td>Physician</td>
<td>Yes</td>
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<td>John Wyatt</td>
<td>1700-1766</td>
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<tr>
<td>James Hargreaves</td>
<td>1720-1778</td>
<td>Anglican</td>
<td>Illiterate</td>
<td>Tailor</td>
<td>No</td>
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<tr>
<td>Richard Arkwright</td>
<td>1732-1792</td>
<td>Anglican</td>
<td>No</td>
<td>Tailor</td>
<td>No</td>
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<tr>
<td>Jedediah Strutt</td>
<td>1726-1797</td>
<td>Unitarian</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<td>Samuel Courtauld</td>
<td>1793-1881</td>
<td>French Reformed</td>
<td>No</td>
<td>Silversmith</td>
<td>Yes</td>
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<tr>
<td><strong>Paper and Stationary</strong></td>
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<tr>
<td>Henry Fourdrinier</td>
<td>1766-1854</td>
<td>Reformed Protestant</td>
<td>No</td>
<td>Paper-Maker</td>
<td>Yes</td>
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<td><strong>Ceramics and Pottery</strong></td>
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<tr>
<td>Josiah Wedgewood</td>
<td>1730-1795</td>
<td></td>
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<td></td>
<td>Dissenters</td>
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<td><strong>Metalurgy</strong></td>
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<tr>
<td>Abraham Darby</td>
<td>1678-1717</td>
<td>Quaker</td>
<td>No</td>
<td>Farmer/Locksmith</td>
<td>Yes</td>
</tr>
<tr>
<td>Henry Bessemer</td>
<td>1813-1898</td>
<td>n/a</td>
<td>No</td>
<td>Engineer</td>
<td>Yes</td>
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<td>Samuel Garbett</td>
<td>1717-1803</td>
<td>Anglican</td>
<td>No</td>
<td>n/a</td>
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<td><strong>Silver Plating</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Thomas Bouldover</td>
<td>1705-1788</td>
<td>Dissenter</td>
<td></td>
<td></td>
<td>?</td>
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<tr>
<td><strong>Optics</strong></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>John Dollond</td>
<td>1706-1761</td>
<td>Reformed Protestant</td>
<td>n/a</td>
<td>Silkweaver</td>
<td>Yes</td>
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<td><strong>Banking</strong></td>
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<tr>
<td>John Houblon</td>
<td>1632-1712</td>
<td>Reformed Protestant</td>
<td>n/a</td>
<td>Merchant</td>
<td>Yes</td>
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<tr>
<td>David Latouche</td>
<td>1671-1745</td>
<td>Reformed Protestant</td>
<td>n/a</td>
<td>n/a</td>
<td>Yes</td>
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<td><strong>Stock Exchange</strong></td>
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<tr>
<td>John Castaing</td>
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<tr>
<td><strong>Cartography</strong></td>
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<tr>
<td>Francis Beaufort</td>
<td>1774-1857</td>
<td>Anglican</td>
<td>n/a</td>
<td>n/a</td>
<td>Yes</td>
</tr>
</tbody>
</table>
and cities doubled.\textsuperscript{10} It is well documented that the entire silk weaving industry in Spitalfields owed to their arrival, marking the beginning of extensive product differentiation in the British textile and clothing industry. Another example is the Irish linen industry that developed in Lisburn, largely as a result of Huguenot Louis Crommelin, again marking the beginning of the British/Irish fine linen industry. According to William Henry Foote,

The revocation of the Edict of Nantes sent about 70,000 manufacturers and their workmen to Great Britain. These were mostly from Picardy and Normandy, on the British Channel, from the seaports on the west and from Lyons. These introduced many new branches of manufacture; of these, that of silk was the most extensive and profitable. The workmen introduced the looms used at Lyons and Tours, and manufactured brocades, Padua silks, watered silks, black velvet, fancy velvet and stuffs mixed of silk and cotton. A workman by name Mongeorge, brough them the secret lately discoverd at Lyons, of glazing taggety. Until this time the English had imported annually about 200,000 livres worth of this kind of goods. The silk manafactories continued to grow till the coursde of trade was turned from England to the continent and even France itself. (Foote 1870, 455).

Also of considerable importance was the quality or what could be referred to as the “productivity” or “geographical breadth” of these merchants, as measured by the extent of their trading networks. Not only did the number of merchants in England and Ireland increase, but the Huguenot merchants, given their cultural ties to other refugee communities, had extended Britain’s trading network to include the Huguenot diaspora, and France itself. Specifically, now British wares could, at least theoretically, find their way more easily into Prussia, South Africa, Switzerland, the Caribbean, and France—in short, in countries with a significant Huguenot refugee merchant community. According to Susanne Lachenicht,

Those Huguenots who had fled France after 1685 and established themselves as merchants in London, New York, Boston or Charleston also maintained and strengthened ties with family members who had chosen to remain in France. Too little research has been carried out so far, but it seems that Huguenot merchant families favored

\footnote{If ten percent of the refugees were merchants—a conservative estimate—then the ranks of the British merchant class would have increased by 5,000 members, which by all measures is considerable}
a model where one member of the family converted to Catholicism and stayed behind in France in order to uphold the family’s long-established trading contacts and networks in and from France. The London Huguenot merchant Pierre Albert was thus able to trade wine from Bordeaux with the help of his family back in the Bordelais region. Relying on his brother, Baudouin Seignoret successfully organized silk contraband trade from Lyon to London. (Lachenicht 2016, 36)

4.1 The Huguenot Diaspora and the Emergence of the Protestant International

To better appreciate this argument, consider the following thought experiment. Take 200,000 culturally-homogeneous merchants and tradesmen and women in the 17th century from Country A and disperse them in the rest of the world. Then observe the trade patterns and networks that result. Clearly, the resulting trade network will be extensive, involving virtually all the countries in which the refugees migrated to, in addition to Country A’s original trade network. This case, we argue, describes to a tee, the case of the Huguenot diaspora.

Bertrand Van Ruymbeke, Randy Sparks and others have studied the Huguenots and the Atlantic Diaspora extensively. According to R.C. Nash, access to/participation in the diaspora was a key predictor of financial success of South Carolina Huguenot merchants.

For the merchants who arrived after 1700, we find more concrete evidence that the success of Huguenot merchants in South Carolina was based on their connections to prominent networks of European-based Huguenot merchants. The Revocation of the Edict of Nantes strengthened Huguenot economic power by dispersing Huguenot merchants among the leading trading centers of Europe. The Huguenots were the most important element in the massive influx of foreign merchants into England (including Dutch and German Protestants and Portuguese Jews) which itself was the most important change experienced in the organization of English foreign trade in the late seventeenth and eighteenth centuries. Huguenot merchants had traded in London from the late sixteenth century, but the first major wave of Huguenot merchant migrants to England came in the post-Revocation period, mainly from western France, from the ports and inland trading towns which had prospered in the seventeenth-century expansion of the Atlantic economy and which were dominated by Protestant merchants. These refugee merchants traded principally with northern
Europe and the Mediterranean. Insofar as they had colonial interests, they were focused on the established trades to the West Indies and to Boston and New York; before 1700, these merchants took little interest in the insignificant Anglo-Carolinian trade. (Nash 2003, 210)

According to John F. Bosher, this is exactly what happened. He refers to the outcome as the Protestant International or the Atlantic Trade Area, which resulted from the dispersion of French Huguenots in the Americas, in the North Atlantic, and in Africa. Figure 1 shows the emigration patterns and numbers involved. We see that the majority of the refugees went to England and Holland, followed by Prussia, Switzerland. Interestingly, many Dutch refugees eventually emigrated to either England or North America.

Figure 1 **Huguenot Diaspora**

Like the Jewish diaspora out of the Middle East in the 10th century that witnessed the cre-
ation of extensive trade networks in Europe, the Huguenot diaspora led to the creation of a trade network that stretched from Africa to Northern Europe to North America, the Caribbean and South America. Huguenots found their way to Africa, Switzerland, Prussia, Holland, England and Ireland, Sweden, the 13 Colonies, Brazil, Saint-Domingue, Jamaica, New France. Bosher referred to the resulting trade routes and patterns as the Protestant International.

As persecution intensified during the 1680s, Huguenot merchant colonies in Amsterdam, London, Rotterdam, and elsewhere grew larger than the foreign communities in French ports, and their numbers swelled dramatically after the revocation of the Edict of Nantes by the addition of the merchants among the 150,000-200,000 new refugees. Until then, the mercantile part of the Protestant international had been largely composed of English and Dutch merchants together with Walloon refugees from the Spanish Netherlands, but the late 1680s were a turning point when the French element became substantial. Huguenots took an active part in the phenomenal expansion of the Anglo-Dutch and Anglo-American trade in the North Atlantic. The diaspora of Huguenot merchants has been an elusive historical subject. This is partly because the records are scattered and the merchants do not fit easily into the national history of any country. Historians tend to classify Huguenot merchants with other immigrants and so to miss their essentially cosmopolitan character. Much Canadian and American history treats the people who reached North America as though they had turned their backs on Europe, but the Huguenot merchants, at least, had not. (Bosher 1995, 78)

The resulting trade network had a profound effect on Britain’s trading patterns, shifting them from being European-based to being predominantly concentrated in the Atlantic. This is borne out in the data. For example, Figure 2, taken from Thomas and McCloskey (1992) shows a clear shift in trading patterns from Europe to North America and the West Indies. We see that in the case of domestic exports, Europe’s share fell from 82 percent to 21 percent, while that of North America and the West Indies increased from 6 to 32, and from 5 to 25 percent from the beginning to the end of the 18th century. We contend that this was largely the result of the Huguenot merchants and the Protestant International.

Figure 2 Evolution of England’s Trading Patterns
4.2 Huguenot Merchants, the Protestant International and Aggregate Demand

The addition of 50,000 merchants and tradesmen and tradeswomen altered fundamentally Britain’s trading patterns, as shown by the data. In practical terms, it resulted in a greater participation in the Atlantic (read: triangular) trade between Britain, Africa, and the Caribbean. While Britain had been excluded from the slave trade by the Spanish, Portuguese and French, the arrival of the Huguenots who had ties with French slave traders (e.g. in Senegal) marked the beginning of a new era.\(^\text{11}\) Like the Portuguese in Brazil, Britain would now partake in the highly lucrative slave trade. However, it could be argued that the Huguenot presence in King William III’s army and government

\(^{11}\) Clearly, the Asiento, obtained in the Treaty of Utrecht of 1713, contributed greatly to establishing the British slave trade. However, it could be argued that the Huguenot presence in King William III’s army and government
Africa and West Indies trade, including the Carolina and Virginia Companies/colonies. The demand for tradeables (copper bar, iron bar, buttons, etc.) increased markedly, raising prices and prompting a supply response on the part of British manufacturers.

Unlike other colonial powers (Spanish, Portuguese) that focused primarily on trade, Britain emphasized domestic production of tradeables. For example, in lieu of importing copper and iron bar (two important slave trade-related tradeables), and textiles, the British encouraged domestic production—in Devon and Wales. It is our view that the presence of Huguenot merchants, artisans and tinkerers was largely responsible for this development. Unlike the Portuguese and Venetian merchants who engaged solely in trade, the Huguenots multi-tasked, so to speak. Furthermore, it provided an important impetus to innovation. For example, Huguenot innovator Louis Paul was in the employ of London and Lancashire Huguenot merchant and slave trader Samuel Touchet.

Where Britain’s experience differs from that of say Brazil or Spain, was in the domain of innovation. Specifically, we maintain that Calvinism as expressed in the Huguenots and indeed in Calvinist Britons, was in general more conducive to innovation and technological change (Merton 1938). As shown in Table 1, most of the major technological developments of the industrial revolution, including those in banking and trade, were the province of Calvinists with a disproportionate number being Huguenots (relative to the population). What is also noteworthy is the fact that a large proportion of the non-Huguenot key technological innovations occurred in towns and counties with a significant Huguenot population. For example, Derbyshire and Birmingham (Boulton, Watt, Arkwright, Strutt, Boulsover) in the 18th century had significant Huguenot communities.\(^{12}\)

\(^{12}\)The idea here is that the existence of a Huguenot community would be indicative of the presence of the pull factors identified in this paper, namely access to the Protestant International.
As Adam Smith pointed out in the Wealth of Nations, the division of labor is limited by the extent of the market. In this paper, we argue that innovation in England was fostered and, to a large degree, driven by pull (as opposed to push) factors, the most important of which was the emergence and growth of the Huguenot-based Protestant International following the revocation of the Edict of Nantes in 1685 and the arrival of tens of thousands of Huguenots in England. In other words, the resulting growth in outlets for manufactures (textiles, manufactures) extended the market, making invention and innovation profitable and hence, highly desirable.\textsuperscript{13} Table 2 presents a non-exhaustive listing of some of the more prominent Huguenot London merchants. Unlike the silk weavers of Spitalfields and Soho, Huguenot merchants left no trace of their existence, having for the most part integrated rapidly into London and indeed British society.\textsuperscript{14}

5 Predestination: A Powerful, Far-Reaching Incentive

Max Weber had traced the origins of the Protestant ethic to the Reformation, though he acknowledged some respect for secular everyday labor as early as the Middle Ages. Specifically, the Roman Catholic Church assured salvation to individuals who accepted the church's sacraments and submitted to the clerical authority. However, the Reformation had effectively removed such assurances. From a psychological viewpoint, the average person had difficulty adjusting to this new worldview, and only the most devout believers or “religious geniuses” within Protestantism, such as Martin Luther, were able to make this adjustment, according to Weber.

\textsuperscript{13}This is consistent with Desmet and Parente (2011) who argued that innovation was increasing in market size.
\textsuperscript{14}Unfortunately, no definitive list exists. However, there is reason to believe that they numbered in the hundreds if not thousands.
Table 3: **Some Leading London Merchants and Merchant-Bankers of Huguenot Origin**

|--------------------------|--------------|----------------|---------------|-------------------|---------------------------|---------------------------|-------------------------|------------------|----------------|----------------|-----------|----------------|----------------|------------------------|----------------|----------------|----------------|----------------|-----------------|---------------------|

began to look for other “signs” that they were saved. Calvin and his followers taught a doctrine of double predestination, in which from the beginning God chose some people for salvation and others for damnation. The inability to influence one’s own salvation presented a very difficult problem for Calvin’s followers. It became an absolute duty to believe that one was chosen for salvation, and to dispel any doubt about that: lack of self-confidence was evidence of insufficient faith and a sign of damnation. So, self-confidence took the place of priestly assurance of God’s grace.

Worldly success became one measure of that self-confidence. Luther made an early endorsement of Europe’s emerging divisions. Weber identifies the applicability of Luther’s conclusions, noting that a “vocation” from God was no longer limited to the clergy or church, but applied to any occupation or trade. Weber had always detested Lutheranism for the servility it inspired to-

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15Interestingly, Weber was himself descended from 17th century Huguenot emigrants to Germany.
ward the bureaucratic state. When he discussed it in the Protestant Ethic, he used Lutheranism as the chief example of the *unio mystica* that contrasted sharply with the ascetic posture. Later he would associate "Luther, the symbolic exponent of bureaucratic despotism, with the ascetic hostility to Eros an example of Weber’s sporadic tendency to link together bureaucratic and ascetic modes of life and to oppose both from mystical and aristocratic perspectives."[8]

However, Weber saw the fulfillment of the Protestant ethic not in Lutheranism, which was too concerned with the reception of divine spirit in the soul, but in Calvinistic forms of Christianity. The trend was carried further still in Pietism. The Baptists diluted the concept of the calling relative to Calvinists, but other aspects made its congregants fertile soil for the development of capitalism—namely, a lack of paralyzing ascetism, the refusal to accept state office and thereby develop unpolitically, and the doctrine of control by conscience which caused rigorous honesty.

Our hypothesis should be seen as a refinement of Weber’s to the realm of trading activity and technology/technique. While worldly possessions (e.g. accumulating money) could be seen as a “measure of self-confidence,” we believe that scientific and technological discovery was a more significant measure as it indicated a certain oneness or communion with God. For example, if one could transform coal into useful energy, with which work could be accomplished, then one would be “godly” in a certain sense. In other words, if I could uncover the secrets of nature, then that would be a sign of my state of grace with God.16 In the next section, we develop a AD-AS model of the industrial revolution that combines pull and push factors.

16Interestingly, Presbyterian James Watt, the inventor of the external condenser-augmented steam engine, converted in later life to Deism, the belief that one could attain salvation through knowledge of the natural world.
6 Model

In this section, we present a formal model of the pull and push factors described earlier. Specifically, we present a macro model consisting of an aggregate demand and an aggregate supply equation, as shown by Equations 1 and 2, augmented by what we shall refer to as the Huguenot shock, denoted by $h_t$. In keeping with the immigration literature where it is assumed that complete cultural assimilation typically occurs within three-four generations, we assume that the "Huguenots" effect will have dissipated after three generations. References. $y_t^s$ and $y_t^d$ are aggregate supply and aggregate demand, respectively, while $p_t$ is the price level at time $t$ and $h_t$ is the number of Huguenots in the population at time $t$. To begin with, we assume that $\sigma_0$, $\sigma_1$, $\sigma_2$, $\sigma_3$, $\delta_1$, $\delta_2$, and $\delta_3$ are all non-negative, while $\delta_0$ is non-positive.

\begin{equation}
y_t^s = \sigma_0 p_t + \sigma_1 h_t + \sigma_2 h_{t-1} + \sigma_3 h_{t-2}
\end{equation}

\begin{equation}
y_t^d = \delta_0 p_t + \delta_1 h_t + \delta_2 h_{t-1} + \delta_3 h_{t-2}
\end{equation}

This two-equation system can be solved for $y_t^*$ and $p_t^*$, the equilibrium levels of output and the general price level at time $t$. These are given by equations 3 and 4, respectively.

\begin{equation}
y_t^* = \frac{(\sigma_0 \delta_1 - \sigma_1 \delta_0)}{\sigma_0 - \delta_0} h_t + \frac{(\sigma_0 \delta_2 - \sigma_2 \delta_0)}{\sigma_0 - \delta_0} h_{t-1} + \frac{(\sigma_0 \delta_3 - \sigma_3 \delta_0)}{\sigma_0 - \delta_0} h_{t-2}
\end{equation}

\begin{equation}
p_t^* = \frac{(\delta_1 - \sigma_1)}{\sigma_0 - \delta_0} h_t + \frac{(\delta_2 - \sigma_2)}{\sigma_0 - \delta_0} h_{t-1} + \frac{(\delta_3 - \sigma_3)}{\sigma_0 - \delta_0} h_{t-2}
\end{equation}

Equations 3 and 4 capture the push and pull factors affecting both the level of output (in this case, in 18th century Great Britain) and the corresponding price level. In general, an increase in $h_t$ can be viewed, in keeping with the contemporary growth and RBC literatures, as a supply shock.
$h_t$ will increase output via both more tinkering activity and the resulting new output-increasing technologies, and secondly via more merchant activity, increasing aggregate demand. More tinkering activity will, ceteris paribus, increase output via its effect on $p_t$ the aggregate price level. Specifically, it will decrease the overall price level, thus provoking an increase in aggregate demand via an increase in the number of profitable trade opportunities and hence in the number of merchants and, as such, in trading activity both in Great Britain and in the trade networks of the Protestant International. Lower product prices will increase profit opportunities, thus increasing the number of merchants (Huguenot and non-Huguenot).

6.1 Predictions

In this section, we outline the predictions of our model. To do so, we contextualize the model in terms of the question at hand, namely the origins of the industrial revolution. To render our analysis more relevant, we redefine $t$ in terms of generations. That is, $t=1$ corresponds to what we refer to as the first generation of French refugees (1625-1700), $t=2$ as the second generation (1700-1775), and $t=3$ as the third generation (1775-1850). The idea is that an increase in $h_t$, the number of Huguenots in the British population, will affect tinkering and merchant activity in that generation, but will also have effects in later generations. In other words, tinkering in time $t$ will engender more tinkering in the next generation, as well as the generation after that. The important point is that the tinkering and merchant activity in question need not be carried out by the descendants of Huguenots, but by other Calvinists.

The model is general enough to accommodate any combination of parameters and values for $h_t$. The most historically accurate/likely parameterization is one in which $\sigma_1$ is less than $\sigma_2$, but that $\delta_1$ is greater than $\delta_2$, which in words corresponds to the case in which an increase in
Huguenot refugees had a more immediate effect on aggregate demand via the increase in the number of merchants, than it did on aggregate supply via the number of tinkerers. However, the resulting increase in the aggregate price level would have generated a supply response. In the next generation, tinkering activity and perhaps less new merchant activity will combine to lower lower the price level and increase output. This process will continue into the next generation, and then peter out.

7 Empirical Evidence

Our model and indeed our theory predicts that output and growth will be increasing in the three generations of Huguenots and their descendants, the result of the pull and push factors identified. It also predicts that the impetus (pull factor) will come from a change in the structure of Britain’s foreign trade, that the resulting increase in foreign trade will result in important technological advances (push factors) by Huguenot and non-Huguenot tinkerers, and that Huguenots will rise to prominence in the City of London. It also predicts that the sectors most affected by tinkering-based technological advances will be in the tradeables sector of the economy. In this section, we examine the evidence.

A number of writers have pointed out that the industrial revolution was not a singular event, but rather, one that was drawn out over time, consisting of a series of inventions and innovations that culminated in a major change in the structure of the economy as well as in per-capita income. Our model and predictions is consistent with this view, as the shock in question, namely the arrival of 50,000 Huguenot refugees set in motion pull and push factors

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\(18\) In fact, it could be argued that the well-documented increase in wages in the first half of the 18th century owed to heightened trade within the Protestant International. And that this contributed to fostering labor-saving innovation on the part of the “tinkerers.”
that would culminate in the industrial revolution. These changes, such as Louis Paul’s carding machine, were incremental in nature, changing the nature of the underlying processes. In the early part of the 18th century, the increase in the rate of growth would have been relatively modest. However, this would change with the crowning achievement of the 18th century, namely the Watt steam engine, which, by increasing energy efficiency, increased process speeds, thus increasing productivity and output. Tables 4 and 5 show an increase in the average growth rate of British GDP over the course of the 18th century, which is consistent with our predictions. The most pronounced of these occurred towards the end of the century and corresponded to the commercialization of the Boulton-Watt steam engine.

The various pull and push factors identified above would have been operating on the British economy throughout the 18th century. The development of Atlantic trade throughout this period would have exerted a constant pressure on U.K. manufactures to increase output, whether by increasing conventional capital and labor, or via new techniques.

In this section, we proceed as follows. To begin with, we present evidence in the form of existing theoretical and empirical work, the idea being that our approach provides a structuring framework for existing studies and hypotheses. That is, it incorporates virtually all existing hypotheses as part of a greater whole. This is then followed by a call to the some summary data on the growth rate, and finally, by a discussion of the Protestant International.

Table 4 presents our first approach, namely a call to existing theoretical and empirical work, broken down by the three generations. For example, the first generation 1625-1700 witnessed the arrival of the first wave of Huguenots from Wallonie, followed in the 1680 by the 50,000 French Huguenots prior to and after the revocation of the Edict of Nantes. This would have contributed to the formation of Bosher’s Protestant International, with England being one of
<table>
<thead>
<tr>
<th>Generation</th>
<th>Parameterization</th>
<th>Effects</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High $\sigma_2$</td>
<td>Important technological innovations</td>
<td></td>
</tr>
<tr>
<td>III: 1775-1850</td>
<td>High $\delta_3$ and $\sigma_3$</td>
<td>Further growth in markets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smith (1776)</td>
<td>Further innovations</td>
<td></td>
</tr>
</tbody>
</table>
Table 5: **British GDP growth, 1700-1870 (%) per annum**

<table>
<thead>
<tr>
<th>Year</th>
<th>Crafts-Harley</th>
<th>Present Estimates</th>
<th>Annual Data</th>
<th>Present Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700-1760</td>
<td>0.69</td>
<td>0.65</td>
<td>1700/09-1760/69</td>
<td>0.54</td>
</tr>
<tr>
<td>1760-1780</td>
<td>0.64</td>
<td>0.81</td>
<td>1760/69-1780/89</td>
<td>0.92</td>
</tr>
<tr>
<td>1780-1801</td>
<td>1.38</td>
<td>1.56</td>
<td>1780/89-1801/10</td>
<td>1.64</td>
</tr>
<tr>
<td>1801-1830</td>
<td>1.90</td>
<td>1.58</td>
<td>1801/10-1830/39</td>
<td>1.85</td>
</tr>
<tr>
<td>1830-1870</td>
<td>–</td>
<td>2.50</td>
<td>1830/39-1861/70</td>
<td>2.46</td>
</tr>
<tr>
<td>1700-1870</td>
<td>–</td>
<td>1.37</td>
<td>1700/09-1861/70</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Sources: Crafts (1985,45); Crafts and Harley (1992,715).

Table 6: **Average annual growth rate of British population and per capita income, 1700-1870 (%) per annum**

<table>
<thead>
<tr>
<th>Year</th>
<th>Population Growth</th>
<th>Per-capita GDP Growth</th>
<th>Annual Data</th>
<th>Population Growth</th>
<th>Per-capita GDP Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700-1760</td>
<td>0.35</td>
<td>0.30</td>
<td>1700/09-1760/69</td>
<td>0.34</td>
<td>0.20</td>
</tr>
<tr>
<td>1760-1780</td>
<td>0.63</td>
<td>0.19</td>
<td>1760/69-1780/89</td>
<td>0.74</td>
<td>0.19</td>
</tr>
<tr>
<td>1780-1801</td>
<td>1.00</td>
<td>0.56</td>
<td>1780/89-1801/10</td>
<td>1.09</td>
<td>0.56</td>
</tr>
<tr>
<td>1801-1830</td>
<td>1.43</td>
<td>0.14</td>
<td>1801/10-1830/39</td>
<td>1.44</td>
<td>0.41</td>
</tr>
<tr>
<td>1830-1870</td>
<td>1.18</td>
<td>1.32</td>
<td>1830/39-1861/70</td>
<td>1.21</td>
<td>1.25</td>
</tr>
<tr>
<td>1700-1870</td>
<td>0.84</td>
<td>0.53</td>
<td>1700/09-1861/70</td>
<td>0.85</td>
<td>0.48</td>
</tr>
</tbody>
</table>


two hubs, the other being the Netherlands.

Our second approach is to infer, on the basis of our model, a causal role for the generations of Huguenots in measured economic growth, presented in Table 5. We see that average decade growth rates increased throughout the 18th and 19th centuries, going from 0.54 in the first half of the 18th century to 1.85 in the beginning of the 19th century.

Our theory also predicts that the pull factor associated with the creation of the Protestant International would have shifted Britain’s foreign trade from being predominantly based in and with Europe, to the Atlantic Economy.. Thomas and McCloskey (1984), whose data are presented in Figure 2, show this important development:
A notable fact about England’s trade in the eighteenth century is that Europe’s relative importance as a source of imports to England or as markets for its exports declined. By the end of the century, although most re-exports still went to Europe, only 29 per cent of English imports still came from Europe and only 21 per cent of English exports went there. The relative decline was due arithmetically speaking to the rapid growth of the colonial markets, particularly those bordering on the Atlantic Ocean. (Thomas and McCloskey 1984, 90)

Again, it is important to point out that while the Protestant International would have been the impetus to this change, it would not have been limited to first and second-generation Huguenot merchants. For example, while trade with the Carolina and Virginia companies/colonies would have involved a significant number of Huguenot merchants and trading networks, non-Huguenots were also heavily involved. The slave trade was also largely dominated, at least to begin with, by Huguenot refugee merchants, given their propensity to trade in what were “French-dominated” trade networks (i.e. Senegal). Davis (1979) came to similar conclusions, finding that: “Overseas trade did much to strengthen Britain’s economic life during the eighteenth century, and in doing so it helped to create the base without which the industrial take-off might not have proceeded so fast or gone so far. Moreover, once home demand ceased to be sufficient to maintain the momentum of growth of the most advanced industries, around 1800, overseas trade did begin to play an absolutely vital direct part in their further expansion (p. 10).” However, it stands in contrast with Allen (2011) who maintained that high wages and the low cost of coal spurred on innovation, which lowered prices and thus contributed to an increase in foreign trade. The evidence, however, shows that Britain’s improved trade position, especially in the Atlantic, preceded the commercialization of the Boulton-Watt rotary steam engine by half a century.

Our last prediction pertains to the sectoral breakdown of innovation. Our model predicts that given the relevant “pull factor” being the increase in the demand for tradeables, most of the innovation would have been concentrated in these sectors. McCloskey (1989,1994) pointed out that innovations occurred in a diverse range of sectors and activities, casting doubt on
unicausal explanations. Our predictions are consistent with this view, and provide an important refinement, namely that most of these innovations would have occurred in the tradeables sector, given the presence of an important pull factor. Referring to Table 1 which presents the “fathers of the industrial revolution” as well as the corresponding innovations, we see that most did, in fact, occur in the tradeables sector. These included the iron industry, the copper industry, the textiles industry, and the manufactures industry, all of which were heavily solicited by the Atlantic trade (Davis 1979). A good example of this is the British copper industry that was, for all intents and purposes inexistant at the end of the seventeenth century, but which by 1770 was producing half the world’s output (Evans 2015, 3). According to Chris Evans, the emergence of the British copper industry at the end of the seventeenth century and England’s first serious inroad into slave trafficking was more than coincidence.

That a British copper industry should emerge at the tail end of the seventeenth century, just as the English made their first serious inroads into slave trafficking, was more than coincidence. The slave Atlantic constituted an important source of external demand for the fledgling industry. The close relationship between copper and slaving was soon evident in investment patterns and product design. Investors in copper were very often investors in slaving. That so much of the entrepreneurial impetus behind Britain’s copper industry originated in Bristol proved to be telling. Slavers were apt to take shares in copper works because they thereby gained privileged access to the supplies they needed for trading on the Guinea coast; copper masters were likely to take shares in slaving ventures because they thereby secured a market for their metal. This much is evident in the earliest copper works to be established in the Swansea valley, those at Llangyfelach (1727) and White Rock (1739). The partnerships that established them were led respectively by Richard Lockwood, a director of the Royal African Company, and Thomas Coster, MP for Bristol, and a merchant who was deeply involved in shipping captives to South Carolina. (Evans 2015, 3)

Furthermore, the evidence would seem to indicate that two key institutional innovations that paved the way for the industrial revolution, namely the development of the stock market and central banking were also “tradeable goods-related,” specifically with regard to the Atlantic trade. For example, Walvin (2011) has argued that “The thriving British economy after 1660 was made possible mainly because of Britain’s financial institutions. Trading houses, insurance
companies and banks emerged to underpin Britain’s overseas trade and empire. The expansion of overseas trade, especially in the Atlantic, relied on credit, and bills of credit which were at the heart of the slave trade. Similarly, the maritime insurance, which was focused at Lloyds of London, thrived on the Atlantic slave trade. (Walvin 2011, 1).

7.1 Not all Tinkerers Were Created Equal or Created Equally

As shown in Table 1, not all tinkerers were created equal, or created equally. Some focused on new processes, while others focused on new products, or improvements to existing products. Still, others focused on power generation and transmission technologies. Moreover, some were instrumental in developing new, trade-related instruments and institutions. For our present purposes, we shall distinguish between two types of process innovations, namely GPT-based innovations and the associated applied process innovations. The story of the industrial revolution is one in which applied innovations were interwoven with GPT-based innovations over a period of a century, resulting ultimately in an increase in GDP and per-capita GDP. In more practical terms, it is the story of a new prime mover in the form of “steam power” and the associated—and necessary—inventions in process-specific power transmission applied technologies—in short, of integrating the steam engine into the relevant material process.

The narrative begins with a series of applied, tinkering-based innovations, the purpose of which was to convert what were artisanal techniques into industrial ones. Take, for example, Huguenot Louis Paul’s hand-operated carding machine consisting of variable-speed rollers which automatically carded wool, silk and cotton. It would take roughly 30 years before a successful, water-powered (read: industrial) carding mill would appear. Then, some 40 years later, this process would be operated by a steam engine, increasingly markedly machine/process speed and
productivity. Put differently, the core, GPT innovation proceeded the applied innovations. This was also the case in spinning and weaving, where important non-steam engine related process innovations preceded the takeoff phase.

These pre-steam engine process innovations, we argue, were predominantly in the textile industry and were the result of the growing demand for tradeables on the part of the Atlantic trade brought about by the Protestant International. Put differently, the increase in the demand for tradeables (textiles, iron and copper bar, manufactures) put the onus on manufacturers to increase output. In many cases, merchants were directly involved in the financing and overseeing of the tinkering. A good example is London and Lancashire Huguenot merchant Samuel Touchet who was directly involved with Louis Paul in the establishment of the first mechanized carding mill.

The crowning achievement in this story is the steam engine, specifically the Watt steam engine, which represents the culmination of generations of Calvinist/Huguenot tinkerers, beginning with Denys Papin in the late 17th century. His external condenser-version of the Newcomen steam engine was to unleash the energy stored in Britain’s rich coal fields and usher in a period of unprecedented output and income growth. In terms of our model, it corresponds to a non-negligible value for $\sigma_3$, the output effect from the third generation of Calvinist/Huguenot tinkerers, of which James Watt is the quintessential example. This being said, it need be pointed out that without James Watt’s external condenser-augmented Newcomen steam engine, the unprecedented increase in productivity and growth of the late 18th century may have never occurred. Until then, the various innovations (hand- and water-powered machinery) would have increased output, but by a considerably less magnitude.
7.2 Samuel Touchet and Louis Crommelin: The Quintessential Push/Pull Huguenots

According to our thesis and model, the 50,000 Protestant Huguenot refugees did two things, namely pushed technology and supply forward (i.e. $\sigma_1$) and pulled markets and demand forward (i.e.$\delta$), resulting in an increase in growth and output (i.e. $y_t$). In this section, we examine the case of London and Lancashire Huguenot Merchant, Banker, Slave-Trader Samuel Touchet, whose activities were representative of the Huguenot community as a whole, and personify the push and pull factors described above.\footnote{Put formally, Touchet and his fellow Huguenot merchants were simultaneously shifting the demand and supply curve, resulting in an overall increase in output. Again, in so doing, we avoid the specious, circular reasoning found in Gilboy (1932).} Born in Manchester, the son of a cotton trader and manufacturer, Samuel Touchet (Member of Parliament for Shaftesbury, but who represented the interests of Manchester merchants) started his career representing his father’s business in London.\footnote{His career importing raw cotton from the Levant and the West Indies was successful to the extent that manufacturers in Manchester began to suspect him of seeking a monopoly (Kidd 2008).} In 1742 he became involved with the Birmingham inventors Lewis Paul and John Wyatt, who had designed the first machinery to successfully spin cotton mechanically, receiving a grant for 300 spindles off Wyatt. In 1744 Touchet and a partner called Bowker set the spindles up at Touchet’s Mill in Birmingham in association with Paul and with assistance from Wyatt. Little is known of the fate of this mill, but it was sufficiently successful for Touchet later to secure the lease of Marvel’s Mill in Northampton, another of the Paul-Wyatt cotton mills, from Edward Cave. As Touchet became very wealthy over the course of the 1750s his business interests diversified into shipping, insurance broking and the sugar and slave trades.

Another example of a Huguenot push and pull merchant/entrepreneur is Louis Crommelin
who is credited with establishing the very successful Irish linen industry. In 1697, Huguenot Pierre de Ruvigny, now the Earl of Galway, sent a Frenchman to survey Ireland and report on the potential for developing the linen industry. It is believed that this Frenchman was Louis Crommelin since, in the following year, he was appointed as overseer of the Royal Linen Manufacture. Crommelin set up a factory in Lisburn and brought over French Huguenot artisans who had already left France and taken refuge in Holland. Then in 1705 he published an Essay towards the Improving of the Hempen and Flaxen Manufactures in the Kingdom of Ireland. By 1711 the original 70 Huguenot families who had settled in Lisburn had risen to some 120. On the strength of this, Crommelin has always been credited with a decisive role in the development of the linen industry in Ulster and Ireland as a whole. However, it has been argued convincingly that this view is incomplete. The linen industry was already flourishing at the end of the seventeenth century. In 1690 another Huguenot, Nicholas Dupin, had already put forward plans to promote linen manufacture, and in 1697 George Stead claimed that there were between 500 and 1000 looms at work dispersed over the counties of Down, Antrim, Armagh, Tyrone, Derry. Like Touchet, Crommelin combined both pull and push factors, which we argue were instrumental in the origins of the industrial revolution. Having a market (i.e. the Protestant International) for the product, and access to new production techniques were instrumental in the development of the Linen industry in Ireland.

Another example of the transformative effect of the Huguenots on British society is provided by the stories of Huguenots in the cities they established themselves in. Consider the case of the Devon Huguenots, as told by John Lerwill.

Just down the lane and not more than 50 yards from St. Peters is the Chapel of St. Anne’s. Dating, probably, from the early 14th c., this Chapel (now a Museum) remains one of the oldest buildings in the town, and its use has included that of containing a grammar school (where Gay, of Beggar’s Opera fame, was educated). This Chapel was given over to the Huguenots, and they continued services there until 1762 - still in French. The refugees proved a benefit to the town, for in connection
with the woollen trade, they introduced and perfected different branches of manufacture and dyeing processes for which the town became famous. One of the party (and her family, the St. Michels) moved to London where she married Samuel Pepys. In around 1900, an old lady of the Servante family died aged about 100. Mounier Roche (original founder of the Barnstaple Bank) lived to a great age, and said “If my grandfather had not been drowned at 111, he might have been alive now!” One of the actual refugees, M. Daney, lived to be 100. Many of the Barnstaple Huguenots lived to a great age, it is said. (http://www.lerwill-life.org.uk/history/devhugs1.htm)

The Devon case can be seen not only as a microcosm for the role of Huguenots in the Industrial Revolution, but of their effect on the many communities they settled in (e.g. Holland, Switzerland, Germany). A similar point was made by Heinz Schilling in the case of the Huguenots in German towns and their role in the industrialization of Germany as a whole.

Figure 2 Calvinist Netherlanders in German Towns and Cities

Table 1. — Number and Percentage of Netherlandish Refugees in the Population of Selected German Towns

<table>
<thead>
<tr>
<th>Towns</th>
<th>Before 1567</th>
<th>During 1570s</th>
<th>After 1585</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>2,000</td>
<td>13</td>
<td>1,500</td>
</tr>
<tr>
<td>Cologne</td>
<td>—</td>
<td>—</td>
<td>1,000</td>
</tr>
<tr>
<td>Emden</td>
<td>2-3,000</td>
<td>40</td>
<td>5,000</td>
</tr>
<tr>
<td>Wesel</td>
<td>500-1,000</td>
<td>—</td>
<td>7,000</td>
</tr>
<tr>
<td>Aix-la-Chapelle</td>
<td>500-1,000</td>
<td>&lt;5</td>
<td>3,000</td>
</tr>
<tr>
<td>Hamburg</td>
<td>—</td>
<td>—</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Source: H. Schilling, Niederlandische Exulanten (Gütersloh, 1972), p. 179. For a detailed discussion of the figures, which are necessarily approximative, see pp. 175-78.

Note: The table lists only the most important refugee settlements in Germany.

7.3 Huguenots and German Industrialization in the 17th Century

The first Huguenot diaspora, the one that gave Great Britain the Hubelons and other leading Walloon families, also contributed to what at the time was a massive influx of refugees in what is today Germany. Figure 3, taken from Schilling (1983) shows the number and percentage of Huguenot refugees in selected German towns and cities. In a comprehensive study of these immigrants, he identified a similar push-pull pattern to the industrial development of these towns and cities. In short, the refugees brought with them new techniques in a number of fields, including silk weaving, textiles, metallurgy, and trade.

In both respects the impact of Flemish and Walloon immigration was much more dramatic in Frankfurt. When it started in the middle of the sixteenth century, the political elite of the metropolis on the Main was withdrawing gradually from economic activities and well on its way to becoming an urban aristocracy called the Patriziat. In consequence, the Netherlanders for generations dominated Frankfurt’s economic system nearly absolutely, in commerce and banking as well as in industry. Due to their activities the imperial city, well-situated in the center of the economically dynamic western part of the Holy Roman Empire, became one of the most important centers of finance, with the largest annual fairs apart from Leipzig and with powerful modern industries. The industrial innovation had especially far-ranging consequences for the structure of the economic as well as of the social system. In introducing silk production, jewel polishing and special branches of the New Drapery oriented towards a mass market, the Netherlanders introduced new forms of mass production, of techniques and labour organization. They founded proto-factories of capitalistic character, employing unskilled wage labourers in piecework, or businesses based on the work of small masters in domestic industries under the control of big merchants, distributors and entrepreneurs. (Schilling 1983, 21)

The growth of industry in these German cities, according to Schilling, owed to the presence of highly-developed trade and finance networks, similar to those referred to earlier in the case of 18th century Great Britain. He highlighted the case of Johann von Bodeck from Antwerp.

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20 Schilling refers to Calvinistic Netherlanders in reference to Walloon and Flemish Huguenots—that is, from what at the time was the Southern Netherlands.
Johann von Bodeck (1554-1631) from Antwerp, banker and wholesaler, the first
guilder millionaire of Frankfurt, is perhaps the best example of a Flemish refugee
who made a great fortune that was the envy of his native competitors. His emi-
gration from Antwerp after its recapture by the Spaniards in 1585 was in reality a
translocation or transfer of business. Re-established at Frankfurt, Bodeck built up
a far reaching network of banks and wholesale firms all over Europe, typical of the
business organisation of Antwerps’ merchants in the diaspora. (Schilling 1983, p.22).

In addition to the von Bodecks, the families that dominated Frankfurt’s industrial landscape
in the 17th century included the de Neufvilles, cloth and jewellery merchants and bankers, the
du Fays, the Heldeviers and Couvreurs, entrepreneurs and merchants of silk; or the Malapert
and de Spina, who controlled the salt production at Bad Soden and consequently the salt supply
of Frankfurt.

As was the case in Great Britain, second and third generation effects were also present.
For example, the Friedrich Bayer, the founder of the Bayer AG began his career as a silk dyer
in the northern German town of Barmen-Wichlinghausen and could well have descended from
refugees.21 In fact, a number of writers have pointed to this industry as the birthplace of the
highly successful and innovative German chemical industry. In closing, while there are important
parallels between the British and German cases, it bears reminding that there were important
differences, some of which were completely fortuitous. Perhaps the greatest difference was the
nature of the trade network. The British Huguenot community could count on a more extensive
trade network, the Protestant International, which contributed to its vigor. Second, Germany
was not confronted with the problem of water in its coal mines, and hence was not presented
with the “opportunity” to develop the steam engine, the defining innovation of the industrial
revolution. It did, however, spur innovation in German industry, which laid the foundation for
its phenomenal 19th and 20th century economic growth.

21 Bayer, Beyer, Boyer

34
8 Conclusions

God’s grace, predestination and industry were important elements of Calvinist identity. They propelled Calvinists in general and Huguenots in particular to engage in trade, to take up professions and trades, and to strive towards a state of being such that they were more than likely chosen to be in God’s grace. This, we argued, was the key factor in the birth of the industrial revolution in England. In short, the industrial revolution can be understood as the result of pull and push factors associated with the arrival on the shores of Great Britain of 50,000 French Huguenot Calvinists whose sheer presence steered the country away from trade with Europe to trade in the Atlantic. However, not only did they augment the openness of the British economy and the resulting patterns of trade, their inventiveness, relative to other Atlantic empires (France, Portugal, Spain, Holland) resulted in major technological innovations that would go on to change the world. Among these were the steam engine, optics, paper making, steel making, not to mention important innovations in the organization of trade (i.e. banking, stock exchange, etc).

This argument, while novel, is nonetheless consistent with the contributions of the many scholars of the origins of the industrial revolution. As such, in addition to its novelty, it can be seen as a structuring argument, providing the missing pieces to the puzzle. For example, it identifies clearly, cause and effect, not to mention the question of timing. The cause was the arrival of 50,000 French Huguenot refugees, which set in motion, a series of events/developments over several generations that resulted in industrial revolution. These included the shift in Britain’s trading patterns from Europe to the Atlantic, involvement in the slave trade, import substitution via the production of tradeables (iron, copper, textiles), and tinkering-based process and product innovation that was to define the industrial revolution.
It confirms the role of cultural factors as well as technological ones. However, unlike Joel Moykr who emphasized the “Republic of Letters,” and the development of science (what he refers to as the Baconian Programme), we focused on what we refer to as “tinkerers,” who with little scientific knowledge proceeded to make significant changes to processes and products—largely in response to demand-related factors. As far as McCloskey’s idea of bourgeois values, it too is part of the story, as manifested by a surge of Calvinism in London and other port cities, giving rise to, as pointed out, the Protestant International. The Huguenots were merchants, artisans and tinkerers. Their presence in British port cities, we maintained, affected the culture in the direction of “bourgeois dignity.” Allen’s argument regarding the role of energy in general, and steam in particular, against a background of a growing market, is also a constituent part of our narrative. However, we filled in the blanks, providing a description of the various pull and push factors that provided the impetus to the development of the Watt steam engine. The point is that the steam engine was not an isolated, manna-from-heaven-like development, but rather part of a dynamic social and economic process that had its roots in the arrival of 50,000 Huguenot Calvinist refugees.

It is important to understand what we are not saying. We are not arguing that the Huguenots and the Huguenots alone were responsible for the changes that define the industrial revolution, nor in developing the Protestant International. Rather, we are arguing that their arrival *en masse* significantly altered the course of the British history in such a way that all Britons (Huguenot and Non-Huguenots alike) were affected. Yes, Huguenot Denis Papin invented the steam engine, but Thomas Newcomen and James Watts perfected it. Likewise, Huguenot Louis Paul invented the first carding machine, but it was left to others to implement and commercialize it. Put differently, they put Britain on a new, altogether different path, one which propelled it to technological, industrial and economic greatness.
Seen through the lens of religion and culture, one could argue that the Huguenots gave material expression to the Calvinist/Non-Conformist/Protestant revolution that culminated with William of Orange’s victory in the Glorious War of the late 17th century. Unlike the Presbyterian Scots, the French Reformed Huguenots had a tradition of tinkering and merchant activity, which from 1685 onward spread throughout Britain.

In a counter-factual sense, one could argue that Portugal, a country also heavily engaged in Atlantic trade via the Knights Templar and then the Knights of Christ, could have spawned the industrial revolution (via pull factors), but for its lack of Calvinist tinkerers (push factors) contented itself with trade activity alone. Another potential candidate, the Dutch Republic, with its 50,000 Huguenot Refugees and extensive trade network, would have come up short for a number of reasons, namely the virtual monopoly of the Dutch East India Company, the absence of heavy industry and coal, and the emphasis, like Portugal, on pure trade activity. The clinchers, it therefore follows, were the Huguenot/Calvinist propensities to trade and tinker, propensities that were given full reign in 17th and 18th century Britain, resulting in the industrial revolution.
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