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The positive impact of developments in technology on the economy has historically outweighed the disruptive impact on employment. Society has benefited from the efficiency gains derived from the application of technology in production, while workers displaced by these technologies have largely been successfully retrained and employed in other jobs. However, the pace of development of the "Fourth Industrial Revolution" now presents a risk of mass displacement of human labour, particularly in tasks that are repetitive and menial. The "Fourth Industrial Revolution" is characterised by significant progress in a closely-linked cluster of areas such as robot dexterity, machine learning, processing power, and sensor capabilities, which reduce the costs of automation and enhance its potential benefits.

While most workers will be able to continue in their roles after job alteration, for instance, through being trained to operate the machines which now perform their old jobs, some workers may be unable to retain their jobs post-automation because they lack all the skills required to perform the redesigned job (structural unemployment).

Worker displacement as a consequence of automation generates the social costs of supporting and retraining displaced workers, which constitute a negative externality, resulting in market failure. The idea of a "robot tax" (a range of proposals attempting to tax the use of machines which replace human workers) has been debated in several jurisdictions as a response to the increasing adoption of automation technologies, which threaten to displace large numbers of workers. Proposals for a "robot tax" have largely faced difficulties in defining the concept of a "robot" as a unit on which to base the tax. In my recent paper with Glendon Goh, "Taxation of Automation and Artificial Intelligence as a Tool of Labour Policy", we consider an "automation tax", identifying the core problem as the unemployment caused by workers being made redundant as they are replaced by automation technologies, rather than the less certain concept of a "robot tax".

The "automation tax" proposed in our paper is aimed to correct the above market failure. The appropriate policy response is not to impose a blanket tax on automation as the proponents of a robot tax suggest, but instead to recognise the distinction between automation's employment-substituting and employment-complementing effects, incentivising the latter and disincentivising the former. Employment-substituting technologies perform the same tasks which human workers currently

perform, rendering human workers redundant. On the other hand, employment-complementing technologies are used by human workers to enhance their productivity, by allowing them to expand the range of tasks which they can perform.

The aims of an automation tax are twofold: first, to slow the introduction of automation technology in industries which would otherwise suffer rapid and massive unemployment as a result of automation, so as to provide as much time as possible for governments, welfare systems, and workers to prepare for the impending effects of structural unemployment; second, to impose a tax on companies that automate, so as to generate revenue for the support and re-skilling of displaced workers. Regulators must take care to only adopt these policy responses in cases where structural unemployment is widespread, irreversible, and clearly attributable to automation. Such cases are likely to be small in number.

Our paper recognises the theoretical difficulties in attempting to define a measurable unit such as “robots” or “jobs displaced”, and the practical difficulties in attempting to compute the tax due even if such a unit could be successfully define. We propose that the “automation tax” could be introduced through changes to the existing system of depreciation/ capital allowances. The deductibility of capital investments should vary depending on the effect of the capital investment on employment. Such a tax would provide a policy tool for the Government to control the rate at which automation displaces human workers. As automation may affect employment in a myriad of different and unpredictable ways, the ideal automation tax would have to be flexible enough to keep up with rapid technological developments. As such, the comprehensive schedules used in depreciation/ capital allowances regimes are particularly suitable for this task. This approach has the benefit of sidestepping the tricky question of attempting to define a measurable unit to be taxed, and instead allows policy-makers to have the flexibility to set different tax rates for different assets, depending on the industry in which such assets are utilised. This proposal also has the added benefit of low administrative costs, as the existing system of capital allowances/ depreciation may be used, eliminating the need to design a new tax from scratch and train both administrators and users to use such a new system.

The two main dimensions that may be adjusted to produce intended distortionary effects are: 1) accelerated depreciation, and 2) bonus depreciation. Accelerated depreciation is the allowance of deductions for declines in the value of an asset at higher rates than are expected to occur in practice. Bonus depreciation occurs where the taxpayer is allowed to deduct more than 100% of the cost of the capital asset. As a useful tool for governments to have on hand, an automation tax can be quickly implemented by building on the existing depreciation/ capital allowances framework where necessary. It can be used to manage the balance between the positive and negative externalities of automation and artificial intelligence by calibrating the level of their adoption through the use of these tax incentives. While the efficiency gains from the adoption of automation mean that the automation tax is unlikely to have widespread application, it does provide a useful tool for specific situations where the rate of automation needs to be slowed due to its resultant social costs.

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