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***Cotton Manufacture in Switzerland and Southern Germany, 15<sup>th</sup> - 18<sup>th</sup> Centuries: Agrarian Pre-conditions, Family Economy and Economic Institutions***

The manufacture of cotton cloth and mixed fabrics (in particular fustians) in southern Germany, including Alsace, and northern Switzerland constituted an important element of cotton processing on the European continent. After its early beginning around 1400, it underwent successive stages of development, until it emerged as one of the first major district applying mechanized cotton spinning on the continent in the early 19<sup>th</sup> century.

Incentives and frameworks of decision making provided by economic institutions were of paramount importance on several occasions in the industry's development. Hence, the paper begins by an outline of the history of cotton manufacture in the region under study with special regard to the institutional context. Two shorter paragraphs in turn discuss the agrarian pre-conditions of proto-industrial growth in the region of the Upper Rhine and look at the ways in which cotton manufacture was imbedded in the family economies of rural households.

*Industrial development and economic institutions*

On the basis of pre-existing networks of export-oriented linen manufacture, the production of fustians emerged in southern Germany in two waves ca. 1365–85 and 1411–35. By the middle of the 15<sup>th</sup> century some 60 towns can be identified in which relevant parts of the labour force were engaged in fustian manufacture. A focal area of this network lay in Swabia that formed an industrial district including several major manufacturing towns such as Augsburg, Ulm, Nördlingen and Memmingen. The rural hinterland of these cities formed part of the industrial system in that spinning of yarn was performed largely by rural households (STROMER 1978).

The differential evolution of cotton manufacturing districts in the Near East and in Central Western Europe was mainly the consequence of differences in the course of the Late Medieval crises and of institutional responses in the two regions. As a result of plague epidemics, whose effects were compounded by political turmoil in the wake of the Mongol invasion in the Near East, both areas suffered a sharp reduction in population during the 14<sup>th</sup> century. In the Near East, cotton manufacture had been located in political centres. Their decay, together with labour scarcity, led to a major dislocation of the industry. Cotton, rather than constituting the base for local manufacture, gradually converted into a cash crop cultivated for export in the framework of Eastern Mediterranean trade. In the West, by contrast, the prime consequence of the crisis was relief from Malthusian pressure: Food prices fell and, consequently, a higher share of incomes could be spent on consumer goods, resulting in a general boom of urban economies.

Towns in Southern Germany, in particular, were in an excellent position to exploit the social capital they had acquired through the previous phase of building independent urban communities. In fact, the interaction between town authorities and master artisans produced important economic institutions that were crucial for overcoming high transaction costs (and, consequently, adverse selection and market failure) in the long-distance trade of manufactures: First, artisans organized in craft guilds which functioned, among others, as agencies for quality control: Guild officials regularly inspected the workshops of individual artisans. Second, town authorities and craft guilds together created inspection boards that marked and sealed every piece of cloth destined for export. These trademarks limited the costs of product inspection in trade, and both instruments (workshop inspection and product inspection) together created the potential to create reputation for a particular trademark. As a result, trademarks for fustians from a number of Swabian towns enjoyed a high reputation in a wide market area from ca. 1400 until the early 17<sup>th</sup> century.

The end of this first period saw the emergence of a producer of small cloths made exclusively of cotton, namely, Zurich, situated at the southern margin of the Swabian industrial district. Zurich had at best a weak tradition in export-oriented linen or fustian production and, therefore, possessed only weak guild structures in this sector. Solitary women acting as co-ordinators of

dispersed female production were a major element in this trade when it emerged in the second half of the 16<sup>th</sup> century. Quite unusually it was supported by town authorities eager to provide employment for their poor townsfolk as well as for their subjects in the rural hinterland as climate worsened and Malthusian population pressure made itself felt from the 1560s onwards. The Reformation, which had placed the responsibility for the administration for poor funds in the hands of the authorities, may have provided the decisive incentive for such a policy. In concrete terms, the Town Council repeatedly provided credit for merchants trading with Venice to complement their purchases of raw silk<sup>1</sup> with cotton and financed a stock of cotton for a couple of years in the 1580s. Urban industrial policy was instrumental to the transformation of merchants in long-distance trade into organizers of proto-industrial production (PFISTER 1992a).

The general crisis of the second quarter of the 17<sup>th</sup> century brought a marked shift in the structure of the industrial district of Swabia and adjacent Switzerland and can be considered as a (short) second phase in the industrial development of this region. The dislocations related to the Thirty Years war led to a disruption of export -oriented textile manufacture from which the production sites of southern Germany never really recovered. In the context of the general ruralization of proto-industrial production in Europe during this era, Swabia was highly disadvantaged by its extreme territorial fragmentation. As town and country frequently belonged to different political regimes, unified labour regimes covering a larger geographical area were difficult to create (KIEßLING 1992; S CZESNY 2002).

By contrast, Zurich possessed a substantial subject territory with some 115000 inhabitants during the second half of the 17<sup>th</sup> century. Ruralization of manufacture could therefore operate within an encompassing institutional framework. In concrete terms, no urban (and female) organizers of the cotton sector are documented after the 1630s, and rural putter-outs appear in the sources around this period. From the 1660s onwards, urban authorities attempted to subject the whole range of rural industries, which included wool and silk processing together with cotton

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<sup>1</sup> Silk processing emerged during the third quarter of the 16<sup>th</sup> century along with the integration of Protestant refugees from Italy into the town.

manufacture, to comprehensive regulation. To some extent, this may have helped to check the transaction costs associated with the organization of dispersed production characterized by a high degree of labour division.

A third stage in the industry's development set in with the advent of calico printing. A major event triggering the spread of this activity in our region was the ban of French authorities, eager to protect state-sponsored trade with India, on the production of printed cottons in France itself in 1686–1759. This led to the establishment of a number of production sites along the eastern border of France from the late 17<sup>th</sup> century onwards, the most important centres being Strasbourg, Mulhouse, Basle, Neuchâtel and Geneva, but also Augsburg and Zurich developed important calico printing sectors in the course of the 18<sup>th</sup> century (LÜTHY 1959–1961; CASPARD 1979; PIUZ / MOTTU-WEBER 1990; SIMON 1994).

To some extent, the emergence of calico printing reflects changes in demand. In addition, however, this phenomenon is connected with important shifts originating in the transaction sphere that presage the industrial revolution in a number of respects. Three elements should be highlighted here.

First, calico printing mills were distinguished by their sheer size. Mean factory size amounted to one hundred and more in major production centres (cf. Thomson 1991), and in our region we frequently find large enterprises with 500 to 700 workers. As such, they were considerably larger than early mechanical mills. Typically, large factories included laboratories for the mixture of colorants and mordants, workshops to carve printing blocks, the printing and painting workshops proper, as well as facilities for bleaching and finishing cloth. Calico printing mills were paradigmatic examples of proto-factories according to the typology of FREUDENBERGER / REDLICH (1964): They managed a complex production process characterized by a high degree of labour division, albeit with a low degree of mechanization. The principal advantage of integrating intra -industry transactions into a single firm organisation consisted in limiting transaction costs between individual stages of production (costs of measurement, of coordination and of the holding of stocks).

Second, calico printing firms were at the forefront of a number of innovations in the transaction sphere. To begin with, several of the individuals that owned calico printing mills in our region owned other mills in locations at a distance of hundreds of km, such as France or Northern Italy. We know as yet little of the logic that underlay these early multinationals, but it appears that the motive of market proximity was complemented by the motive to tap information both with respect to demand trends and technologies. Most importantly, owners of calico printing manufactories apparently travelled little to serve their markets. Rather than frequenting larger fairs and markets, as earlier generations of merchant-manufacturers had done, they preferred to sell their manufactures by way of correspondence and books of patterns. This technique, which appears to have been an original development of the 18<sup>th</sup>, was a pre-condition to serving markets characterized by high degrees of product differentiation and rapid demand shifts according to fluctuations in fashion. By making systematic use of the techniques of the business correspondence and the book of patterns, the cotton sector of Western Europe capitalized on the growing internationalisation of business techniques that resulted from the spread of business manuals and the corresponding lowering of entrance barriers into long-distance trade (cf. JEANNIN 2002). Systematic use of this innovation may well have constituted a decisive element in creating a comparative advantage of western European calico printers vis-à-vis their Asian competitors.

Third, the dynamic expansion of calico printing during the 18<sup>th</sup> century produced a tremendous demand pressure on the preceding stages of cotton processing. As a consequence of the emergence of a string of industrial production sites engaged in calico printing along the eastern French boarder, cotton spinning and weaving expanded vastly beyond the confines of the Canton of Zurich during the 100 years following the late 17<sup>th</sup> century: In the concluding decades of the 18<sup>th</sup> century the cotton district of northern Switzerland constituted an area that included a territory of ca. 30 to 50 km beyond the Canton's border, ranging from central Switzerland (Glarus, Zug) to the Black Forest in the north and from Lake Constance to Argovia in the southwest. Only part of the labour force of this district was still controlled by entrepreneurs

operating from Zurich, while independent production sites emerged notably in Appenzell, Glarus and Argovia.

The rapid growth of demand for a product manufactured manually by a dispersed labour force soon led to supply bottlenecks. In Zurich, piece rates for cotton spinning increased by clearly more than 100 percent between 1713 and the 1740s, and piece rates in cotton weaving increased by about 50 percent between the 1730s and the 1760s. Part of this can be explained by the transaction costs arising from organizing an ever growing geographically dispersed labour force. In fact, by the late 18<sup>th</sup> century, the industry rested on a complex hierarchy of middlemen, ranging from small peddlers to substantial drapers, that linked rural spinners with urban calico printers or exporters of white cloth. In part, however, the supply bottleneck was also due to an inelastic labour supply, a point that will be dealt with in the last section of this contribution.

Given these supply bottlenecks it is of no wonder that Alsace and Switzerland were among the first regions on the continent to adopt mechanical cotton spinning in the early 19<sup>th</sup> century. As these bottlenecks appeared quite early it appears appropriate to ask why innovations were not adopted earlier — “Why not Switzerland first?” so to say.

To answer this question it is instructive to compare the cotton sector with silk manufacturing, which experienced a similar boom in Zurich during the eighteenth century. Until the third quarter of the 18<sup>th</sup> century silk milling was performed by hand-driven mills “*alla Milanese*”, and silk winding was performed manually by some 2–300 women living in the immediate vicinity of the town. Labour scarcity, documented by the explosion of the wages for silk winding, led to the construction of several water-driven silk mills “*alla Bolognese*” that also mechanized silk winding during the 1780s. The main reason why labour-saving technology was not adopted in cotton manufacture as well lies in the different organization of the two trades: Silk manufacture was firmly controlled by urban merchant-manufacturers, whereas in the cotton trade rural drapers and putter-outs of spinners acted largely independently from urban merchants and calico printers. Due to the prerogatives of town burghers with respect to the inhabitants of the subject territory, however, rural drapers and putter-outs were not allowed to engage in import and export

trade. In addition to increasing transaction costs and hampering the adoption of advanced trade techniques by rural entrepreneurs, this induced a fragmentation of decision making processes that made a response to supply bottleneck impossible. The potential of urban communities to provide for economic institutions to link dispersed producers with long-distance trade found its clear limits here. After the French invasion in 1798, which entailed the abolition of the prerogatives of town burghers, rural drapers rapidly acquired the knowledge to build and operate spinning mills (DUDZIK 1987).

The account provided so far highlights the role of economic institutions and business techniques. In concluding this section attention should be drawn to Marshallian agglomeration effects. Most important fustian producing towns in Swabia exported linen as well, and Augsburg comprised a substantial workforce engaged in ribbon manufacture until the mid 18<sup>th</sup> century. Basle and Zurich were also important silk towns, while Geneva's principal industry in the 18<sup>th</sup> century consisted in the manufacture of clocks. The simultaneous presence of several branches of (textile) manufacture rendered it possible to spread risks, to benefit from trade and banking services and thereby exploit economies of size, as well as to increase the scope for the acquisition of information on new trends and opportunities. Agglomeration effects made an important contribution to the long-term success of cotton in the region under study.

#### *Agrarian pre-conditions for proto-industrial development*

Dispersed rural production of manufactures in western Europe was a regional phenomenon. As a consequence, its development has frequently been linked to specific agrarian conditions. A high incidence of small farms and/or an agrarian system characterized by labour-extensive work processes both implied low levels of labour productivity. This reduced the opportunity costs of or generated a need for industrial employment in rural households (see PFISTER 1997 for a general discussion of the themes of this section).

15<sup>th</sup> century and early modern cotton manufacture in Swabia and Switzerland developed in an area that also constituted a major reservoir of mercenary labour for the rapidly expanding war

industry of the age. In addition, the northern slope of the Alps emerged as a major supplier of cattle to feed the populous towns of the plain of Lombardy from ca. 1400 onwards. Obviously, the reduction of Malthusian pressure following the severe crisis of the first part of the 14<sup>th</sup> century engendered a transition towards labour-extensive agrarian systems in the region under scrutiny. Lower labour requirements of agricultural work released labour; males tended to engage in migrant mercenary labour, females in proto-industrial activities.

The general elements of this process were repeated during the so-called crisis of the seventeenth century. The gradual restoration of peace during the 1640s engendered a re-cultivation of the devastated agrarian surfaces in the Alsace, the Palatinate and other parts of southern Germany. This lowered food prices and ended the war-time boom enjoyed by (comparatively unproductive) grain cultivation in northern Switzerland. Labour was released partly for emigration into the fertile, but under-populated plain of the Upper Rhine, partly for proto-industrial activities: Lower food prices improved the terms of trade of manufactures and thus made it feasible to create small farms whose economic viability rested in part on proto-industrial employment. Shifts in relative prices in the wake of the seventeenth-century crisis was a powerful force behind the massive expansion of the industrial labour supply and the ruralization of the manufacturing sector during the second phase of the industrial history of Swabia and northern Switzerland.

A shift from labour-intensive grain cultivation to labour-extensive cattle-breeding, labour migration and proto-industrial employment required elastic food supplies. However, before the construction of railway networks the perimeter of continental grain markets was notoriously reduced, creating a high inelasticity of supply. For this reason, proto-industrial regions frequently emerged in close geographical proximity to regions possessing a comparative advantage in commercial grain production. In such a situation, a process of complementary specialization of the two adjacent regions in a so-called bifurcation process could follow.

The macro-region under study lent itself to such bifurcation processes well since hilly areas that were little suited for grain production were interspersed with basins along the upper Rhine and Danube rivers as well as on the northern shore of lake Constance. Thus, the rapid development of



cotton manufacture and other textile trades in northern Switzerland from the late 17<sup>th</sup> century was matched by a development of commercial grain cultivation in the basins adjacent to the north (Göttmann 1991). Contemporaries estimated that by the third quarter of the 18<sup>th</sup> century about a third of grain consumption in the Canton of Zurich was supplied by imports. Price-elastic grain supplies made available through complementary specialization of adjacent regions constituted an important pre-condition for the continuing growth of the cotton sector during the 18<sup>th</sup> century.

*Cotton manufacture in the rural household economy and supply-side bottlenecks*

Why was there a bottleneck with regard to labour supply in the 18<sup>th</sup> century that called for labour-saving innovations? This section draws on extended research in the proto-industrial family economy of rural Zurich to answer this question.

In a simple neo-classical perspective, a rise of labour demand, by increasing wages, facilitates household formation since higher wages allow adolescents and young adults to accumulate a marriage fund in a shorter period of time. A decrease of the marriage age and an increase in the propensity to marry increases fertility, which in turn leads to an expansion of the labour supply in the mid-term. In the long run, therefore, wages should fluctuate around an equilibrium, and labour supply bottlenecks cannot persist.

Positive evidence for this model can be found under specific circumstances. For instance, in one part of the Canton of Zurich there existed a strong correlation between an indicator of real income in the proto-industrial sector and the marriage rate from the 1740s to the 1780s. In this period, piece rates for cotton spinners were so high that it was possible to create house holds without a base in agriculture. Hence, the labour supply schedule essentially mirrored leisure-income preferences.

As a comprehensive description of the proto-industrial labour supply of rural households, however, the model sketched above is rather inappropriate. A systematic scrutiny of material

avail able from both, the Canton of Zurich and elsewhere, demonstrates that proto-industrial labour supply depended from the relative productivities of labour and capital in the proto-industrial and agrarian sectors, respectively (PFISTER 1992b). In many situations, the marginal productivity of household capital was higher in the agrarian than in the industrial sector.<sup>2</sup> Under such circumstances, households will save part of their proto-industrial incomes and invest them in expanding the agricultural side of their household economy. Over the life course, households will therefore shift the composition of their labour force from proto-industrial to agricultural activities. In a few parishes heavily engaged in cotton processing I have been able to observe such a shift of the sectoral composition of family labour over the family cycle. High demand for proto-industrial labour will have the perverse consequence to enable households to effect this shift in a shorter period of time and thereby *ceteris paribus* to reduce proto-industrial labour supply.

In sum, as long as cotton processing was imbedded in pluri-active rural household economies, labour supply was highly income-inelastic. Consequentially, periods of sustained growth of the manufacturing sector were systematically prone to supply bottlenecks.

### *Conclusion*

The main reasons for the early emergence of cotton manufacture around 1400 and its successful development until mechanization in the early 19<sup>th</sup> century can be summarized as follows:

- (1) The social capital created by the formation of late-medieval and 16<sup>th</sup> century urban communities was instrumental to the emergence of economic institutions that linked small dispersed producers to long-distance trade at low transaction costs.
- (2) Agrarian conditions, to the extent that they determined the relative prices of grain, foodstuffs produced with labour-extensive agrarian technologies and cottons, respectively, constituted a major determinant of labour supply.

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<sup>2</sup> Adding a new loom to a household economy in which all members are already fully equipped with instruments for textile production produces zero marginal output. Adding land, livestock, buildings, fences etc. to the household capital stock produces positive marginal returns at a vast range of input values.

(3) The emergence of calico printing with the so-called consumer revolution from the late 17<sup>th</sup> century produced a radical transformation of the cotton sector as a whole. For the first time, we see the widespread presence of integrated firm organizations employing hundreds of workers. Due to intensive international competition, pressure for technological and product innovation was high. Distribution of differentiated and rapidly changing products relied on business correspondence and books of patterns. These innovations in the transaction sphere were complementary to the consumer revolution and were a precondition for turning cottons objects of fashion (together with silk cloths and ribbons, which, however, served much more exclusive markets).

(4) The rapid expansion of calico printing led to rising demand for white cloth and cotton yarn. Material from Zurich suggests that the prices for these inputs were rising fast during the 18<sup>th</sup> century, indicating serious bottlenecks of labour supply. Two factors account for this phenomenon: First, the co-ordination of an ever-increasing number of dispersed labourers must have led to an increase in transaction costs. Second, the supply of protoindustrial labour was not simply governed by the leisure-income preference. The fact that cotton processing was performed within the framework of the peasant household economy implied that labour supply was contingent upon relative productivities of capital and labour in the proto-industrial and agrarian sectors, respectively. This in turn implied a low income elasticity of proto-industrial labour supply, which explains the observed bottle-necks.

(5) The supply bottlenecks engendered by the rapid expansion of calico printing could be overcome by the adoption of labour-saving technology and the centralization of production, i. e., the creation of spinning mills. Interestingly, however, this remedy was applied only after a change of the political regime that allowed rural drapers and putter-outs to operate as independent entrepreneurs. The urban communities producing the welfare effects mentioned in point (1) above for the 15<sup>th</sup> and 16<sup>th</sup> centuries had evidently turned into institutional barriers by the 18<sup>th</sup> century.

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