SOURCES OF PRODUCTIVITY GROWTH
Each of the five regimes of best practice at sea, reflected in rising levels of men served per ton in Europe, has different sources for the efficiency improvements those stages reflect. While in general the same forces were at work over the long term in raising labour productivity some were more important than others within the five regimes identified. Those sources can be lodged in three general categories. Those were economies which came from a larger scale of operations, better productivity from technical improvements, and advances in ratios of tons served per man because of institutional changes on land and at sea. The last, most noticeable in the reorganization of work in ports and in the ways public authorities internalized the costs of protecting shipping, were more important in the third period, that is in the seventeenth century when ratios of at least 14 reflected best practice. In the fourteenth and fifteenth centuries when 10 tons per man was the attainable goal advances came more from better ships and a larger volume of goods shipped. The roots of gain were similar in the years after about 1780 when there was first a shift to a best practice level of 18 tons per man and in the subsequent period after 1850 when ratios approached 30 tons per man. The rather gross generalization is consistent with findings reported by the contributors to this volume. It should be emphasized that there were changes in all three categories all of the time under each of the five regimes. There was a shift in emphasis or importance of the differing sources of gain over time. Throughout developments in, for example, the volume of shipping enabled the implementation of design improvements in ships or more efficient cargo handling in harbours. The interaction of the varied forces at work was necessary to generate the rising tons per man

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1 On the efficiency regimes see Lucassen and Unger above in this volume.
2 Figure 1–5 on manning ratios in Lucassen and Unger above in this volume.