CHAPTER 2

Understanding the Market Through Bicycle Statistics

Abstract How many bicycles are manufactured each year in each country? How many of these are exported? How many bicycles are imported? How large is the domestic market for bicycles? How widespread is the bicycle in each country? The answers to these questions require data that can be used for informative and decision-making purposes. The chapter is a journey into the bicycle statistics available to emphasize current drawbacks and limitations. A selection of five statistics is presented through examples based on primary and secondary data drawn from the UK, Italy, the US, Canada, Japan and Taiwan.

Keywords Bicycle output · Exports · Imports · Apparent consumption · Bicycle ownership

The original version of this chapter was revised: The source line for Table 2.1 has been updated. The correction to this chapter is available at https://doi.org/10.1007/978-3-030-50563-9_5

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2.1 Why Bicycle Statistics Are Important and the Problems Associated with Them

Sound decisions generally stem from sound analysis based on data and information, which will reduce the level of uncertainty in making a decision. Successful managers are knowledgeable managers who have an understanding of the markets in which the organization competes. This is true for both a private profit-oriented firm and a public or a nonprofit organization. For instance, suppose that a marketing manager of a bicycle firm has to decide the new products to launch, or a mayor of a city has to choose whether to invest public money to build a bicycle infrastructure. In both cases, it is essential that the best possible solution is based on data available. Both marketing managers and city mayors are accountable to their stakeholders and using data and information in decision-making can lead to good outcomes, instead of relying on instinct and feelings that usually lead to bad outcomes. Bicycle statistics play a relevant role in providing a knowledge base to address issues regarding market opportunity, industry evolution and public policy to support the industry, city cycling, new road building, road maintenance and other decisions that can be improved if data are available. For example, statistics can facilitate measuring the number of potential people using the bicycle as a means of transportation or the potential number of cargo bicycles used to deliver goods. Bicycle statistics can highlight which kind of bicycle is preferred by cyclists and how the industry performs over time. Statistics can help to understand which countries are manufacturing, importing or exporting bicycles and components. Bicycle statistics can be used to frame a public policy intervention aimed at developing or improving the industry. Statistics can provide clues on the number of cyclists potentially interested in building a new road or can help to establish a linkage between the number of bicycles and road maintenance needs.

Bicycle statistics must possess certain characteristics if it is to be useful for decision-making. That is, statistics must be reliable, sufficient and comparable. Reliability refers to the degree to which statistics reflect reality and are accurate. Sufficient means that statistics must be complete so that data are not affected by any gaps. Comparability refers to the possibility that a sequence of data over time, or between one place and another, is measuring the same variable. A place can be a country, a geographical area or a bicycle firm. Bicycle statistics show serious problems with each of the three characteristics and it is not an exaggeration to state that data and information are plagued by unreliability, incompleteness and incomparability.

Moreover, bicycle statistics are affected by two further problems that make even more difficult to use them for decision-making or studying

purposes. Firstly, bicycle data are not available and, secondly, if they are the access to them is not always guaranteed. Whoever attempted, at least once, to search for bicycle statistics, knows that it can prove a very challenging endeavour because of the almost complete lack of data. Practitioners, policymakers and scholars have to face the dilemma of understanding the bicycle industry with no or very few data. Unavailability of statistics is presumably due to the size of the industry that has been considered less significant than other industries with the consequence of preventing from gathering extensive data. Another possible explanation is that bicycles were considered jointly with other sets of goods, such as the means of transportation, within official statistics, and again the outcome was that no data specifically focused on bicycles were provided.

Even when data are available, it is not sure that they will be accessible. This is particularly true for proprietary statistics gathered by bicycle firms or trade associations. It is a very common practice for most of bicycle firms not to release their internal data. For instance, it is almost impossible to access a copy of the company annual report, except for a very small number of large firms, such as Accell Group (The Netherlands), Dorel (Canada), Fox Factory Holding Corp. (United States) and Shimano Inc. (Japan), which provide a digital version of their most recent annual reports. If a bicycle firm is too small for publishing an annual report, it could still release its basic data through other options less demanding than developing a complete annual report. Access to data remains particularly hard when someone is interested in knowing the number of bicycles manufactured by a firm. This piece of information is surrounded by a halo of secrecy that has become anachronistic over time and it cannot be explained through the usual recall of rivalry between the firms of the industry. According to the data available, the Accell Group is the only firm releasing the number of bicycles manufactured each year. Since 2004, its annual report includes such information (Accell Group 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020).

Bicycles statistics are usually provided by four primary sources in each country: office for national statistics, customs department, trade organization and bicycle firms. Each public office for statistics conduct periodically a census of industrial activity aimed at measuring variables such as output, employment, number of companies and company size. As already explained, very few data are available and it is difficult to build a long time series to understand how the bicycle industry evolved over time.

Customs departments are involved in gathering foreign trade statistics that record the physical movement of merchandise between countries. Export and import statistics are collected and compiled according to both national and international commodity classifications. For instance, the United Nations developed the Standard International Trade Classification (SITC) and the Harmonized Commodity Description and Coding System (also known as the HS) to allow comparability of international merchandise trade statistics; the European Union introduced its Combined Nomenclature (CN), which is based on the HS; and each country usually adds its own classification for further statistical needs. In Italy, imported or exported goods are classified using an 8-digit code number. This means that the level of disaggregation is higher than that of other classifications such as the HS that uses a 6-digit code number. The more digit there are in the code, the more precise the classification, and in turn the possibility of identifying the goods and gather relevant data increases as well. For example, Japanese customs agency classifies merchandise using a 9-digit code number. Export and import statistics record the quantity and the value of shipping goods. The former can be the number of units or the weight of merchandise, the latter is the value of transactions. Foreign trade statistics suffer from various limitations such as reporting errors (that is, mistakes or omissions) and timeliness (that is, import or export records not processed in time to be included in the current month's statistics may be carried over into a subsequent month's statistics). The timeliness problem requires a revision procedure usually on a monthly and annual base.

Trade organizations within the bicycle industry were established to collectively represent the manufacturers and protect their interests. In 1893, the Cycle Manufacturers Trade Protection Association was formed in England and renamed the Cycle & Motor Trades Association in 1900. Later, in 1910, it became the Cycle & Motor Cycle Manufacturers and Traders Union and in 1919 the British Cycle & Motor Cycle Manufacturers and Traders Union Ltd. (Millward 1999, p. 382). Italy, as mentioned in the previous chapter, formed its association of bicycle manufacturers in 1920 and called it ANCMA. In 2015, the Confederation of the European Bicycle Industry (CONEBI) was formed as a merger between the Association of the European Two-Wheeler Parts' and Accessories' Industry (COLIPED), established in 1960, and the Association of the European Bicycle Industry (COLIBI), established in 1973. Other countries formed similar organizations to combat the problems facing the industry as a whole. These associations usually provide some bicycle statistics, particularly those regarding the production of bicycles and components. They also compile foreign trade statistics using data

gathered by the customs department. For instance, CONEBI releases a yearly short report describing the European bicycle industry. The report was issued for the first time in 2009 and was accessible free of charge until the 2017 edition, from the 2018 edition a payment is due. The bicycle statistics gathered by trade organizations share a common feature: the lack of an in-depth analysis of both industry and competitors in each country and worldwide.

Bicycle firms are the fourth source of bicycle statistics and, despite having some valuable data in their internal records, it is extremely difficult to access that information as already mentioned. This situation has not changed over time and it seems an entrenched practice within the industry all over the world.

The following sections of this chapter offer a sketch of bicycle statistics through examples of data available in different countries. The chapter is by no means a thorough description of all the statistics available within the industry. It is a starting point to scratch the surface of the topic. In approaching bicycle statistics, the first task is to understand what, if any, data exist, and what gaps and weaknesses affect those data. The chapter is focused on a limited selection of bicycle statistics that provide a fragmentary snapshot of the industry from a historical perspective. Five variables are presented as relevant for understanding a small piece of business history of the industry: the production of finished bicycles measured through the number of bicycles manufactured, the exports and imports of finished bicycles measured through the number of units involved in foreign trade, the apparent consumption measured through the number of bicycles potentially available for the domestic market and the bicycle ownership measured through the stock of bicycles in a country. All these variables are measured in quantity to make comparability between countries easier. Some bicycle statistics, particularly those regarding exports and imports of bicycles and components, are also measured in value. This chapter does not include any statistics measured in value to prevent the problem associated with comparing different currencies and their exchange rate over time.

2.2 Bicycle Production Statistics

This section examines data regarding the output of the bicycle industry as a whole in six countries, presented in the following order: the UK, Italy, the US, Canada, Japan and Taiwan. As already mentioned, the statistics

available do not allow to draw a complete picture of the industry in those countries, nevertheless they can help to acquire a preliminary knowledge of the size of bicycle production.

Statistics for UK are based on two secondary sources (Millward 1999, pp. 160, 279–280; Rosen 2002, pp. 73, 120) that compiled data from various primary sources. The time series built on both sources covers the years from 1876 to 1995, however many data are missing and it is not possible to fill in the gap. A thorough interpretation of these data requires an extensive study that is beyond the scope of this chapter. It is clear from the chart shown in Fig. 2.1 that UK bicycle industry had a significant growth during the 1930s and the 1950s. Its production began to decrease in the mid-1970s and the size of its output reached a pick of about 3.5 million units in the 1950s, and was over 1 million units in the 1990s.

Further data are from the internal records of the most important British firm: Raleigh Cycle Company. The time series shows the production of bicycles from 1896 to 1959 at Raleigh (Rosen 2002, pp. 52–53). There are two missing data (1906 and 1958) and all the years ending in August. The graph (Fig. 2.2) highlights that the contribution of Raleigh to bicycle production of UK industry was fundamental. The existence of such statistics corroborates the hypothesis that some bicycle firms do collect their own data, even though they are not easily released.

Bicycle production statistics in Italy cover the 1950–2019 time frame. Before 1950 very few data are available from scattered sources. An estimate of bicycle output between 1907 and 1914 shows that Italian industry manufactured an average of 146,000 finished bicycles, ranging from 98,062 in 1907 to 221,612 in 1910 (Piloni 1982, p. 49). The time series provided by the trade organization ANCMA (2019, 2020) is plotted in Fig. 2.3 and reveals a first period, from 1950 to 1958, characterized by steady bicycle production of approximately 400,000 pieces. In the subsequent period, from 1959 to 1965, bicycle production increased 2.5 times and reached approximately 1,000,000 pieces. From 1966 to 1978 and from 1979 to 1989, bicycle production showed a further growth of 100%, reaching 2,000,000 pieces and 3,000,000 pieces, respectively. The years from 1990 to 1994 are the last growth trend in the complete time series. The peak, of 5,800,000 bicycles, is observed in 1994. A significant decline whereby bicycle production is reduced approximately by 60% begins in 1995 and lasts until 2002. Bicycle production fluctuates from 2002 to 2019 and then upward to approximately 2,600,000 pieces.

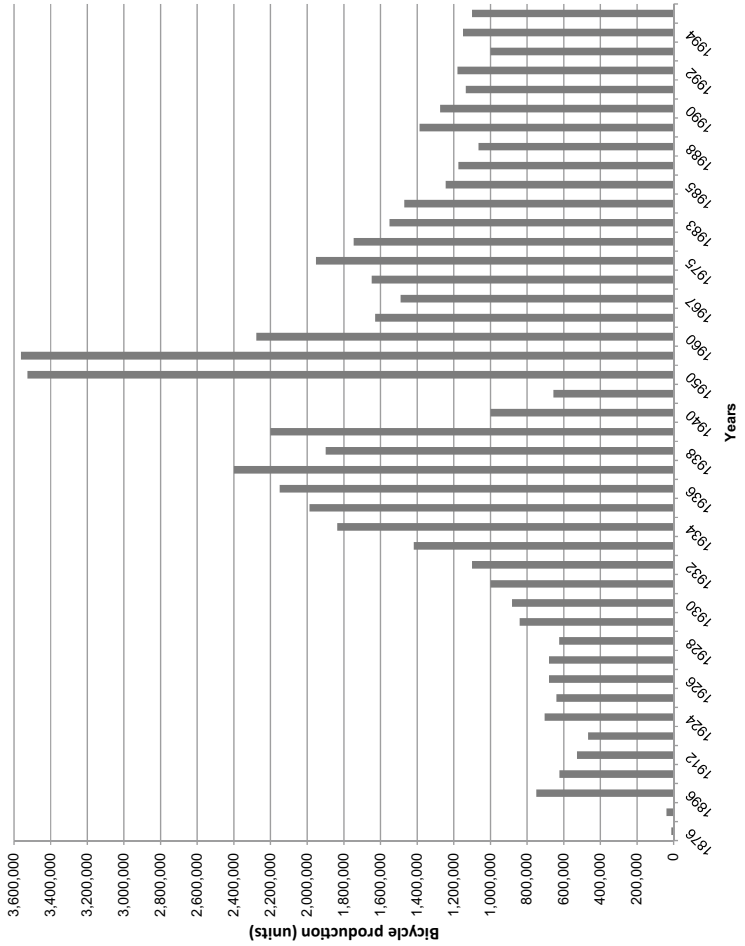

Fig. 2.1 British bicycle production 1876–1995

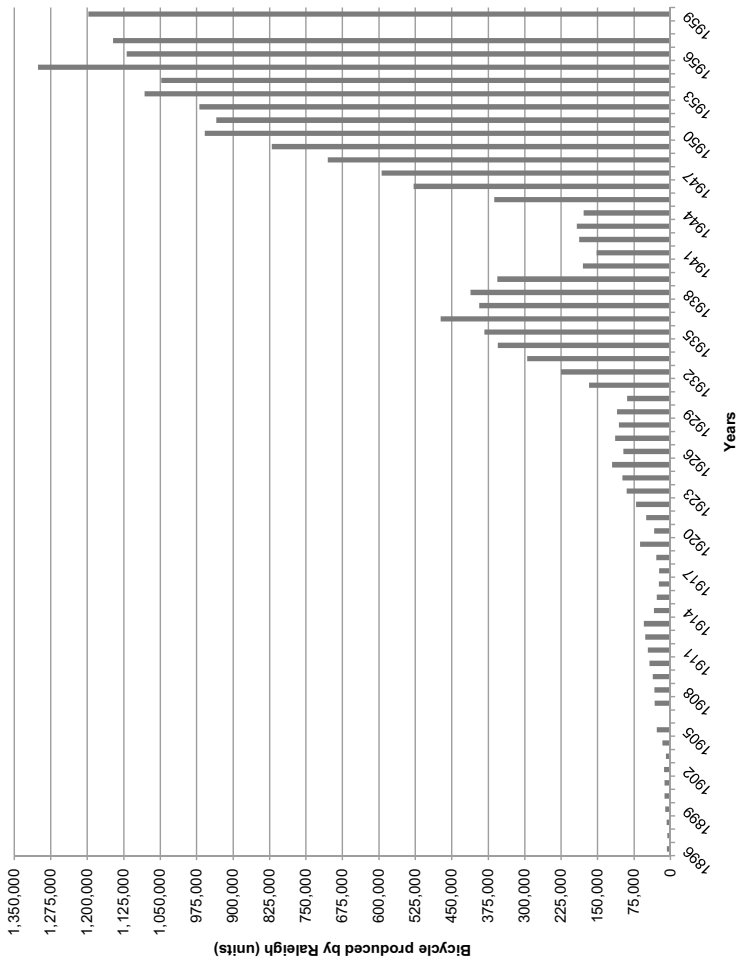

Fig. 2.2 Bicycle production by Raleigh 1896–1959

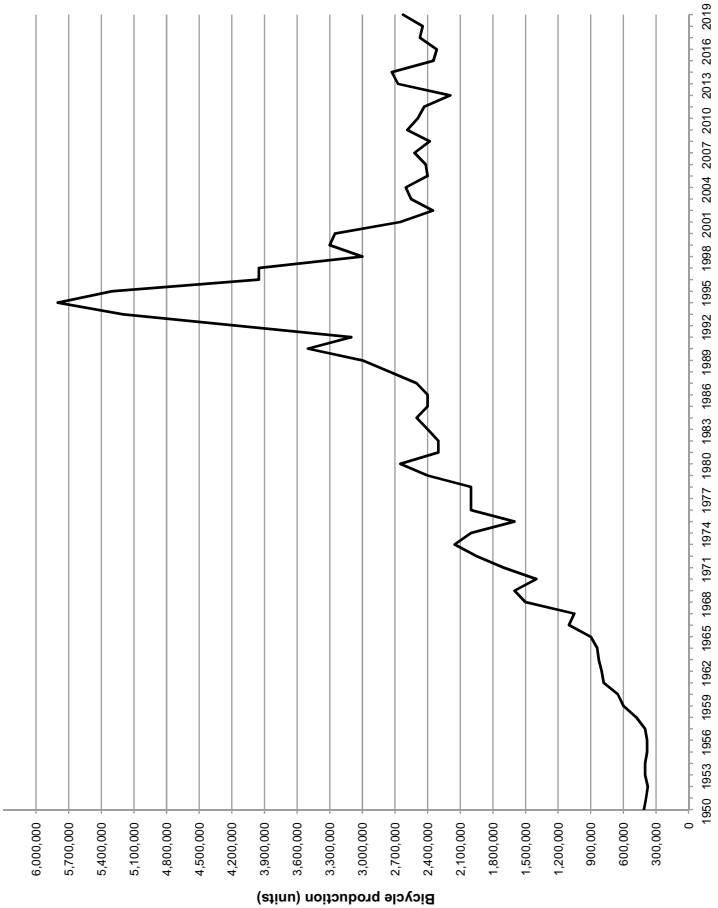

Fig. 2.3 Italian bicycle production 1950–2019

The statistics from ANCMA show two main limitations. Firstly, the data represent an estimate of the domestic production of bicycles, not actual production. Secondly, the process of estimation is based on the assumption that one bicycle frame is equivalent to one bicycle. ANCMA makes an estimate of the number of frames, both manufactured in Italy and imported, that becomes a proxy for the number of bicycles produced every year as explained by ANCMA's director of bicycle industry (Nigrelli 2018). According to ANCMA, the bicycle production estimate has a margin of error of plus or minus 50,000 bicycles. Although the time series is 69 years long, it seems more reasonable to state that such a margin of error applies to the recent years, presumably since the 2000s. Moreover, it is not clear how the number of bicycle frames is estimated, particularly the domestic production of frames. The number of imported bicycle frames is not an estimate, as such data are available through the official statistics provided ex post by the Italian Customs Agency. A further issue stemming from the process of estimation is that estimation methods might have been changed over time. If more than one method of estimation was used, a comparability issue has to be considered, as it is necessary to understand if two different methods were employed to measure the same variable.

Statistics for the United States of America are drawn from two secondary sources (Epperson 2001, 2012; Chu and Li 1997, p. 60) that provide an initial understanding of bicycle output in that country. The data, covering the early years of US bicycle industry from 1878 to 1914, clearly show the so-called bicycle boom during the second half of the 1890s when production reached its peak of approximately 1,300,000 units (Fig. 2.4). Epperson's contribution is one of the very few studies specifically devoted to the topic of bicycle statistics, and it offers a valuable analysis of the US context.

The other source compiles data from further secondary sources and it is focused on a more contemporary situation regarding the years from 1966 to 1991. The chart in Fig. 2.5 highlights the sharp increase during the first half of the 1970s when bicycle output increased to over 10 million units. The average yearly bicycle production during this time frame was approximately 6,400,000 pieces.

There are very few sources regarding bicycle statistics in Canada and one of these provides a time series from 1920 to 1959 (Babaian 1998, p. 105) compiled using various primary data. The graph of bicycle production (Fig. 2.6) shows two peaks during the second half of both

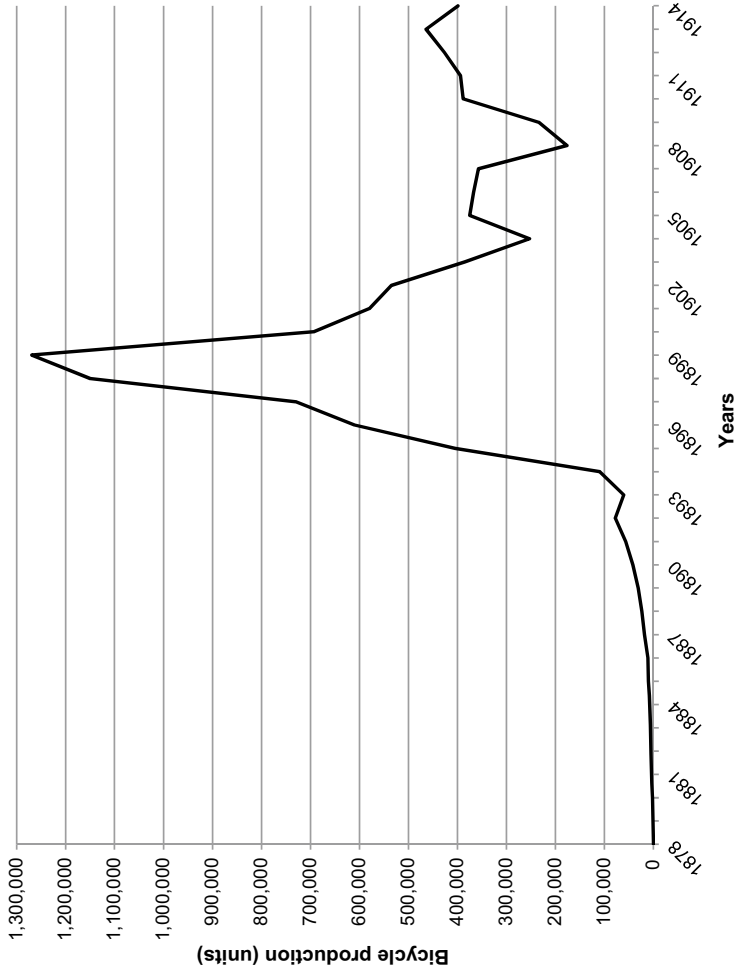

Fig. 2.4 US bicycle production 1878–1914

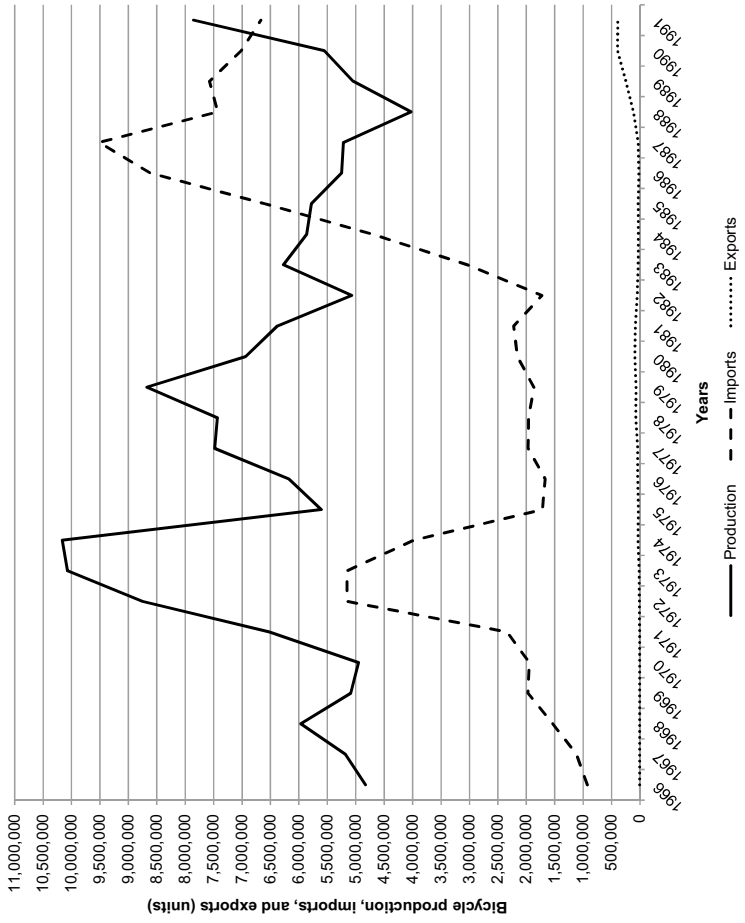

Fig. 2.5 US bicycle statistics 1966–1991

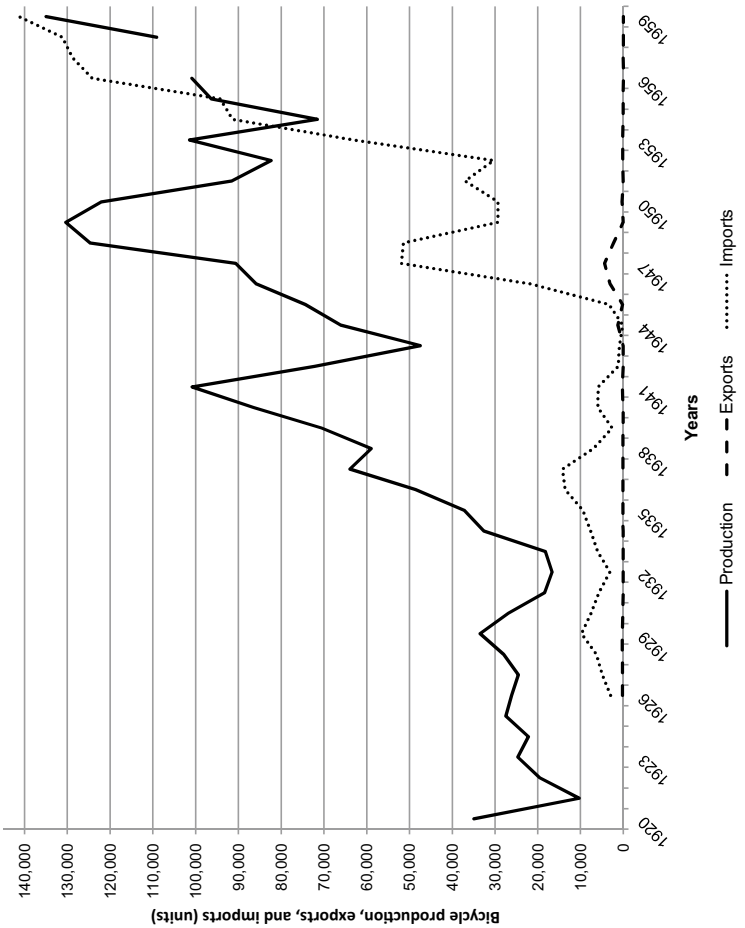

Fig. 2.6 Canadian bicycle statistics 1920–1959

the 1930s and 1940s. One year is missing (that is 1957) and the average yearly output was approximately 62,000 units.

Bicycle production statistics in Japan are available for a long time series, even though there are some gaps arising from the different sources examined (Takeuchi 1991, p. 137; Ueda 1981, p. 45; Kotha and Fried 1993, p. 13; Japan Bicycle Promotion Institute 2019, p. 5). Takeuchi studies the formation and the development of the bicycle industry until the 1930s, using the Ministry of Commerce and Industry's statistics from 1929 to 1938. Ueda examines the history of the post-war Japanese bicycle industry, focusing on the 1950s and 1960s, and provides output data from 1923 to 1978 based on various primary sources. The case study developed by Kotha & Fried includes bicycle production data from 1982 to 1991, gathered by the Japan Bicycle Manufacturer's Association. The Japan Bicycle Promotion Institute compiles data, covering the 2004–2018 time frame, based on the Ministry of Economy, Trade and Industry (METI) Current Production Statistics. A limitation of these statistics is the gap within the time series. The years from 1979 to 1981 and from 1992 to 2003 are missing. The chart in Fig. 2.7 shows the peak of production during the first half of the 1970s when most countries experienced the bicycle boom, and the stabilization of bicycle output to around 7 million units in the 1980s. Current data, since 2004, emphasize the significant decrease of bicycle production from approximately 2,454,000 pieces in 2004 to 850,000 pieces in 2018.

There are both primary and secondary sources of bicycle statistics for a preliminary understanding of the Taiwanese industry. The former is the Ministry of Economic Affairs of Taiwan (2020) that provides a time series from 1981 to 2019, easily accessible through its website in English language. The latter is a study that provides bicycle output data from 1968 to 1992 using an estimate method based on export statistics and domestic sales (Chu and Li 1996, 1997). The rationale is that the export data, collected by the customs office, have a broader coverage that makes them more reliable, whereas the industrial production data have a smaller coverage and firms routinely misrepresent their sale data, presumably for tax purposes (Chu and Li 1997, p. 70). According to this study, reliable statistics became available only in the late 1970s. The graph of bicycle output in Fig. 2.8 is based on secondary data for the period 1968–1980 and primary data from 1981 through 2019. The chart shows the huge increase during the 1970s and 1980s when the production jumped from 394,000 units in 1971 to approximately 10,738,000 units in 1987. Later,

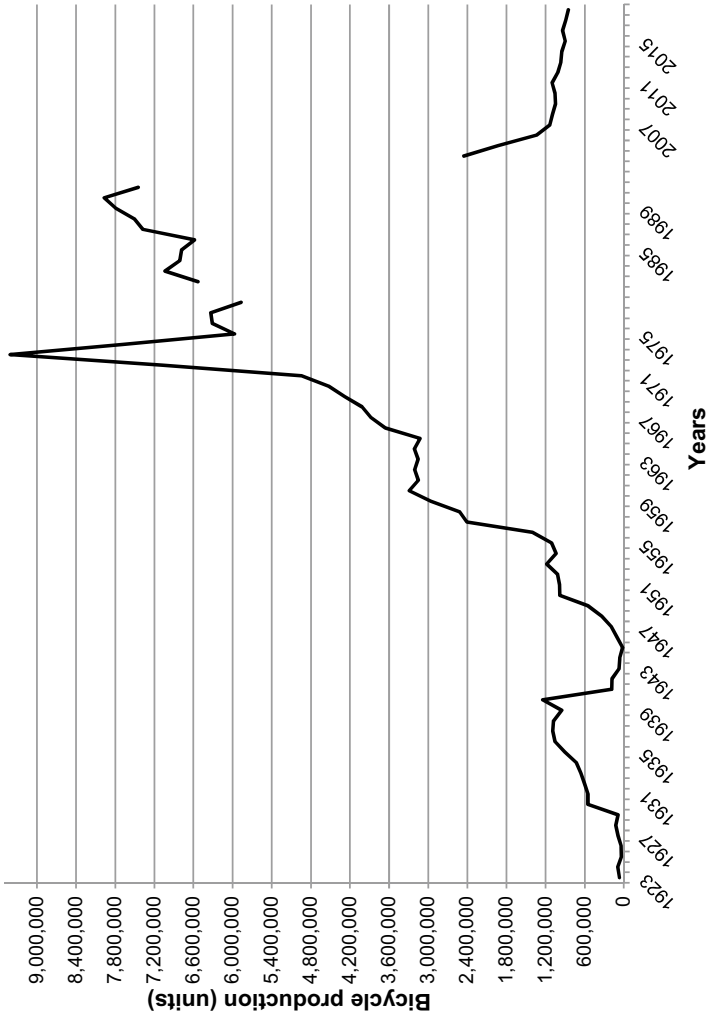

Fig. 2.7 Japanese bicycle production 1923–2018

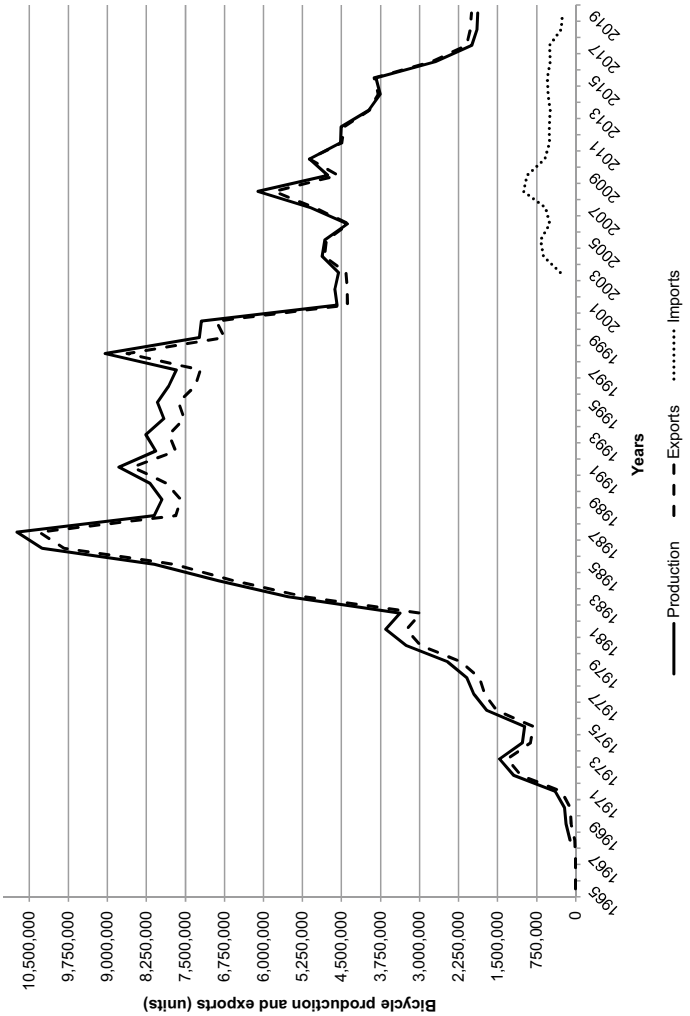

Fig. 2.8 Taiwanese bicycle statistics 1965–2019

bicycle output stabilized around 8 million pieces until 2000. Since the 2000s, the size of bicycle production significantly decreases to reach the lowest level of approximately 1,880,000 units in 2019. Presumably, the explanation of such a situation is the choice made by large bicycle firms, such as Giant and Merida, to move in part their production capacity to countries where the cost of labour is lower than Taiwan.

2.3 Bicycle Export and Import Statistics

This section analyses export and import data of the bicycle industry as a whole and reiterates the same organization of the previous section presenting a short discussion of six countries: the UK, Italy, the US, Canada, Japan and Taiwan.

The time series of British exports range from 1907 to 1939 and is incomplete as many years are missing, particularly those between 1908 and 1923 (Millward 1999, p. 278). According to these data, UK was an exporting country and played a key role in influencing the bicycle industry in other geographical areas, as explained in the previous chapter. During the 1920s and the 1930s the average yearly exports increased from approximately 255,000 units to 400,000 units (Fig. 2.9).

Bicycle import data are based on two time series, from different sources (Millward 1999, p. 279; Rosen 2002, p. 120), which provide a wider picture than the export statistics. The first set of data covers the 1902–1939 time frame and the second includes some years within the 1967–1992 range, showing many gaps. Despite some cautions that must be kept in mind when interpreting data outside their context, it is plausible to suggest that until the 1930s the United Kingdom imported very few bicycles, with the exception of 1902 that is difficult to explain (Fig. 2.10a). The situation completely changed since 1975 when bicycle imports began to climb and reached a yearly average of approximately 1,500,000 units (Fig. 2.10b).

Italy adopted an import-substitution industrialization model as discussed in the previous chapter and foreign trade statistics support this argument. Two time series are available from a secondary and a primary source. The former is a study (Piloni 1982, pp. 27–28) providing data covering the birth and early development of the industry from 1878 to 1914, with one year missing (that is 1895). The latter is the database of the Italian office for national statistics, called Istituto Nazionale di Statistica (ISTAT), which compiles data drawn from the customs agency

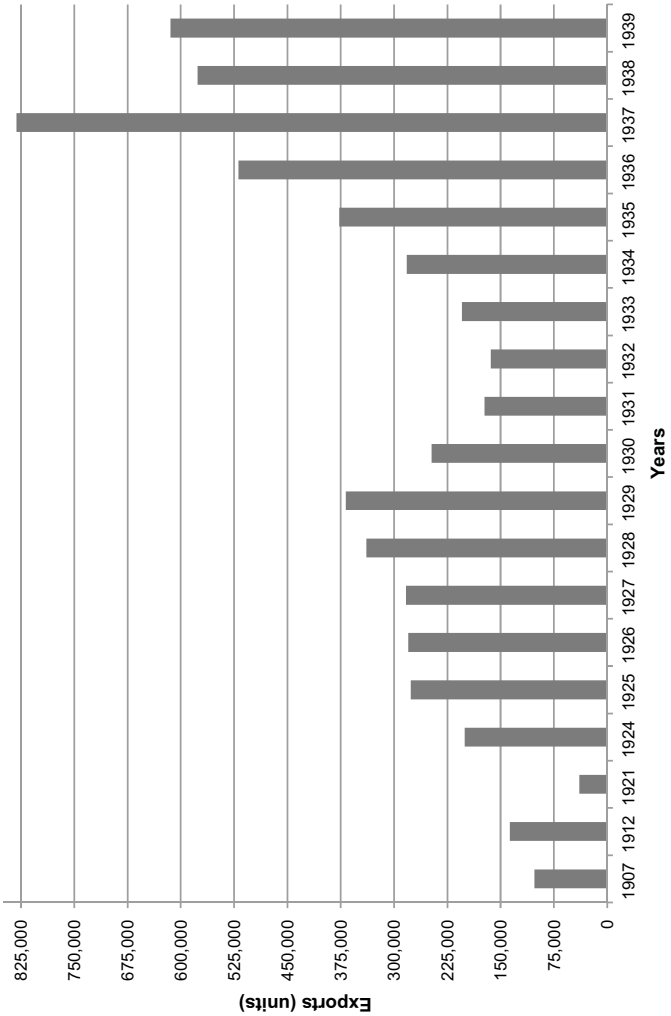

Fig. 2.9 British bicycle exports 1907–1939

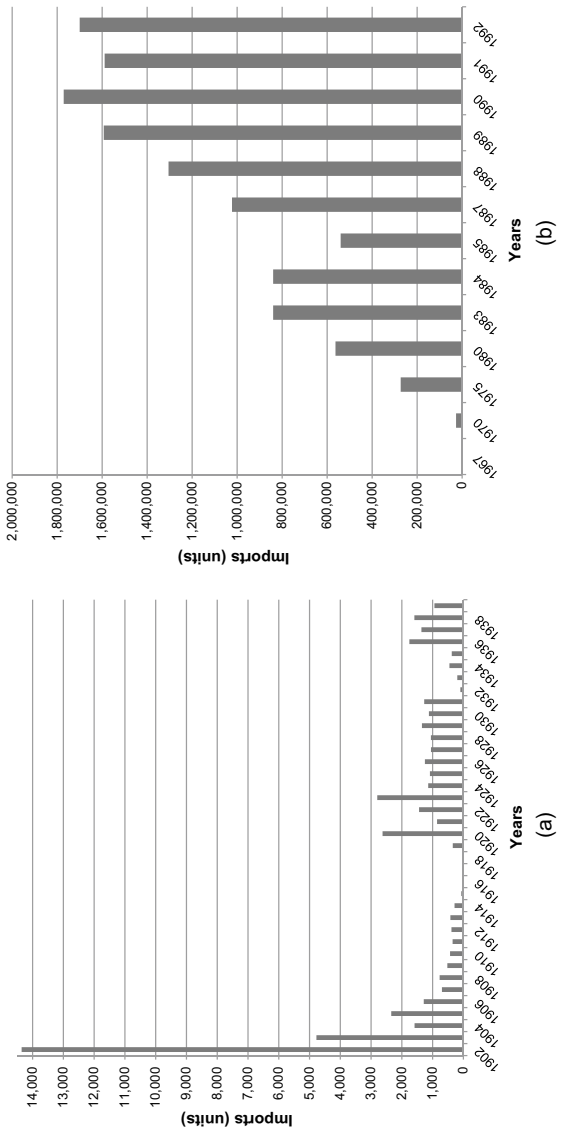

Fig. 2.10 British bicycle imports 1902–1992 **a** 1902–1939 and **b** 1967–1992

records. This data set includes a time series from 1994 to 2019 for finished bicycles and from 1991 to 2019 for bicycle frames (Istituto Nazionale di Statistica 2020). Before the 1990s it is not possible to identify both bicycles and bicycle frames as they were combined with other goods, preventing any deeper analysis. This is the result of the changes that, repeatedly over time, affect the Combined Nomenclature, particularly the level of data aggregation that, in turn, impacts on the possibility of isolating bicycles form other goods. Figure 2.11 is the chart of the first time series showing that bicycle imports were a significant source for the Italian market until the end of the 1890s and during the 1910s, even though the nascent industry began to compensate with exports.

The second time series, focused on more contemporary data, shows a declining trend in bicycle exports since 1994 and a stabilization around to a yearly average of 1,536,000 units (Fig. 2.12). The import of bicycles is characterized by a growth trend between 1994 and 2005, when the number of imported bicycles increased tenfold, reaching approximately 811,000 pieces in 2005. From 2006 to 2017, the import of bicycles fluctuated upward and downward around approximately 675,000 pieces. Later, imports decreased significantly in 2018 and indicated a recovery in

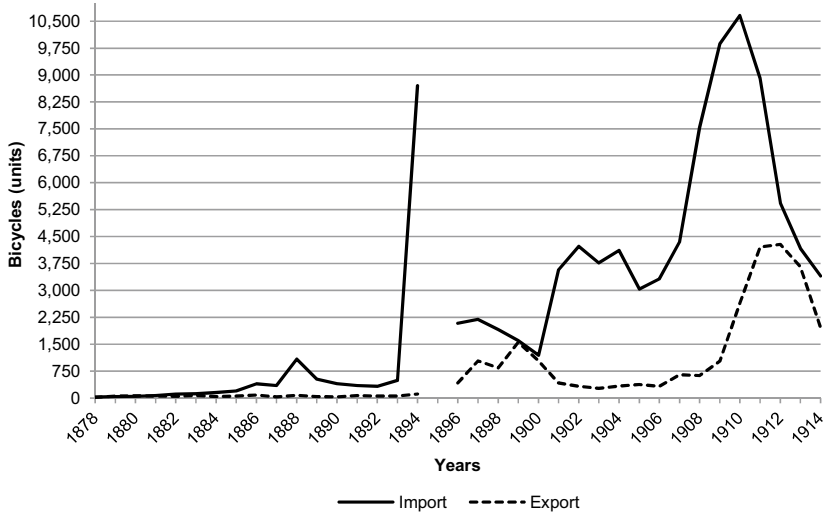

Fig. 2.11 Italian bicycle exports and imports 1878–1914

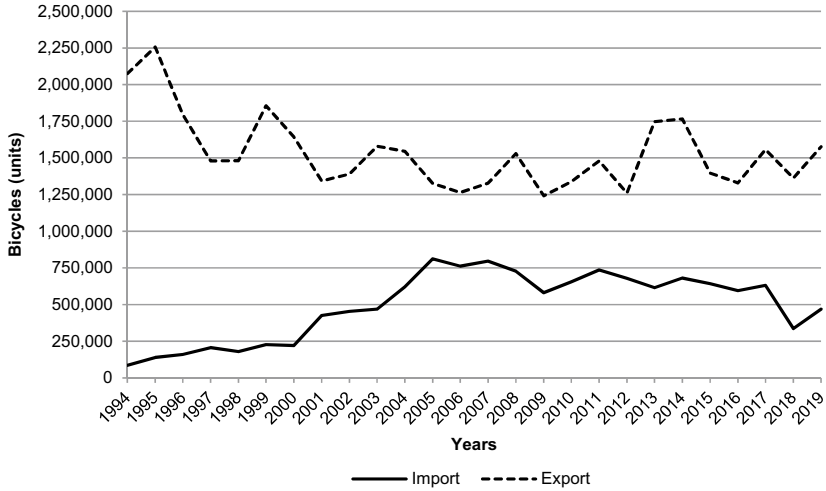

Fig. 2.12 Italian bicycle exports and imports 1994–2019

2019. This last year data are still provisional and subject to change when the final revision from ISTAT will be available.

As discussed in the previous chapter, Italian bicycle firms have almost completely set frame fabrication aside and this change is clearly visible through foreign trade statistics. The export of Italian bicycle frames was significant between 1991 and 1999 (Fig. 2.13). There was a more than fivefold increase, and the figure eventually reached 1,268,000 pieces. From 2000 to 2004, however, there was a dramatic decrease that reduced frame exports by approximately 83%. Since 2005, the yearly average number of exported bicycle frames was approximately 197,000 pieces. The import of bicycle frames shows an almost ninefold increase from 1991 to 2002, eventually reaching 2,340,000 pieces. The number of imported frames rose sharply from 2003 to 2004 and reached a peak of 4,051,000 pieces. From 2005, there was a decrease characterized by upward and downward fluctuations, and the yearly average number of bicycle frames was approximately 2,890,000 units. The last year is a provisional data, waiting for the usual revision due to the timeliness problem, and it shows a sharp drop in the number of bicycle frame imported. Despite the 2019 data, the figures about bicycle frames indicate that

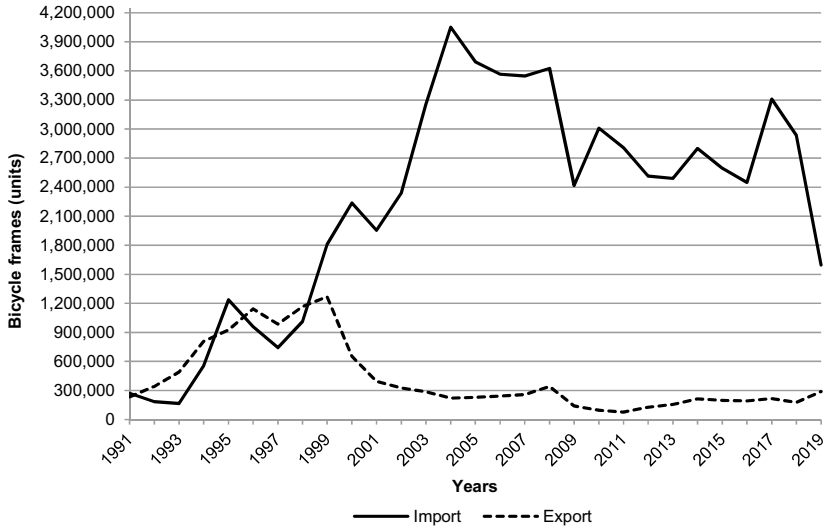

Fig. 2.13 Italian bicycle frame exports and imports 1991–2019

Italian bicycle companies are progressively replacing the manufacturing of frames with the import of products, presumably from Asia.

The export and import statistics of finished bicycle by the US industry is plotted in Fig. 2.5 where a 26-year time series, already examined in the previous section, shows that during the 1966–1991 time frame exports were almost negligible, except at the end of the 1980s and the beginning of the 1990s. Instead, bicycle imports played a key role into the domestic market, particularly during the first half of the 1970s and most of the 1980s until 1987 when a peak of approximately 9,500,000 units was reached.

A similar situation happened in Canada, during the 1926–1959 time frame (Fig. 2.6), where exports were negligible as well, and bicycle imports served the domestic market adding a significant number of units, particularly since the second half of the 1930s and after the end of the World War II.

The sources used for Japan's foreign trade statistics are the same as those already examined to discuss bicycle production. Export data are based on three time series. The first covering the 1930–1978 time frame, with some gaps (that is the years 1931–1932 are missing); the

second from 1982 through 1991; and the third from 2001 until 2018. Figure 2.14 shows the graph of bicycle exports, which became a notable achievement for the industry since the end of the 1950s until 1974, with a peak of 1,546,000 units in 1972. Later, there were downward and upward fluctuations for about 10 years, followed by a sudden decrease until 1991, when the export of bicycles reached 203,000 units. The 2000s saw a sequence of 15-years increase until 2015, with approximately 3,558,000 bicycles exported. Afterwards, the exports reversed direction and began to fall.

The import of bicycles in Japan can be broken down into three distinct phases based on the time series available. The first phase from the inception of the industry through 1972 (Fig. 2.15a) is another example of the import-substitution industrialization model. Imports progressively decline as local production of bicycles increases. There are some discrepancies and inconsistencies between data provided by Takeuchi (1991) and Ueda (1981) and further sources were used to address the problem. The sources are the annual statistics of foreign trade from The Department of Finance

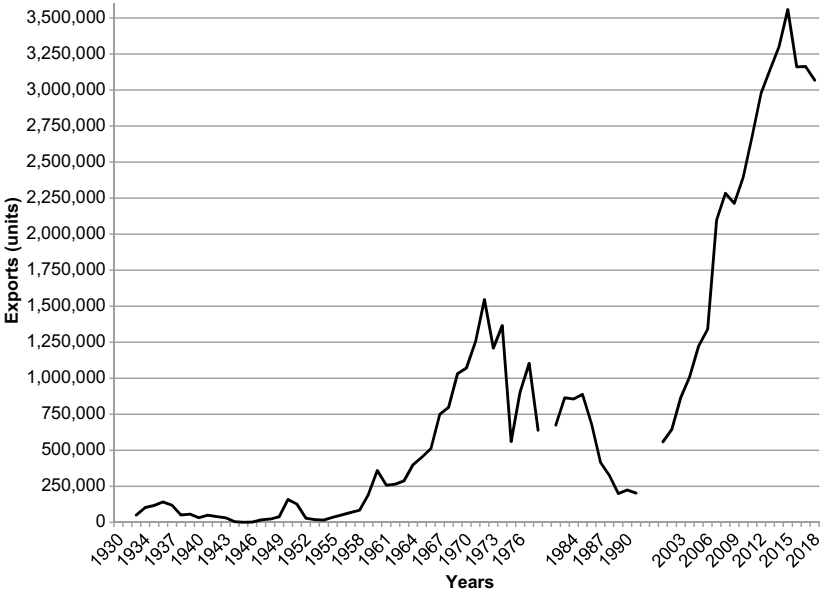

Fig. 2.14 Japanese bicycle exports 1930–2018

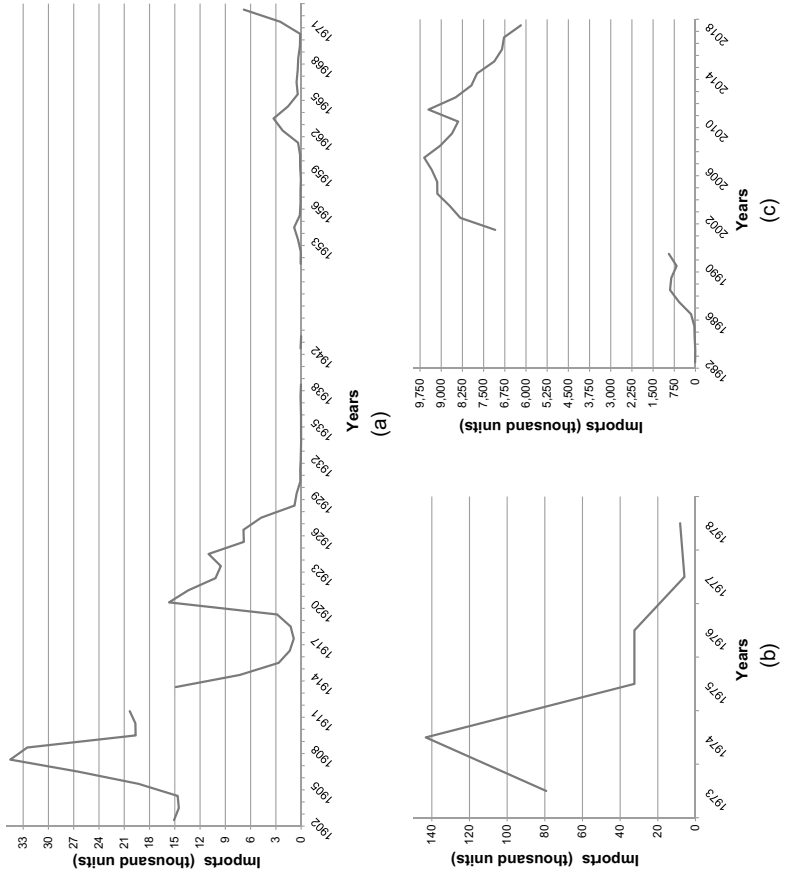

Fig. 2.15 Japanese bicycle imports 1902–2018 **a** 1902–1972, **b** 1973–1978, and **c** 1982–2018

(n.d.a, b) and the overview of the bicycle industry developed by the Japan Association of Bicycle Manufacturers (1979). During the second phase, from 1973 to 1978, imports reached the highest peak to over 143,000 units in 1974 (Fig. 2.15b). The last phase, from 1982 through 2018, can be divided into sub-time periods. The first, covering the 1982–1991 time frame, saw a significant growth of imports to 940,000 pieces in 1991 (Fig. 2.15c). The second period, from 2001 through 2018, marked a steady increase of imports with a yearly average of approximately 8,800,000 units until 2011. Afterwards, bicycle imports began to decrease to approximately 6,182,000 units in 2018.

The export data of Taiwan are based on the same sources already used for bicycle production statistics. Secondary data cover the 1965–1980 time frame and primary data are from 1981 until 2019. Foreign trade statistics of the Taiwanese bicycle industry highlight that bicycle export is a fundamental activity for local firms as their output is almost completely sold to other countries. The graph of bicycle export (Fig. 2.8) shows that the time series of both production and exports are fully overlapped. In some years the number of exported bicycles exceeds that of production, presumably the time series has not been revised yet. There are no import data by the Ministry of Economic Affairs of Taiwan. Import statistics are available through the database of Customs Administration that provides a time series from 2003 to 2019 (Customs Administration of Taiwan 2020). Imports of finished bicycles reached a peak of approximately one million units in 2008 and then began to decrease to approximately 252,000 units in 2019 (Fig. 2.8). The average yearly imports were approximately 546,000 units during this period of time.

2.4 Apparent Consumption Statistics

It is a very common practice in the bicycle industry to use export and import data to create a further statistics to understand the size of domestic market. This statistics is called apparent consumption and is considered a proxy for domestic sales of bicycles. It is derived residually as the difference between bicycle production and net exports, which in turn is the algebraic sum of import and export data. The use of apparent consumption is justified as the only way to grasp bicycle unit sales of a specific country in a specific year. Although such a practice is understandable, it is flawed conceptually and methodologically. The concept of bicycle unit sales is different from that of apparent consumption. The former

is the number of bicycles actually sold, while the latter combines the number of bicycles manufactured, usually obtained through an estimation process, and the number of bicycles actually imported and exported, usually subject to a long revision process. Apparent consumption is also problematic from a methodological perspective, as it does not account for inventory at the retail and wholesale levels. This means that it is not possible to know how many bicycles remain unsold. Bicycle production data provide an estimate of what was manufactured but do not determine the actual number of bicycles sold. Even though the net exports are based on actual data, they do not necessarily indicate that an imported or exported bicycle was also sold; it could still be unsold at some point within the distribution channels. The interpretation of apparent consumption requires caution because of the limitations highlighted earlier and the composite nature of such a variable. Moreover, the use of apparent consumption seems more appropriate when the focus of the analysis is understanding the status of the domestic market rather than the status of industry performance.

The time series of bicycle production, exports and imports examined in previous sections do not allow to compute the apparent consumption statistics for each country due to many missing data. Therefore, the following example is based on a long time series of 26 years describing the contemporary Italian bicycle market. Figure 2.16 shows the apparent consumption from 1994 to 2019. The domestic market decreased by approximately 56% from 1994 to 1999, and it fluctuated in subsequent years, reaching a yearly average of approximately 1,665,000 bicycles. Apparent consumption cannot provide enough clues to evaluate the market situation of a geographical area. It is a rough estimate that needs further information to understand how well or bad that bicycle market is performing.

2.5 Bicycle Ownership Statistics

A further statistics that might shed light on the bicycle industry is the stock of bicycles available in a country or, as it is usually called, bicycle ownership. This statistics provides a preliminary knowledge about how widespread is the bicycle within the population of a country. It is an aggregate measure that tells something about the size of bicycle adoption by a specific population, which can be the inhabitants of a country, a region, a city, or a town. Bicycle ownership suffers from the same problems as those

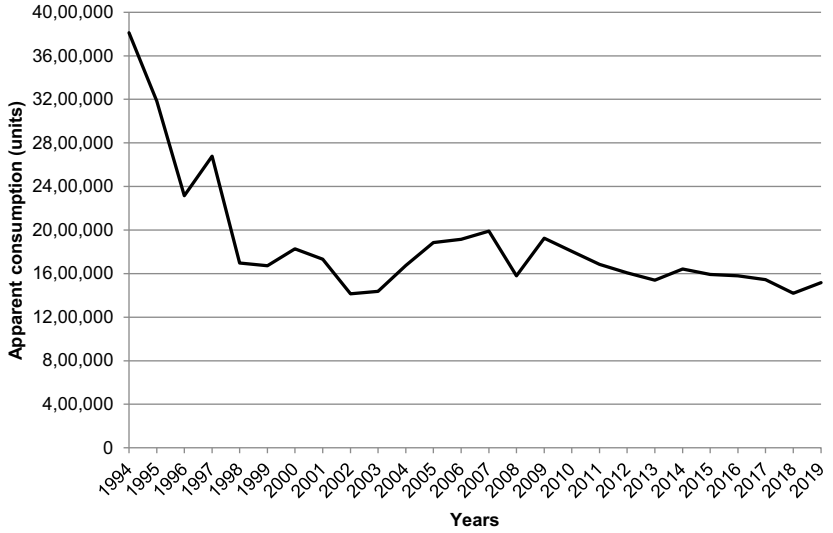

Fig. 2.16 Italian apparent consumption 1994–2019

already referred to as other bicycle statistics. It is very difficult to find bicycle ownership data available and, if data exist, they are usually unreliable, incomplete and incomparable. This section includes two examples of bicycle ownership statistics from Italy and Japan. The other countries, such as the UK, US, Canada and Taiwan, have no or very limited data. The Italian case (Mari 2018) offers an in-depth analysis of the topic and highlights most of the problems associated with this statistics.

Statistics about bicycle ownership in Italy are drawn primarily from magazines published by the Touring Club Ciclistico Italiano (TCCI), a national organization of cyclists focused upon tourism founded in Milan in 1894. Three relevant magazines were reviewed: *Rivista Mensile del T.C.I.* (published from 1895 to 1920), *Le Vie d'Italia* (published from 1917 to 1943 and from 1946 to 1967), and *Le Strade* (published from 1919 to 1943 and from 1946 to 1970). The TCCI used to compile a report of bicycle ownership that was published in one of the organization's magazines. Raw data were drawn from two sources: bicycle registration plates and membership reports. The first source was based on data gathered by the Ministry of Finance, and it was the prevailing channel used to understand how bicycle ownership evolved over time in

the country, whereas the second source was not very frequent, presumably due to practical difficulties and cost issues. Bicycle registration was introduced for taxation purposes in 1897, and any bicycle had to have its own plate, attached to the bicycle frame, showing that the tax was paid. Such registration was a very controversial initiative that aroused the opposition of cyclists and their advocates, such as the TCCI. The tax was reduced in 1910 and then abolished in 1927. It was reintroduced in 1931, and its final abolishment was announced in 1938 (with implementation beginning in 1939). Table 2.1 shows the data available drawn from varied and scattered sources. The figures cover the time period from 1895 to 1959. It is even more difficult to find further data on bicycle ownership after the 1950s. Table 2.1 highlights some gaps in the sequence that makes the time series incomplete and more difficult to interpret. The number of bicycles increased approximately tenfold from 1895 to 1905. There was approximately one bicycle for every 150 people in 1901 and one bicycle for every 60 people in 1911. The adoption of bicycles greatly increased until the 1950s. In 1921 there was one bicycle for every 23 people and in 1936 one bicycle for every 11 people. After World War II, there was one bicycle for every 6 people in 1951 and one bicycle for every 5 people in 1959.

Data usually were available if the bicycle registration tax was due, as the Ministry of Finance created its own statistics for taxation purposes. It was more difficult to obtain data on bicycle ownership when the tax was abolished, as happened in some years. In addition to the problem of accessibility, the use of data on the bicycle registration tax for statistical analysis has some drawbacks. Firstly, tax evasion was a relevant issue, and many sources in Table 2.1 claim that figures usually underestimate the true number of bicycles. There are not any estimates of the size of tax evasion, but the perception is that the problem had a significant impact on the reliability of the statistics. Secondly, there was a tax exemption for some kind of bicycles, such as military and police bicycles; consequently, figures do not include those bicycles. It is not possible to know how many bicycles were exempted, but the military and police still used bicycles as a means of transportation until the 1940s. Thirdly, the figures should match the number of bicycles, but this is not necessarily true. Some sources claim that a better interpretation is the number of registration plates or the number of cyclists. This means that some cyclists, who owned more than one bicycle, attempted to pay the registration tax just once even though they were required to pay it for each bicycle. They simply moved the

Table 2.1 Italian bicycle ownership 1895–1959

Year	Bicycle ownership	Source	Bicycle ownership	Source	Bicycle ownership	Source	Bicycle ownership	Source	Bicycle ownership	Source	Year
1895	30,000	(a)									
1898			185,000	(t)							
1899	109,019	(b), (c)	200,000	(t)			111,027	(y)			1898-1899
1900	124,861	(c)	215,000	(t)			128,245	(y)	126,080	(z)	1899-1900
1901	142,918	(c)	221,000	(t)			141,358	(z)			1900-1901
1902	174,507	(c)	230,000	(t)							
1903	200,887	(d)	242,000	(t)							
1904			295,000	(t)			239,691	(aa)			1903-1904
1905			343,000	(t)							
1906			368,000	(t)							
1907			412,000	(t)			368,181	(bb)			1906-1907
1908			475,000	(t)							
1909			504,000	(t)							
1910			605,000	(t)			606,195	(cc)			1909-1910
1911							930,651	(cc)			1910-1911
1912							996,182	(cc)			1911-1912
1913							1,109,354	(cc)			1912-1913
1914	1,250,701	(e)									
1915	1,276,476	(e)									
1916	1,070,573	(e)									
1917	1,055,419	(e)									
1918	1,067,069	(e)									
1919	1,363,936	(e)									
1920	1,603,569	(e)									
1921	1,685,533	(e)	1,849,272	(u)							
1922	1,849,272	(e)									
1923	2,039,161	(e)									
1924	2,224,025	(e)	2,223,995	(h)	2,264,105	(u)					
1925	2,549,718	(f), (g), (h), (i)									
1926	2,896,523	(i)									
1927	3,275,000	(j)									
1928	3,670,000	(j)									
1929	4,070,000	(j)									
1930	4,480,000	(j)									
1932	3,500,000	(k)									
1933	3,476,721	(l), (w)	3,465,791	(v)			3,443,767	(x)			
1934	3,655,460	(l)	3,650,050	(v)	3,554,940	(w)	3,637,588				
1935	3,992,076	(l)					3,982,851				
1936	4,019,509	(m)					4,047,640				
1937	4,493,124	(n)					4,504,861				
1938	4,935,019	(o)					4,954,117				
1939	6,000,000	(p)									
1940	4,000,000	(q)									
1941	5,000,000	(q)									
1948	8,000,000	(r)									
1949	8,000,000	(r)									
1950	8,000,000	(r)									
1951	8,000,000	(r)									
1952	8,000,000	(r)									
1953	8,000,000	(r)									
1954	7,000,000	(r)									
1955	7,000,000	(r)									
1959	10,870,000	(s)									

Source (a) Johnson (1896); (b) Bertarelli (1900); (c) Anonymous (1903); (d) Anonymous (1904); (e) Ceriani (1926); (f) Anonymous (1926); (g) Spaventa Filippi (1927); (h) Vandone (1927a); (i) Vandone (1927b); (j) Vandone (1930); (k) Vandone (1934); (l) Anonymous (1936); (m) Anonymous (1937); (n) Anonymous (1938); (o) Anonymous (1939); (p) ANCMA (1953); (q) Anonymous (1942); (r) Roghi (1956); (s) Luzzatto Fegiz (1960); (t) Roseo (1912); (u) Anonymous (1924); (v) Vandone (1935); (w) Gazzaniga (1935); (x) Biffi (1941); (y) Bianchi (1901); (z) Brentari (1902); (aa) Anonymous (1905); (bb) Bianchi (1908); (cc) Bertarelli (1915)

plate from one bicycle to another. Available data do not make it possible know the average number of bicycles owned by each cyclist, but it is reasonable to state that the majority of Italian families had more than one bicycle, as it was the most affordable means of transportation until the 1940s. Fourthly, bicycle registration statistics were determined for taxation purposes and very seldom distinguished among bicycles, tandems, tricycles, quadricycles and motorized bicycles. Figures usually include all these vehicles, and it is not possible to know the quantity for each category. It is plausible to state that bicycles were the largest group within those vehicles. Fifthly, the Ministry of Finance used a fiscal year that was different from the calendar year, and statistics follow the former in some cases, whereas in other cases, they follow the latter. The comparability of the time series is jeopardized, as it is not always clear on which year (fiscal or calendar) the data available are based.

Table 2.1 is organized to emphasize the discrepancies and inconsistencies arising from the different sources quoted below the table. There are five columns each for *Bicycle ownership* and for *Source*. For each year, the reader can see the available figures, the alternative figures (when they exist) and the sources reported in the reference section of the chapter. There are some data in the upper-right corner of Table 2.1 that the sources reported according to fiscal year (included in the last column of the table). Such a year usually began on July 1 and ended on June 30 of the next year (for example, from July 1, 1898, to June 30, 1899). It is clear from Table 2.1 that bicycle statistics often contradict each other and, in many cases, are rough estimates that require caution in interpretation. A possible explanation of discrepancies and inconsistencies, besides the drawbacks already mentioned, is copy error where data are drawn from the bicycle registration tax, as the figures were passed from one level of the bureaucracy to the next. If there were no data available because the registration tax was not due, the most plausible explanation is that figures are the result of an estimation process. It would be necessary to know exactly how the figures were compiled to understand the process of estimation and say something about the results. The sources usually do not provide any information about how they derived the figures, and it is thus very difficult to make any judgement. For example, data from 1898 to 1902 highlight a significant discrepancy among the available sources (Bertarelli 1900; Anonymous 1904; Roseo 1912) that presumably is explained through the tax evasion issue. This means that the source (Roseo 1912) had made some estimations to take

into account the number of cyclists who did not pay the registration tax. In other cases, the sources clearly stated that they simply provided an estimate of bicycle ownership. This was the case for 1927 through 1932 (Vandone 1927b, 1934) and 1939 through 1955 (ANCMA 1953; Anonymous 1942; Roghi 1956). A further example is 1924, for which three different figures are available. Their size is very similar, except for one source (Anonymous 1924) that reported that the number of bicycles (2,264,105) referred to the first five months of 1924. The last example is 1959, which represents a completely different source (Luzzatto Fegiz 1960), as it is a survey conducted by a private firm engaged in public opinion research. The survey is based on a probability sample of the Italian population, and it provides a broader picture of bicycle ownership and the characteristics of Italian families that relate to bicycle ownership.

Bicycle ownership data in Japan do not allow a thorough analysis as that of Italy, nevertheless, it is useful to provide a brief discussion of the statistics available. The time series is from 1903 to 1977 and is drawn from two sources examined earlier in this chapter. The first source (Takeuchi 1991, pp. 122, 134) includes data from 1903 to 1909 and from 1916 to 1930. The second source (Ueda 1981, p. 61) provides data from 1913 through 1977. There are many inconsistencies between the sources and it is not possible to understand the reasons behind such a problem. The chart in Fig. 2.17 is created using both sources, but data from Ueda are preferred consistent with other statistics analysed earlier in this chapter.

The time series has a gap between 1910 and 1912. The graph shows that Japanese population adopted the bicycle at an increasing rate from the 1910s through the end of World War II reaching 8,556,000 units in 1944. Afterwards, the diffusion of bicycles was relentless until 1977 when approximately 46,800,000 units were widespread in the country.

2.6 Conclusion

The bicycle industry is about 150 years old and has tackled many complex problems, particularly those impacting the technology of the bicycle. Despite some great outcomes over time, the industry has not developed yet a suitable system for recording its statistics. The problems with current data are almost the same problems as those of the nascent industry. How to proceed for improving the situation? The chapter highlighted that various organizations play a role in providing bicycle statistics and it seems

Fig. 2.17 Japanese bicycle ownership 1903–1977

clear that no one can afford to give up the contribution of the others in this endeavour. At the same time, it is also evident that there is a lack of coordination within those involved in gathering and compiling bicycle statistics. The coordination requires that the topic of bicycle statistics is included in the agenda of one or more of those organizations, as a priority to allow a more informed decision making within the whole industry. And the agenda setting, in turn, is based on the commitment to changing the way statistics are currently gathered. If no organizations express a strong commitment, the business as usual approach will perpetuate and bicycle statistics will still be affected by problems.

Gathering data can be a difficult and costly activity, however technology advancements such as the bar code and application programmes for mobile devices are a pragmatic course of action to address the problem of bicycle statistics. For instance, the trade organizations might promote the development of an International Standard Bicycle Number (ISBIN) similar to what is used in the publishing industry where each book has its

own International Standard Book Number (ISBN). It is not an easy transition from the current system of bicycle statistics to a fully new approach. The technology is already available, what is missing is the commitment to change. Will any bicycle firm be willing to change its behaviour and declare how many bicycles were manufactured each year?

Another useful change regards foreign trade statistics. The chapter emphasized that one of the key problems remains the classification of goods adopted by customs agencies and developed by international organizations such as the European Union. These classifications keep changing and this is understandable since goods evolve over time, however a new edition should guarantee the comparability between same goods included in various versions of the classification. Moreover, code numbers to identify bicycle categories should be based on more digits, and should be harmonized all over the world, preventing the practice of each country to introduce their own code numbers. This change requires the action of international organizations, but it can be encouraged by trade organizations and their members, which might develop an agreed proposal to address the problem.

A further suggestion is for improving the availability and reliability of bicycle ownership statistics. It is advisable to perform a periodical survey to monitor how the relationship between citizens and bicycles develops over time in each country. This can be done through the office for national statistics or a private initiative promoted by trade organizations.

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