



The heterogeneity of the machine tool industry in Brazil

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Abstract

The current paper aimed to investigate the reasons for the technological and competitive heterogeneity in the machine tool industry in Brazil. By analyzing the trajectory of the sector, we can highlight three main reasons for such heterogeneity. First, due to the competitive framework that emerged from the Brazilian import substitution industrialization process (ISI), the companies that produce and used such technological artifact gave emphasis to the accumulation of productive capacity rather than to innovative capacity. Second, ISI institutional ‘dynamics’ configured the machine tool industry international specialization in products with lower technological content. Third, technological and competitive heterogeneity among manufacturers due not only to different innovative efforts among them, but also to the structure of the demand and the level of sophistication and technological efforts by users.

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Resumo

O objetivo desse artigo é investigar os motivos da heterogeneidade tecnológica e competitiva do setor de máquinas-ferramenta no Brasil. Através da análise da trajetória do setor, podem-se destacar três razões principais para tal heterogeneidade. Primeiro, a partir do marco competitivo que emergiu do processo brasileiro de industrialização por substituição de importações (PISI), as empresas produtoras e usuárias de tal artefato tecnológico deram ênfase para acumulação de capacidade produtiva e não de capacidade inovativa. Segundo, a ‘dinâmica’ institucional do PISI configurou a especialização internacional do setor de máquinas-ferramenta em produtos com menor conteúdo tecnológico. Em terceiro, a heterogeneidade tecnológica e competitiva entre os fabricantes decorre não apenas dos distintos esforços inovativos entre os mesmos, mas também é devida à estrutura da demanda e do grau de sofisticação e esforços tecnológicos dos usuários.

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Palavras-chave: Máquinas-Ferramenta; Economia Brasileira; Bens de Capital; Tecnologia

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1. Introduction

The current paper aims to investigate the determining factors of the machine tool industry (MT) technological and competitive heterogeneity in Brazil. From a historical perspective of the ISI process, it seeks to resume some stylized facts in order to characterize them and to argue that the productive and technological dynamism of the MT industry does not depend (and did not historically depend) only on the producer's innovative efforts. They also depend on demand structures and on their sophistication level, which, however, were conditioned by the economy institutional framework within this process. Given that companies and businessmen have a history of learning and they seek to change their productive, technological and organizational routines by implementing innovations—with the support of the institutional environment, science and technology infrastructure (S&T)—it is worth performing an analysis of the ISI regulatory framework and on the incentive environment, in which economic structures were “built” and certain technological and social capabilities were “acquired”. Therefore, the study takes the theoretical assumption that growth and development are dynamic processes that occur from the co-evolution of technology, industrial structure and institutions (Nelson, 1998, 2001; Cimoli and Katz, 2002).

The technological and competitive heterogeneity among MT manufacturers has, as its basic causes, the asymmetric innovative efforts among them, the demand structures and the sophistication level as well as the different innovation efforts by users, especially regarding their revealed preference for innovation processes aimed at developing low cost products and not at innovative products to lead and open new markets, thus requiring more specialized and complex MTs. The theoretical basis of such hypothesis lies on the importance given to the intentional producer-user interaction in order to develop new capital goods (Dosi et al., 1993; Lundvall, 1992; Rosenberg, 2006). The technological capabilities of MT users are crucial to MT companies, since their sophistication is critical to the quality of interaction and to the technological development of artifacts. Since users are those who select the innovations within the market, the low innovative efforts and user's limited technological capabilities keep MT manufacturers' heterogeneity and the relative technological gap at an international level. Therefore, the size of the demand, its structure and sophistication level are also important.

Besides the current introduction, this study presents other three sections in order to investigate the technological and competitive heterogeneity of the MT industry in Brazil. Section 2 gives a brief summary of the MT trajectory and its competitive conditions, technological capabilities and expertise of the MT industry up to the 1980s. This section seeks to highlight the productive features and technological efforts that determine manufacturers' development and expertise, including MT production with computerized numerical control (MT/CNC). It also aims at pinpointing the innovative, competitive and institutional environment configured by ISI policies regarding the development and heterogeneity that characterize the capital goods industry and the Brazilian industry. Section 3 presents a summary of the industrial restructuring process and explains the reasons for the technological heterogeneity within the MT industry from its productive specialization, technological dynamics and user's structure and sophistication. Section 4 presents the final considerations.

2. The technological trajectory and learning by the machine tool industry in Brazil

During the ISI period, Brazil had an ambiguous and contradictory policy with respect to the capital goods industry. On one hand, as for the market reserve, the importation of machinery and equipment with similar national product was forbidden. It was done by applying strong non-tariff (National Similar Product Law) and tariff barriers linked to the importation of such goods. On the other hand, such prohibition facilitated the importation of capital goods with no similar national product by applying tax benefits and foreign exchange benefits aimed at the modernization of the industrial park (Erber and Vermulm, 1993; Nassif, 2007). As a result, the industry has focused on producing capital goods with low technological content when compared with the imported ones. Similarly, according to this regulatory framework, on the one side, the entry of foreign companies in several industrial sectors (durable and capital consumer goods) was encouraged and, on the other, there was the induced entry of small and medium-sized companies. Such companies had excessive verticalization and low economies of scale, which was associated with production fragmentation and high diversification within the capital goods industry. It resulted in the spreading of investments and in the horizontal expansion of sectors holding an excessive number of producers. These results would hinder the efficiency and the incorporation of new technologies. However, “these are not criticisms to the strategy itself, but to its conduct because,

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