B Structural change indexes

## B.1 Calculation

Structural change indexes (SCIs) are used throughout this report to measure the extent of change in the sectoral composition of the economy as a whole. The SCIs summarise information about changes in the distribution of economic activity ― usually output or employment — into a single indicator. This means, on the one hand, that changes in disaggregated output or employment share data can be presented in a convenient and readily interpretable manner. On the other hand, SCIs do not make use of all the information available — for example, they provide no information about within‑sector change or changes in the *level* of output or employment.

An SCI may be thought of as the total number of percentage points of economic activity that has ‘moved’ sectors (broad industry groupings) within a given period. The SCI is calculated by halving the sum of the absolute value of the changes in the share of economic activity of each sector, in percentage points (equation 1). The absolute value of changes is used to ensure that positive and negative changes in shares do not cancel each other out. The total is divided by two so as to avoid counting the same shifts twice.

(1)



where is the percentage employment share of sector *i* in the economy at time *t*

By construction, the value of *SCIt* falls between zero and 100, with a value of zero representing no structural change between time *t‑1* and time *t*, and a value of 100 representing a complete change in composition over that time.

Given the methodology underlying SCIs, it is important that any comparison of SCI values use indexes that are calculated in the same way. This is because the formula above is sensitive to both the level of industry or sector aggregation, and the time period chosen for comparison.

### Level of industry or sectoral aggregation

The level of aggregation used in constructing an SCI impacts on the value of that index. This is by virtue of the fact that the index does not quantify changes that occur *within* a sectoral grouping, but only includes changes *between* sectoral groups. As a result, an index calculated using the four broad sectors — agriculture, mining, manufacturing and services — will always be less than or equal to an index calculated using the 19‑industry divisions that make up those sectors (appendix A).

Decisions regarding the level of data aggregation depend largely on the research questions being considered and the data available. However, it is important to recognise that it is not possible to interpret an SCI value without knowing the industry aggregation used in creating it. Where SCI values are to be compared (say, across countries), it is crucial that they be based on the same aggregation for the comparison to be valid.

To illustrate this point, figures B.1 and B.2 each plot three separate SCIs (for real output and employment, respectively), using an increasingly disaggregated breakdown of the services sector (alongside the agriculture, mining, and manufacturing sectors).

Figure B.1 Real output structural change indexes, by level of sector disaggregation, 1969 to 2012**a, b**

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a Real output measured as gross value added by industry in chain volume terms (reference year 2010‑11). b Appendix A provides information on the aggregation of industry divisions into sectors.

*Sources*: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0) and E. Connolly (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

Figure B.2 Employment structural change indexes, by level of sector disaggregation, 1969 to 2012**a, b**

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a Data are for financial years until 1985, and annual averages of quarterly data, ending in the May quarter of each year, from 1986 to 2012. Industries are at the ANZSIC 2006 division level. b Appendix A provides information on the aggregation of industry divisions into sectors.

*Sources*: Productivity Commission estimates using ABS (*Labour Force, Australia, Detailed, Quarterly,* Cat. no. 6291.0.55.003) and E. Connolly (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

As is apparent, the three indexes in figures B.1 and B.2 follow a similar trend, rising or falling together. However, there is usually a gap between them, due to the fact that indexes based on a greater number of categories allow more potential shifts between industries/sectors. For example, in figure B.2, equal but opposite changes in the employment shares of the Health care and social assistance and Education and training industries would be picked up by the 19‑industry index, but not the 4‑ or 8‑sector indexes, in which they are aggregated together. Similarly, equal but opposite changes in the employment shares of the business services and social services sectors would be picked up by the 8‑sector index, but not the 4‑sector index. Finally, changes in the employment shares of the broad services sector and the agriculture sector would be picked up by all three indexes.

Changes in the size of the gap between indexes reflect the extent to which structural change is occurring within aggregated sectors without affecting the overall share of those sectors in employment. For example, in 1984, share changes were taking place within the broad services sector that were not reflected in the overall share of services. Hence the large gap between the 8‑sector and 4 sector indexes. This suggests that share changes within services at the time were occurring in opposite directions. Conversely, in 1988, there was no difference between these two indexes, indicating that all individual shares within services were changing in the same direction. (The same reasoning can be applied to explain the existence or absence of a gap between the 8‑sector and 19‑industry indexes.)

The comparison of indexes based on varying levels of disaggregation highlights an interesting fact. With the proportion of workers employed in the broad services sector now reaching almost 90 per cent of total employment, the rate of relative growth of this sector has declined, compared with the 1970s, and with it, the rate of change measured by the 4‑sector index in figure B.1.[[1]](#footnote-1) This can be regarded as an inevitable outcome, since the share of the broad services sector in the economy cannot expand indefinitely, that is, it cannot grow beyond one hundred per cent of employment. By contrast, the change in the distribution of employment among the disaggregated services sectors or industries is not bound in this way. As a case in point, between 2007 and 2012, the 19‑industry index in figure B.1 remained relatively stable, while both the 4‑ and 8‑sector indexes fell.

### Choice of time periods

The period of time between *t* and *t‑1* also impacts on SCI values, and the extent to which they fluctuate over time. Short‑term changes in sectoral shares of economic activity can be driven by both cyclical and structural factors. Therefore, if a short time period is chosen, the SCI may simply reflect cyclical changes in economic activity, rather than a long‑term change in the nature of that activity. Intuitively, by viewing plots of industry shares over time, it becomes apparent whether shares exhibit noisy variability or reflect longer‑term changes. SCIs, by their nature, cannot distinguish between the two.

To minimise the effect of short‑term variability on SCIs, Connolly and Lewis (2010) measure the share of sector *i* in the economy as the five‑year average to year *t.* They then calculate the index by differencing with the five‑year average to year *t‑1*. This approach has been employed throughout this report (with the exception of figure 4.9, for which sufficient data were not available).

## B.2 Interpretation: what drives changes in a structural change index?

In order to correctly interpret an SCI, it is important to be explicit about the economic events that might drive — or, alternatively, might fail to drive — changes to the value of a computed index.

An SCI reacts to both job reallocation and to differing rates of net job creation across sectors. Both the movement of workers and differences in employment growth rates between sectors can lead to ‘movement’ in employment shares — the share of a static industry will decline in the presence of positive growth in another industry, all else equal. More generally, an SCI will be positive in the presence of differential employment growth rates between sectors, even if no workers physically change industries. Although it is unlikely that precisely zero individuals change industries in any given period, the ongoing entry of young people and new migrants into the labour market cautions against the interpretation of an SCI as reflecting solely the movement of individuals between industries (or regions).

Conversely, it is also possible for many individual workers to have moved jobs and sectors, but for the employment shares of industries to remain unchanged — an SCI only captures *net* movement in employment shares. For example, it may be that there is gross employment ‘churn’ between industries that is not captured by an SCI because approximately the same number of individuals is moving between two industries in both directions.

These examples highlight that an SCI should be interpreted as a convenient summary measure of the global change in employment shares of all industries/sectors, not as an indicator of the extent of movement of individuals between specific industries.

1. The time path of the 4-sector SCI in Australia is very similar to that recorded by its OECD average counterpart. From a value of around 4 in the early 1980s, that multi‑country index declined to around 2.5 in the late 1990s, before rising to around 3 by the mid‑2000s (data not shown). [↑](#footnote-ref-1)