A Thermodynamic Perspective on Profits

By Mark Ciotola

Profits are the *raison d'être* for businesses, and in fact the U.S. Internal Revenue Service requires businesses to be profitable to maintain their business status. The concept of profits would appear to be common sense: profit equals revenues less costs. Yet actual definitions of profit are far from simple and involve complicated tax and accounting rules. This article attempts to present an objective, physical approach to understanding the concept of profit by moving away from the monetary world and using principles of thermodynamics.

A brief review of heat engines is in order. A heat engine operates between extremes of temperature to do useful work. A typical automobile contains a heat engine. The energy from combusting gasoline creates a region of relatively high temperature. The automobile radiator creates a region of relatively low temperature. In terms of theory, the automobile's heat engine operates between the thermodynamic potential created by the difference in temperature between the hot combustion chambers and the cool radiator. Speaking in practical terms, the automobile heat moves heat from the combustion chambers to the radiator while retaining a relatively small amount of energy in the form of work. The work propels the automobile and powers headlights, the radio and other equipment.

Despite differences in engineering and construction, the most significant measure of efficiency of a heat engine is the magnitude of the temperature difference. In the case of an automobile, a hotter combustion chamber and a cooler radiator will result in a greater temperature difference and therefore greater efficiency. Low efficiency engines are very expensive to operate in terms of energy. The lower the efficiency of an engine, the less benefit there will be to using it. If the benefit is too low, it won't be used.

The Second Law of Thermodynamics requires that useful energy be lost in order achieve any work, therefore thermodynamics denies the existence of profits in terms of energy gain. There is never any increase in total useful energy despite the best planning, efforts or engineering. (Hubbert, 1936). Yet, work itself can be thought of as profit. So a thermodynamic measure of profit would be the amount of work achieved from consumption of useful energy. Since the difference in temperature represents a potential, a more general concept of profit would be work achieved by bridging *any* potential.

Businesses can be analogized to heat engines, for they bridge potentials. Businesses move resources from sources of supply to sources of demand, and extract the value of a fraction of those resources as profit. In fact the term "entrepreneur" means one who takes (*preneur*) profits by operating between (*entre*) two extremes.

Businesses strive to increase their financial profits by attempting to increase their revenues and decrease their costs. But just as in the case of a heat engine, profits come at a sacrifice. Wealth must irreversibly flow from high demand to high supply areas. A business might have to transfer $10 million in wealth from Canada or the United States to a developing nation to gain $1 million in profits. Such a transfer spans the greatest magnitude potential and therefore is the most efficient choice. As long as the economy of Canada or the United States is much larger than the business, the loss in national wealth will have little direct effect on the business and will not be a factor in it decision-making.

Therefore, for businesses to maximize profits, they must transfer wealth from Canada or the United States to developing nations, resulting in a trade imbalance.

Of course, this discussion is of a very general scope. Specific businesses, industries and combinations of businesses will experience different potentials and exhibit varying behavior. Nevertheless, this thermodynamic approach to the concept of profit can be applied to any scenario.

REFERENCE

Hubbert, M.K., "Man-Hours and Distribution", *Technocracy*. Series A, No. 8, 1936.