Chapter 5. Empirical evidence on recycling and trade in paper and lead in developed and developing countries¹

5.1 Introduction

Empirical evidence on recycling at a global scale is scant. Often data on recycling are provided on national levels only. The few obtainable cross-country studies on recycling are mostly focussed on one particular material or region. Therefore, it is difficult to draw general conclusions on recycling in developed and developing countries. An aggregated overview of trade and recycling in both regions was presented in Chapter 1. It was recognised that trade in secondary materials from developed to developing countries has increased significantly in the last three decades. This typical trade pattern is a strong indication for specialisation in the recycling sector of both regions.

In this chapter the empirical analysis is taken one step further. The main objective of the chapter is to investigate whether specialisation in the recycling sector of developed and developing countries takes place and to determine the causes of these specialisation patterns. To understand developments in the national and international markets of secondary commodities and the differences in recycling between developed and developing countries, two materials are selected for further analysis: lead and paper.

The chapter is structured as follows. Regional trends in recycling and trade in paper and lead commodities are examined in Section 5.2. Whether these patterns and developments can be explained through typical characteristics of developed and developing countries, such as trade regime, wages, population density, and resource endowment, is analysed by means of a regression analysis in Section 5.3. In Section 5.4 conclusions are drawn.

5.2 Regional trend analysis

The main reason for the selection of paper and lead is the availability of country-level recycling data for both regions. Domestic data have been derived from various sources, viz.: Food and Agriculture Organisation of the United Nations (1999); Metallgesellschaft (annual); and World Bank (1999). The trade data are derived from the United Nations Statistical Office COMTRADE databases at the International Computing Center (ICC) in Geneva. For lead the period 1974-1997 is analysed. Paper is considered for the period 1970-1997. The countries considered for the two materials are listed in Table 5.7 in Appendix 5.1.

5.2.1 Methodological background of trend analysis

There is considerable ambiguity in discussions on recycling because the term recycling can be interpreted in many different ways (Connelly and Koshland 1997). First, recy-
Cling involves different forms of waste management, including product reuse, material reclamation, and energy recovery. This study refers to material reclamation, although in some cases the applied data do not explicitly exclude the other forms. Secondly, recycling is generally used as a collective term for the recovery as well as the utilisation of secondary materials. Recovery refers to the diversion and collection of waste materials from landfills, incinerators, or other disposal methods. Utilisation refers to the processing of diverted waste into new useful materials and products. Trade enables the secondary material recovered in one country to be utilised in another country. Therefore, in analysing the recycling and trade relationship between different regions, a distinction must be made between recovery and utilisation of waste. Thirdly, the level of recycling can be expressed in absolute levels (i.e. recovery per capita, gross annual quantities per country) and in relative values (i.e. recovery rate). The latter form represents the recycling intensity in a country and is therefore the preferred variable for recycling in this study. To facilitate an international comparison of these activities, recovery and utilisation are expressed as rates.

The recovery rate \( r \) is the amount of secondary materials domestically recovered for recycling purposes \( (Q_s) \) as a share of the total level of the disposal of the final commodities of that particular commodity in a country. Because statistical cross-country information on disposal levels is not available, consumption of that particular commodity is used (for example, the recovery rate of paper is the total amount of recovered wastepaper divided by the total amount of paper consumption in a country). The total consumption of the final commodity consists of the domestic production \( (Q_f) \) plus imports \( (M_f) \) minus exports \( (X_f) \) of the final commodity. Ideally, changes in stocks of final commodities are also taken into account:

\[
r = \frac{Q_s}{Q_f + M_f - X_f}
\]

The utilisation rate \( u \) is the amount of secondary materials used as a share of the total production \( (Q_f) \) of that final commodity in a country (for example, the total amount of wastepaper consumed, divided by the total amount of paper produced in a country). The domestically recovered secondary material \( (Q_s) \) plus the net-import of the secondary commodity \( (M_s - X_s) \) determine the amount of secondary commodity used:

\[
u = \frac{Q_s + M_s - X_s}{Q_f}
\]

To illustrate the caveats of these recycling definitions, Figure 5.1 shows the produced \( (Q) \) and consumed \( (C) \) material flows in year \( t \) and in year \( t+1 \) in a closed economy. A distinction is made between the applied and the preferred indicator for the measurement of the importance of the recycling sector. Differences mainly occur due to changes in stocks.

As mentioned, the preferred denominator to compare the recovery efficiency is the total amount of recyclable materials recovered from the total disposed final commodities of that material in a particular year. However, because of the absence of data on material-specific waste generation, total consumption is used as a proxy. The assumption that consumption and waste generation take place in the same year can lead to inconsistencies in the recovery rate for materials with a long lifetime, such as most metals. For materials with a short lifetime, such as paper and plastics, the assumption is quite plausible.