

THE FORCE OF CURRENCY DEBASEMENT

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It is usual to think of inflation in terms of the rate of rise in an index purporting to measure the levels of prices at a series of points of time. The purpose of this note is to direct attention to the converse, that is to the corresponding rate of debasement in the value of the unit of currency, and to use standard actuarial techniques to move from a discrete series to the concept of a continuous curve.

Instead of looking at percentage rates of increase in prices from one quarter to another, or from a particular quarter of one year to the same quarter of the following year, it may be more instructive to consider the internal purchasing power of money in the form of a life table. Quarterly periods of time replace years of age, and a force of debasement expressed as a nominal annual rate may be deduced at any point of time corresponding to the deducing of a force of mortality, similarly expressed as a nominal annual rate, at any point of age.

The data available is in the form of a price index, that selected for illustrative purposes being the Consumer Price Index, Six Capitals, All Groups as published quarterly by the Australian Bureau of Statistics in its series Reference No. 9.1. Any such index is very much an approximation. Apart from problems in determining and varying from time to time the composition of the basket of goods and services to be measured, and also field difficulties in assessing prices of the selected constituents, the index for a particular quarter may not exactly relate to the mid-point of the quarter. A more fundamental difficulty is that allowance cannot be made for the exercise of choice by members of the community as prices of constituents vary in relation to each other. The basket is changed every few years but the linking process ossifies any overstatement resulting from the exercise of choice in the meantime, and in general a linked time series of this nature overstates the increase in prices. The bias is always in one direction, so that a fall in prices - if this were to occur - would necessarily be understated.

There is no way of estimating the overstatement in prices and to an unknown extent, therefore, the practical use of the CPI in the process of indexation would include what corresponds to a betterment factor or an allowance for improvement in productivity. There seems to be no better basis available for considering changes in the value of money, and in what follows the chosen CPI series has been accepted as the basis of the arithmetic. It must be emphasised that we are concerned here only with the internal value of the unit of currency. Many considerations and restraints affect its foreign exchange value; the latter is not immediately relevant and insofar as important consequential influences by way of imports, exports, capital inflow, debt repayment, etc, affect the internal economy, these will in due course be reflected in changes in internal prices as measured by the CPI.

It has been assumed that CPI values relate to the mid-point of the quarter to which they refer. As price movements can be affected by specific political and financial decisions, some sudden or unexpected, it would not be rational to assume an underlying mathematical relationship over even a few years; at the same time some arithmetical smoothing would be acceptable to eliminate or reduce any seasonal influences or statistical variations. The procedure adopted was to use 4-term moving averages to deduce CPI values at exact quarter dates and then to apply a minor degree of smoothing; the resultant CPI values were divided into 100,000 to give a series in the form of a life table with a radix of 1000 as at December 31, 1966.

With x representing successive exact quarter dates and adopting the usual actuarial nomenclature, the force of debasement at these points was calculated by the formula:

$$\mu_x = \frac{7(d_{x-1} + d_x) - (d_{x-2} + d_{x+1})}{3l_x}$$

where the digit in the denominator (3 instead of 12) reflects the fact that quarterly values are being used in the determination of a nominal annual rate. Whilst values are thus calculated only at quarterly points, the force of debasement (like the force of mortality) is a continuous curve.

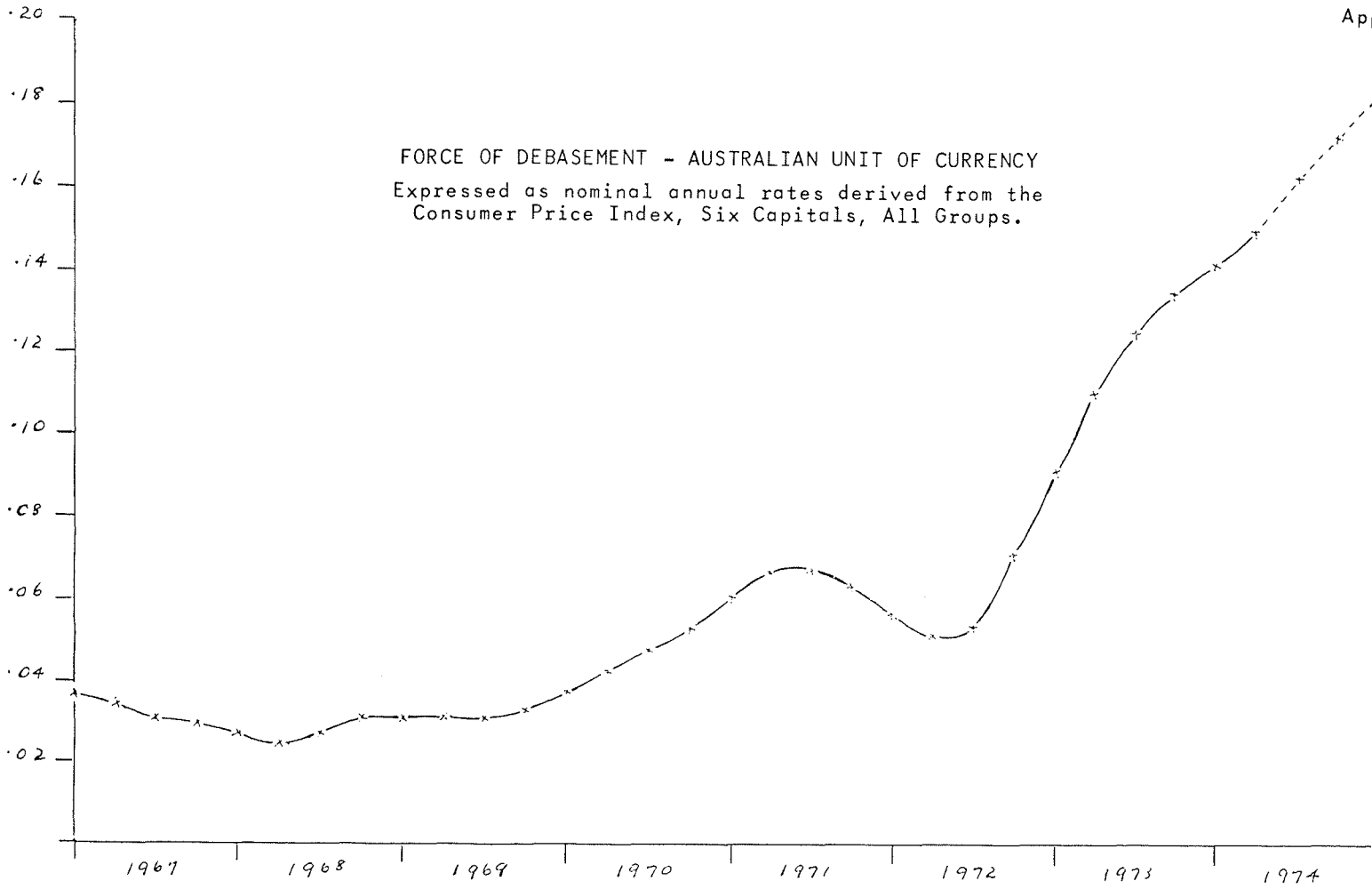
The "life table" recording the decline in the value of the Australian unit of currency since 31 December, 1966 is given in Appendix A and the curve representing the force of currency debasement is illustrated in Appendix B. The table has been extrapolated to 31 December, 1974 but the last three values (in brackets in the table) would be subject, to an increasingly likely degree, to revision as quarterly values of the CPI became available beyond the December quarter of 1974. A feature of the curve is the decline in the rate of currency debasement between mid-1971 and mid-1972 and the rapid escalation since the latter date - an illustration in different form of what is so well known already. A force cannot increase indefinitely at a high rate but the turning point in the curve cannot be deduced by arithmetical extrapolation - we don't know the future.

LIFE TABLE

Australian Unit of Currency

Basis: Consumer Price Index, Six Capitals, All Groups

	l_x	d_x	μ_x
31 December, 1966	1,000	9	.036
31 March, 1967	991	8	.034
30 June, 1967	983	7	.030
30 September, 1967	976	7	.029
31 December, 1967	969	6	.027
31 March, 1968	963	6	.024
30 June, 1968	957	7	.027
30 September, 1968	950	7	.030
31 December, 1968	943	7	.030
31 March, 1969	936	7	.030
30 June, 1969	929	7	.030
30 September, 1969	922	8	.032
31 December, 1969	914	9	.037
31 March, 1970	905	10	.042
30 June, 1970	895	11	.047
30 September, 1970	884	12	.052
31 December, 1970	872	14	.060
31 March, 1971	858	14	.066
30 June, 1971	844	14	.067
30 September, 1971	830	12	.063
31 December, 1971	818	11	.056
31 March, 1972	807	10	.051
30 June, 1972	797	12	.053
30 September, 1972	785	16	.071
31 December, 1972	769	19	.091
31 March, 1973	750	22	.110
30 June, 1973	728	23	.125
30 September, 1973	705	24	.134
31 December, 1973	681	24	.141
31 March, 1974	657	25	.149
30 June, 1974	632	26	(.162)
30 September, 1974	606	(26)	(.172)
31 December, 1974	(580)	(27)	(.182)



Appendix B

March/April

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1975