Proceedings of the First European Academic Research Conference on Global Business, Economics, Finance and Social Sciences (EAR15Italy Conference) ISBN: 978-1-63415-028-6
Milan-Italy, June 30-July 1-2, 2015, Paper ID: I508

The Terminator of Economic Recessions: A New Theory Rising from the Ashes of Keynesian and Neoclassical Economics

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Abstract

Economic recessions continue to haunt mankind from time to time. Their impact on the economy can be dramatic, as demonstrated by the Great Depression of the 1930s and, more recently, the Global Financial Crisis. Although there are numerous studies on the causes of economic recession, most are confined to a relatively small spectrum and fail to uncover the fundamental cause. Using a multi-commodity macroeconomic model, the author illustrates that economic recessions are a consequence of stagnant household consumption, which in turn is a consequence of product innovation scarcity. It is suggested that a thorough revision of patent laws aimed at encouraging innovation, while preventing the abuse of patent monopoly, would eliminate economic bubbles, and open the door to smoother and faster economic growth.

JEL code: *E23, E12,*
Keywords: *Economic recessions, consumption ceilings, product innovation, patent laws, economic growth*

1. Introduction

Economic recessions are not a recent phenomenon. They continue to occur, however, and the contributing factors to this pattern are not yet fully understood. Ongoing research into the causes of economic recession is imperative, because recession can have a significant negative impact on the development of nations, as well as on the living standard of mankind. The effects of large economic recessions can be quite devastating. During the Great Depression of the 1930s, the output of several Western nations fell by 25-30% in the period between 1929 and 1932-33. Unemployment rates were as high as 20% of the total labour force. In the United States (US), the unemployment rate peaked at 25% in 1932-33, and it took almost a decade for US output to return to its pre-1929 level.

More recently, the Global Financial Crisis (GFC) and the current European Debt Crisis are striking examples of the recurrence of economic recessions. During the GFC, the US Dow Jones Industrial Average index dropped to a trough of less than 6,600 points in March 2009, from its peak of more than 14,000 points in October 2007. In the last quarter of 2008, US quarterly real GDP decreased by 8.9%. The unemployment rate in the US increased from 4.6% in 2007 to 10.1% in 2010. As a result of the European Debt Crisis, many nations in Europe also experienced high levels of unemployment. According to the European Commission (2013), unemployment rates in 2012 were 25.0% in Spain, 24.3% in Greece, 15.9% in Portugal, and 14.9% in Cyprus. These statistics may not be appealing emotionally. Nevertheless, with the media suggesting that some families became homeless due to foreclosures or evictions, and that parents had to beg for food for their children, the consequences of recessions such as this one are clearly not only economic but also psychological.

The negative impact of economic recession has triggered a considerable amount of research. A universally agreed-upon explanation and solution for this economic phenomenon has, however, yet to be developed. This is the motivation for this paper. To uncover the fundamental cause of economic recession, the author has proposed several theorems based on common wisdom, and has developed a multi-commodity macroeconomic model. The model preserves the Classical assumption for an economy – the perfectly competitive market – and can provide a simple and universal explanation for recurrent economic recession and for cyclical economic growth.

The remainder of the paper is organized as follows. Previous studies on economic recession are reviewed and discussed in Section 2. Based on observations and reasoning in the real world, Section 3 identifies a series of theorems which are critical to the model. In Section 4, the model is developed and explained. Then, in Section 5, the model is used to illustrate how and when an economic recession will occur, and the implications for commodity and

factor markets are analysed. In Section 6 a dynamic approach is used to reveal the unique role of product innovation in both business cycles and economic growth. The reasons for product innovation scarcity and the ways of encouraging innovation are also discussed in this section. Finally, in Section 7 the paper is summarized, and brief concluding comments made.

2. Previous Studies

There are many studies on economic recession, so it is not possible and not necessary to review them all in this paper. Instead, the author will review studies in this area on the basis of various schools of economic thought. Since it is outside the scope of this paper to discuss fully the theories underpinning previous research in this area, the author will review and comment on only key concepts relevant to this paper.

Arguably the most influential study on economic recession was completed by Keynes (1936) and carried further by his successors, labelled 'Keynesian economists' (either 'old', 'orthodox', 'new', or 'post'). The main contribution of Keynesian economics to explaining economic recession was in its concept of deficiency of effective demand. Keynes attributed this deficiency to decreases in investment. He demonstrated that a decrease in investment would lead to a proportionally greater decrease in output through a multiplier effect. Keynes determined the most important causes of this investment shortage to be, firstly, a lack of 'animal spirits' (entrepreneurship), and secondly, the liquidity preference, or the speculative motive to hold cash in a world characterized by uncertainty (the 'uncertainty argument'). On the factor market, Keynes attributed high unemployment during a recession to the fluctuations of expected profit (or 'marginal efficiency of capital' in Keynes' words), resulting from unstable investment expenditure. The liquidity preference and uncertainty argument was further developed by post-Keynesian economists (e.g. Davidson, 1984, 1991), while new microeconomic foundations were developed by new-Keynesian economists, including real and nominal wage rigidity, price rigidity, efficiency wages, etc. (e.g. Mankiw, 1985, 1989, Akerlof and Yellen, 1985, Romer, 1993). Keynesian economists intuitively identified the key features of an economic recession as depressed demand, and high rates of unemployment. Their reasons for highlighting these features were, however, quite unusual. Through emphasizing lack of entrepreneurship and liquidity preference (by Post-Keynesian economists), and generalizing wage and price rigidity in an economy (by New-Keynesian economists), Keynesian economists discarded the long-standing assumption of Classical economics that perfectly competitive markets exist. By rejecting the existence of Adam Smith's 'invisible hand' (i.e. the efficiency of the market), the solution of Keynesian economists became one of interventionism, where the government intervenes in the economy as necessary to compensate for deficiencies in the market. Taken to extremes, interventionism leads to a planned economy. However, many planned economies have either failed (such as

North Korea and the former Soviet Union) or are evolving into market economies (for example many emerging markets such as China and several Asian and South American economies). The retreat of the planned economy and triumph of the market economy suggests that, generally speaking, the market mechanism can line up self-interest with social benefit. Consequently, Keynes' *General Theory* (Keynes, 1936) is actually about a special case (government intervention) in a market economy.

Classical economics (Old, New, or Neo) is the main alternative to Keynesian economics in explaining economic recession. Classical economists have great faith in the efficiency of market mechanisms and in perfectly competitive markets. They regard economic recessions as large natural economic fluctuations (e.g. Lucas, 1975, Kydland and Prescott, 1982, Plosser, 1989, Prescott, 1986). They believe that, if market forces were allowed to operate alone, economic recessions would be temporary or relatively short-lived. Consequently, they argue that government intervention is unnecessary. This argument has a valid point in that every recession does lead to eventual recovery, although Keynesian economists may argue that this occurs as a result of government intervention. By describing economic recessions as natural fluctuations, however, Classical economists avoid the issue of the causes of economic recession. They tend to ignore the important features of economic recession highlighted by Keynesian economists, such as stagnant demand, unutilized capital, and high unemployment. Instead, they focus on developing economic models and econometric estimations and choose to be indifferent to the economic and psychological damage of a recession to human beings. The Classical economics solution to economic recession – natural recovery – is unpopular with government and public alike.

The majority of economists today are neither strictly classical nor strictly Keynesian. Instead, most appear quite happy to accept the idea that the force of aggregate supply stressed by Classical economists is most important in the long run, while aggregate demand emphasized by Keynesian economists plays a key role in the short run (Sorensen and Whitta-Jacobsen, 2010). Thus, the dichotomy between Keynesian and Classical economics evolves as a dichotomy between the long run and the short run. That is, conflicting theories applying to the same economy but from different perspectives. Economists in this dichotomous camp have to believe, however, that the long run aggregate supply is a vertical line – without a vertical long run aggregate supply curve, the dichotomy between the long run and the short run will break down. When one seeks to uncover the microeconomic foundation for this vertical long run supply curve, the opposite appears to be the case: a vertical supply curve for a firm or an industry is found only in the case of very short run. In the long run, an industry supply curve can be increasing, constant, or decreasing, depending on the nature of the industry. The long-run aggregate supply curve for an economy can be viewed as a

combination of supply curves for all industries. In considering that an economy has many different kinds of industries, the aggregate long-run supply curve should be similar to the moderated form of long-run supply curves for the industry, and thus it can never be a vertical line, i.e. an infinitely inelastic supply curve. Supporters of this dichotomous approach may argue that the vertical aggregate supply curve indicates limited resources in the long run. However, this begs two questions. First, why can there not be resource limitations in the short run? In fact, resource limitations have occurred in many periods throughout history, and can be found either in the long run or in the short run. Secondly, what about the effect of technological progress? It is widely accepted that technological progress is a significant factor in the long run and that it can empower firms to increase their output with limited resources. In the light of this, the limited resource argument is not suitable for the long run. In short, the use of a vertical supply curve in the long run is inappropriate, and cannot be employed to conciliate Keynesian and Classical economics.

Marx's explanation of economic recession has been given little attention in economics literature, perhaps because of his radical idea of advocating class warfare. Nonetheless, there is an element of truth in the Marxist argument that warrants discussion here. Marxists determine that economic recession is caused by inequality. Their explanation is based on their observation of overproduction in the economy and the considerable income gap between the rich and the poor. They argue that capitalists push wages down and raise the rate of surplus value, and that this causes excess supply and inadequate aggregate demand. Certainly, income distribution inequality plays an important role in economic recessions. It is common during a recession that many products cannot be sold, while at the same time many poorer people are unable to buy even necessities. The GFC strongly illustrated the importance of income inequality in economic recessions. Large-scale lending by the rich to the poor did boost demand for housing and consumption. When the rich sense a risk of loan default and want their loans repaid, however, the resulting financial constraint on the poor and thus the consequent decrease in final demand pushes the economy into recession. It is therefore clear that income inequality is a contributing factor to economic recession. It is not, however, a fundamental factor underpinning recession. Given the large production capacity for almost every available commodity in the modern global economy, there is always a possibility of overproduction and thus deficiency of demand, even if income is equally distributed and everyone has sufficient income to buy what they want. So, income inequality can aggravate or accelerate a recession, but it is not a fundamental cause.

Other explanations for economic recession have been proposed. One of these is economic bubble theory. There have been numerous economic bubbles in history. Examples include the Dutch Tulip bubble (1634-1637), the Mississippi bubble in France (1719-1720), the South

Sea bubble in Britain (1720), the British Railway Mania (1840-1846), the Roaring Twenties stock-market bubble (1922-1929), the Japanese assets bubble (1984-1989), the US stock market bubble (1987), the Dot-com bubble (1995-2000), the global housing property bubble (2005-2008), and the European debt bubble (at the time of writing). Three types of economic bubbles have been identified by researchers: first, irrational bubbles where investors make irrational decisions such as herding (e.g. Woodall, 1999, De long et al, 1990, Kindleberger, 1996, and O'Hara, 2008); second, rational bubbles where investors make rational expectations based on available information (e.g. Milgrom and Stokey, 1982, Allen, et al, 1993); and third, intrinsic bubbles exclusively related to intrinsic value (e.g. Froot and Obstfeld, 1991, Boubaker et al, 2009, Naoui, 2011). The basic assumption of economic bubble theory is that a bubble can be created for different reasons. Furthermore, when the bubble bursts, a recession is the most common outcome.

The pre-2008 subprime mortgage lending bubble in the US resulted in the recent GFC. In the wake of the GFC, a considerable amount of research has been undertaken in an attempt to identify its causes. Taylor (2008) concluded that the GFC arose from frequent monetary excess (loose monetary policy), and that this was the primary cause of the housing boom and bust in the US. Arner (2009) argued that the GFC resulted from unprecedented excessive borrowing, lending and investment, motivated by a range of economic and regulatory factors. Berrone (2008) viewed the GFC as an incentive problem: there was no penalty or disincentive for managers of financial institutions, who are responsible for the collapse of their institutes. Crotty (2008) believed that the GFC was caused by flawed financial institutions and financial practices, known as the New Financial Architecture. Jickling (2009) identified 26 causes of the GFC, most of which concerned flawed financial regulation, ranging from bad computer models to the poorly implemented financial innovations.

The causes of the GFC and of economic bubbles identified in this body of research, such as irrational investor behaviour, expectation errors, asymmetry of information, principal-agent problems, government policy errors, lax monetary policy, large imbalance of global savings, and a flawed financial system, are clearly contributing factors. These studies, however, focus on specific areas and tend to overlook the investment conditions that exist before a recession occurs, which may be a key to the fundamental cause of recessions. A few questions need to be addressed regarding the pre-recession investment environment.

The first question is, why do investors repeatedly focus on one or a few types of assets ('sunny spots')? For example, investors focused their investment behaviour on shares in the stock market before the Great Depression, on internet enterprises in the Dot-com bubble, on housing assets in the 1980s in Japan and in the 2000s globally, and on the growth in housing mortgage lending before the GFC. It is widely agreed that investors are generally risk averse

by nature, and should consequently diversify their investment portfolio while putting some money into the 'sunny spots'. If a majority of investors is risk averse, the 'sunny spots' should not become overheated and thus economic bubbles should not occur.

Secondly, why does the attraction of these and other 'sunny spots' lead to very unreasonable and inherently unstable investment decisions? Three examples may be given of such unstable investment environments. First, during the Tulip bubble, a single tulip bulb once sold for the price of several years' salary for an individual (van Horne, 1985). Second, at the peak of the Dot-com bubble in 1999, it was said that a new millionaire was created every 60 seconds in Silicon Valley. Third, during the 2005-2008 housing debt bubble, aggregate household debt in many countries was higher than aggregate annual household income. There may be numerous answers to these unimaginable investment situations, including irrational investor behaviour, greedy individuals, and flawed regulations. When an investment bubble reaches this kind of extreme, however, investors should be worried about the burst of the bubble (in fact, investors were very nervous before the burst of each of these bubbles). Even irrational or greedy investors should therefore seek any possible investment opportunities to 'make their escape' before the bubble bursts. If there were plenty of profitable assets, businesses or projects at such times, perceptive investors would therefore have found them and utilized them. As such, the bubbles would shrink and no recession would follow.

Thirdly, when a bubble bursts, why do investors fail to learn from their mistakes and utilize other investment opportunities? It is possible that investors make mistakes and cause economic bubbles, but they can definitely learn from their mistakes and identify other opportunities when the bubble bursts, if such opportunities are indeed available. As such, the impacts of negative shocks to the economy of a burst bubble should be so short-lived that they will not necessarily lead to economic recession. All these questions point to a reality of the investment environment before and during a recession. That is, there are very few profitable investment opportunities during such times. This may be a key factor behind the recurrence of economic bubbles and associated recessions.

From the above discussion it is clear that previous studies of economic recession hold some elements of truth. They have failed, however, to uncover the fundamental cause of recession, and to provide a satisfactory solution. As long as economic recessions continue to occur, the search for answers must also continue. This paper is an attempt to identify such answers. Previous approaches in macroeconomics have used a highly aggregated model (e.g. AS/AD model) to study economic recession. In contrast, this study will use a multi-commodity macroeconomic model to identify the fundamental factors behind economic recession.

3. Theorems

Prior to building a model to identify the cause of economic recession, it is important to explain the theorems upon which the model is founded. Based on real world observations and commonly accepted norms, three simple theorems have been proposed, each of which are unfortunately ignored in 'traditional' economic theory.

Theorem 1: Every commodity has a saturation point for each individual.

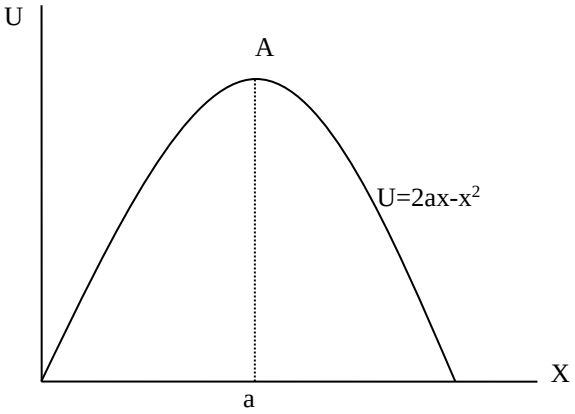
In accepted preference and utility theory, it is assumed that consumers always prefer greater quantities of any kind of commodity. That is, the greater the quantity of commodities consumed, the higher utility will be. This assumption, 'the more the better', is easily understood and widely accepted, but it is not applicable without conditions. For example, most people like ice cream and, generally speaking, more ice cream consumed will result in higher utility. Eating too much ice cream will, however, lead to vomiting or stomach pains. This example can be generalized to any good and service, and suggests that overconsumption is a burden for a consumer.

The above example demonstrates that a satiation point exists for the consumption of any commodity. If the amount of consumption surpasses the satiation point, the utility from consumption will decline. To embody the satiation point in the utility function, a parabolic utility function is proposed:

$$U(x) = 2ax - x^2$$

This utility function is illustrated in Figure 1. When the amount of consumption of x is less than a, the utility achieved increases as the consumption increases. Once x is greater than a, however, further increases in consumption will result in lower utility. For a rational consumer, the maximum consumption of x is at point A, the ceiling of consumption of commodity x.

Figure 1: Utility of a Representative Individual with Consumption



This one-commodity case may be generalized and applied to the real world of multiple commodities, using the following utility functions:

$$U = U(x_1, x_{2,} ... x_n) = \sum_{i=1}^{n} \alpha_i (2a_i x_i - x_i^{\,2})$$

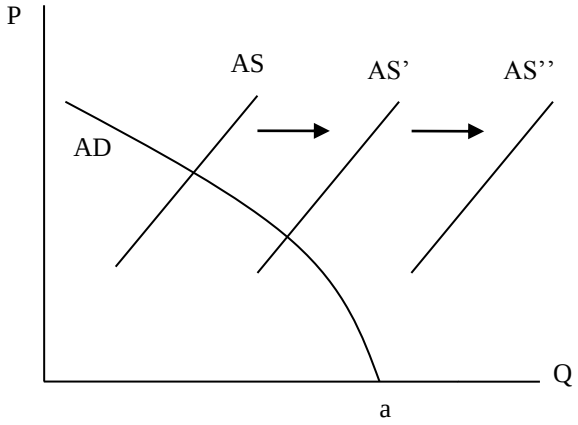
Where α_i is the consumption share of good x_i.

The saturation of consumption looks not very relevant to reality. One may ask: do households experience consumption saturation? The answer is positive for rich people because their enormous wealth is more than enough to allow them to consume anything they wish. The proportion of rich people is very small but the saturation of their consumption has substantial impact on the economy. Although poor people never reach their consumption saturation points because of their financial constraint, the contribution of their consumption to the economy is unlikely to increase if the unequal income distribution in the economy is not to be changed. Taking into account the financial constraint for poor people, one can say that they have a lower consumption ceiling or that they have not reached their absolute consumption ceiling but have reached their much lower relative consumption ceiling. When one thinks about the massive production capacity in a modern economy, it is on the right track to say that the majority of products in the markets – the old products – have reached or are approaching consumption ceiling.

The saturation point of each commodity for each household necessitates a consumption ceiling for any economy with a finite number of commodity varieties and a finite number of households. This consumption ceiling concept is important in explaining the disequilibrium between aggregate supply and aggregate demand. In his analysis, Keynes did not have this concept available. He attempted to legitimise demand deficiency in his work by suggesting that the aggregate demand curve would intersect the horizontal axis at a certain point, so that it was possible that the aggregate supply curve may not meet the aggregate demand curve (known as the 'Keynes effect'). This assertion was, however, quickly dismissed by Pigou (1943) who argued that, as price level decreased, households' real wealth (purchasing power) increased. This meant that the aggregate demand curve would bend to the right and never reach the horizontal axis (the 'Pigou effect'). Thus the aggregate supply curve can always meet the aggregate demand curve, and there will be no demand deficiency. The key to this argument was that the price level could impact on aggregate demand. This argument is flawed, however, because price is endogenous to a supply-demand system. That is, supply, demand and price affect one another and are determined simultaneously. If price impacted on demand exogenously, the supply curve must be absent (or be a horizontal line at a given price). This is of course not what Pigou demonstrated and is not the case in reality. With the concept of a consumption ceiling for each good, it is easy to understand that aggregate demand will always meet the horizontal axis and that the deficiency of aggregate demand is possible.

Consequently, the argument between Keynes and Pigou can be settled using the following simple graph.

Figure 2: The Possibility of Demand Deficiency



In Figure 2, the aggregate demand curve, AD, bends towards the horizontal axis and reaches the consumption ceiling at point 'a'. The aggregate supply, AS, is normally an upward slope, but it has a starting point with a positive price level and a positive quantity level, indicating that production of goods has a minimum cost and minimum scale. This setting of AS is an analogy to the standard supply curve (the part of marginal cost curve above average cost curve) in microeconomics. Due to the increase in inputs (e.g. labour and capital) and the progress of technology, the aggregate supply curve shifts from AS to AS'. The new intersection point indicates a higher output level with lower price level. As the aggregate supply curve continues to shift to AS'', however, it is out of the reach of the aggregate demand curve, AD. Consequently, this leads to an overproduction or deficiency of aggregate demand.

Theorem 2: Saving can generate utility directly and immediately.

Saving is traditionally treated as future consumption, so is normally not included in a utility function. The theory behind this practice is the life cycle theory developed by Modigliani and Brumberg (1954) and the permanent income theory developed by Friedman (1957). These two theories indeed illustrate a valid motive for saving, and provide a conceptual model for saving-borrowing behaviour. They are not accurate, however, in determining the saving decisions of households. Firstly, in the real world, future consumption is not the only reason for savings behaviour. A good example of this is the phenomenon that so many billionaires, who already have more than enough money for future consumption potential, continually seek to increase their wealth and therefore their savings. Secondly, and more importantly, the notation of lifecycle and permanent income is not so useful for a realistic model. Analytical models based on these concepts, such as the Ramsey-Cass-Koopmans model (Ramsey, 1928, Cass, 1965, Koopmans, 1965) are not applicable in the real world. This is because the future is full of uncertainty. Nobody can foresee future income,

future consumption, or an individual's life span. So, how can an individual make savings decisions using the lifecycle and permanent income hypothesis? Given that the future cannot be foreseen, the best practice is therefore to save as much as one can.

Since savings cannot be modelled accurately with respect to likely future consumption, the only practical way to model savings is to place it directly in the utility function. As a particular type of goods, savings do in fact generate utility directly, and this utility underpins household saving behaviour. There are a number of utility-related reasons for maximising savings. The first of these is precautionary saving. That is, savings can avoid or minimise hardship during unforeseen difficult times, and so savings behaviour can give the individual a sense of security. Second, the amount of saving (or wealth) reflects the social status and power of the individual, and it is from this status that some individuals derive considerable satisfaction. Third, individuals can obtain profits from astute investment of their savings, and investment profit is pleasurable for many individuals. Fourth, savings can be used to obtain goods and services that are not currently available, but which are expected to be available in the future. Knowing that one is in a good position to enjoy new products in the future can also generate satisfaction. Finally, savings (and other wealth) can be passed on to offspring, bringing pleasure to those making the savings. The multiple purposes of saving are not exclusive to each other. For example, if an individual saves for rainy days, he can also put his saving into his bank and thus earn some interest.

From these savings motivations we can claim that, although savings are by definition for future consumption, they can generate utility at the present time. Unlike ordinary goods, there is no ceiling for savings, so the concept of 'the more the better' applies. There are a number of functions that feature this concept. For simplification, however, we use a linear function for the utility of saving: $U(Savings) = \alpha_S * Savings$. This utility function of saving also allows negative saving (dissaving) to generate negative utility. In considering all factors affecting household utility, the following utility function is created:

$$U = U(x_1, x_{2,} ... x_n, Savings) = \sum_{i=1}^{n} \alpha_i (2a_i x_i - x_i^{\,2}) + \alpha_S * Savings$$

Including savings in a utility function is not a novel practice. For example, Howe (1975) treated saving as a good in a linear expenditure system. In so doing, Howe derived the same extended linear expenditure system as developed by Lluch (1973), who used an intertemporal utility maximization of the Stone-Geary utility function. What the author suggests in this paper is that savings must be included in the utility function due to future uncertainty.

There may be some concerns regarding this practice. One such concern is that this practice violates the neutrality of money, a doctrine of Classical economics. It must be noted that savings in the above utility function refers to real savings. Real savings can be calculated

as nominal savings divided by the price level. Alternatively, real savings can also be calculated as the sum of all kinds of unconsumed (saved) commodities, i.e. $Savings = \sum_{i=1}^{n} S_i$. Using this second approach, it is easy to dismiss concern that including saving in a utility function may violate the neutrality of money.

Moreover, it may be argued that, for some people who never save, savings may generate little utility (or have little value). Clearly, household savings behaviour is complex, and some individuals do prefer to spend all their wealth. In this case, the amount of savings is negligible, and thus the saving component in the utility function is of little importance. We can also assign a very small value (even zero) for the weight on saving (α_S) for these individuals. Thus, the utility function is still valid in these circumstances. Due to the benefits of saving described above, most people prefer to have savings. Individual saving is arguably more common amongst Asian people than those from Western societies, given the weaker economic safety nets available in most Asian nations. Nonetheless, the strong safety nets of Western nations can themselves be considered collective or compulsory savings, in the form of pensions, social security funds, and superannuation funds. Consequently, these forms of savings provide utility for all Western people. Since almost all people derive utility directly from savings (either individual, collective, or compulsory, or a mixture of all three types), it is necessary to include savings in the utility function.

There may be other arguments against including savings in a utility function. For example, it may cause double counting when the savings are spent, or it may imply that there is always general overproduction in the economy because some output is not consumed (that is, it is saved). The former argument results from the old thinking: the utility of saving results from future consumption. When the utility of saving is viewed as satisfaction from holding savings for various purposes, the utility from spending of savings is the utility of consumption, rather than the utility of saving. Therefore, when savings are used, the utility of consumption of goods in the above utility function increases but the utility of saving decreases. Consequently, the utility function is consistent at all time. Regarding the latter argument, overproduction is indeed possible given this utility function but is not always present. The key to this lies in whether or not savings can be fully utilised. This is related to the theorem regarding investment demand, which will be discussed next.

Theorem 3: Investment demand is determined by consumption growth potential.

Traditional investment theory proposes that a flexible interest rate can always equalize supply of savings and demand for investment, thereby producing equilibrium in the capital

market[1]. A supply curve intersecting a demand curve requires, however, that when the interest rate decreases, the investment demand curve must bend to the right so that it will never meet the horizontal axis, as Pigou (1943) argued in the case of the aggregate demand curve. This requirement implies that the interest rate can affect investment demand exogenously, but contradicts the fact that interest rates are an endogenous factor. That is, supply of savings, demand for investment and interest rates affect one another and are determined simultaneously[2]. Since there is no guarantee that the investment demand curve does not intersect the horizontal axis, equilibrium in the capital market may not be achieved.

The endogenous nature of interest rates means they cannot be a determinant of investment demand. Consequently, a truly exogenous determinant must be found. This is not a difficult task when one considers the purpose of investment: to obtain profit. As Tobin (1969) noticed, investment demand depends critically on profitability, A further thinking can reveal that the profitability is in turn dependent crucially on final demand. The profit from investment is achieved from the sales of goods and services to the final demand (e.g. if you buy shares of a company or a housing asset, the profit ultimately stems from the sales of the company's products or from the renting and/or selling of the housing to the final demand), so investment demand must be determined by the final demand or, essentially, household consumption. In a more rigorous way, the profitability of an investment is determined by both cost of and revenue from an investment. On the cost side, interest rates are a significant factor, but are not a determinant of investment demand due to their endogenous nature. On the revenue side, since investment income is achieved through sales of output[3], the final demand for output is critical as it will affect both price and the quantity of sales made. Final demand for output includes household consumption and investment demand. For simplicity, exports and government consumption are omitted from final demand for output. They simply reflect consumption by different consumer groups, and can therefore be grouped under a broader definition of household consumption. Since our aim is to discover what determines investment demand, we must exclude it from total final demand. Investment demand cannot

[1] In this case we are considering the pure market situation, without government interference in interest rates. Even with government intervention (by setting official interest rates through a central bank), the nature of capital market does not change. Practically, most official interest rates are indicative only, so commercial banks are not necessarily required to follow the official lead. Even in the case of enforceable official interest rates, the shadow or underground banking system will often circumvent the official requirement. Theoretically, an inappropriate official interest rate may cause excess demand or supply, but will not result in a shift of the supply and demand curve. Thus it will not become the equilibrium interest rate. The equilibrium interest rate is determined endogenously.

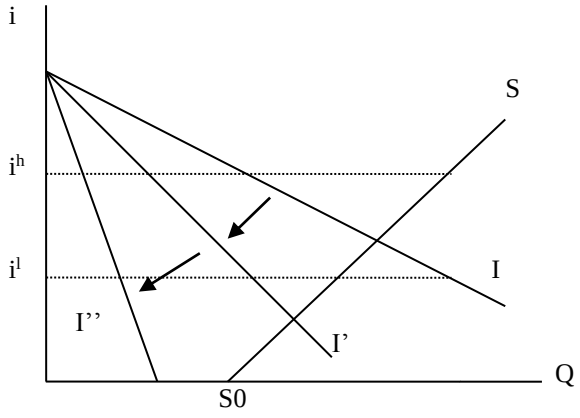
[2] If one insists that the interest rate is exogenous because it is set by a central bank, then the supply curve must be either absent, or identical to the horizontal interest rate line. Without a true supply curve, the argument in favour of a saving-investment equilibrium cannot be made.

[3] For simplicity here we only consider investment in production. The profitability of asset investments, such as housing, bonds, and equities, ultimately rests on the profitability of investment in production. This is because an increase in total wealth in an economy ultimately comes from the increase in production induced by investment.

be a determinant of itself. Consequently, the fundamental final demand – household consumption – is the determinant of investment demand.

To illustrate this point, a simple saving and investment equilibrium graph is employed. In Figure 3, the horizontal axis is the amount of saving or investment and the vertical axis is the interest rate. The investment curve I is a standard one – a downward sloping line. The saving curve S is upward sloping but with a starting point on the horizontal axis. This setting is to reflect the fact that, due to not-for-profit purposes of saving (e.g. precautionary saving), there is a minimum amount of savings even if the interest rate is zero. The effect of official setting of interest rate is to cause investment demand to move along the investment curve. For example, if the Reserve Bank sets the interest rate too high at i^h, the level of investment will be below the level of saving and this will lead to a monetary-policy-led contraction. On the other hand, if the reserve bank sets the interest rate too low at i^l, the level of investment will be higher than the level of saving and this will lead to a monetary-policy-led expansion. In short, an impropriate setting of official interest rates leads to artificial fluctuation of the economy, or unbalanced economic growth. For simplicity, assuming the Reserve Bank is capable of setting the official interest rate at the equilibrium interest rate so that S=I, or saving is fully invested. This equilibrium is, however, achieved only under the condition that there are plenty of investment opportunities, or the profitability of investment is good. If the investment profitability is low, the investment curve will pivot left from I to I'. This leads to a lower level of investment and lower equilibrium interest rate. When the investment profitability is approaching zero or even becomes negative, or the risk of investment is very high, the investment curve will pivot further left to I''. In this case, the investment curve will not meet the saving curve. This means, even if the interest rate is zero, the amount of saving will not be fully invested. The rationale behind this is that, in the time of no investment opportunity or of high risk of investment, it is better for the investor to hold cash rather than to invest and thus make a loss.

Figure 3: The Possibility of Uninvested Savings



More accurately, it is the future growth rate of household consumption that determines investment profitability. The potential for growth in household consumption is represented by the difference between the consumption ceiling, and the current consumption level. Adopting a gravity approach, we can create the following consumption growth momentum function:

$$C^M = (\sum_{i=1}^{n} a_i - \sum_{i=1}^{n} c_i) / \sum_{i=1}^{n} a_i = 1 - \sum_{i=1}^{n} c_i / \sum_{i=1}^{n} a_i$$

Assuming that investment level is positively related to consumption growth momentum and to the consumption ceiling level, the following investment demand function may be created:

$$I = B(\sum_{i=1}^{n} a_i) * C^M = B(\sum_{i=1}^{n} a_i - \sum_{i=1}^{n} c_i) = \sum_{i=1}^{n} I_i$$

$$I_i = \beta_i * I$$

Where B is a constant, and β_i is the share of investment demand for good i (I_i) in total investment demand (I).

4. The Model

The model used in this section is highly simplified, apart from the inclusion of multiple commodities. The economy in the model consists of one representative household and one representative firm. Government is not included in the model. The household provides labour and capital to the firm, and obtains wages and capital rentals in return. The household uses its income to purchase goods from the firm for consumption purposes, and supplies its savings to the firm for investment purposes. Under the zero economic profit condition, the firm uses labour, capital and technology to produce *n* commodities for the economy, and decides on its requirements for labour, capital, and investment in production.

A. the household

The ultimate goal of an economic system is to maximize household utility. This means that household utility is a crucial part of an economy-wide model. The utility function described in the previous section requires further modification before it is used in the model. First, since commodity demand includes both consumption demand and investment demand, we use 'c_i' to replace 'x_i' in the utility function to explicitly indicate consumption demand. Second, we need to consider the fact that there is a large number of households in an economy and that the distributional effect is an important factor in household consumption and utility. It is desirable to develop a multi-household model to include the distributional effect. This would, however, complicate the model and thus interfere with the main purpose of the paper. Instead, the author adds a distributional effect parameter in the utility function of the representative household. The new utility function is as follows:

$$U = U(c_1, c_{2,} ... c_n, Savings) = \sum_{i=1}^{n} \alpha_i (2\theta a_i c_i - c_i^{\,2}) + \alpha_S * Savings \qquad (1)$$

Where θ is the distributional parameter, $0<\theta\leq 1$. $\theta=1$ indicates that every household has the same level of income. When income distribution is not equal, some households cannot reach their consumption ceiling due to lack of income support. In other words, their consumption ceilings are practically lowered due to income constraint. This effect is captured by making $\theta<1$.

The optimal consumption problem for households can be expressed as:

Maximize $U = U(c_1, c_{2,} ... c_n, Savings) = \sum_{i=1}^{n} \alpha_i (2\theta a_i c_i - c_i^{\,2}) + \alpha_S * Savings$

Subject to $Y = \sum_{i=1}^{n} P_i * c_i + P_S * Savings$

Setting up a Lagrangian expression:

$$\ell = U + \lambda (Y - \sum_{i=1}^{n} P_i * c_i - P_S * Savings)$$

Using the first order condition we can derive the optimal consumption of good i as follows:

$$c_i = \theta a_i - \left[\sum_{i=1}^{n} P_i \theta a_i - (Y - P_S * Savings) \right] * \frac{P_i}{\alpha_i} / \sum_{i=1}^{n} \frac{P_i^2}{\alpha_i} \qquad (2)$$

The first item at the right hand side refers to the consumption ceiling. The term in the square bracket shows the gap between income needed to achieve maximum consumption, and current spending on consumption. So the equation shows that household consumption equals the maximum consumption of commodity i, minus the unachieved consumption due to household budget constraints.

The level of savings is determined by marginal utility. The optimal solution should show that marginal utility of consumption equals marginal utility of saving, or $2\alpha_i(\theta a_i - c_i) = \alpha_S$ (for this utility function the marginal utility of saving is α_S). If the gap between θa_i and c_i is large enough, namely $(\theta a_i - c_i) > \alpha_S / 2\alpha_i$, the marginal utility of consumption will be higher than that for saving, and thus consumption will increase and saving will decline. When the gap is small, namely $(\theta a_i - c_i) < \alpha_S / 2\alpha_i$, saving has a higher marginal utility, and thus a greater proportion of income will be saved.

B. the firm

For simplicity, the following Cobb-Douglas production function is used:

$$x_i = A_i * L_i^{\gamma_i} * K_i^{1-\gamma_i} \qquad (3)$$

The optimal production problem can be expressed as:

Minimize $Cost = P_L * L_i + P_K * K_i$

Subject to $Output = x_i = A_i * L_i^{\gamma_i} * K_i^{1-\gamma_i}$

Setting up a Lagrangian expression:

$$\ell = P_L * L_i + P_K * K_i + \lambda(x_i - A_i * L_i^{\gamma_i} * K_i^{1-\gamma_i})$$

Using the first order condition we can show optimal demand for labour and capital as follows:

$$L_i = \left(\frac{x_i}{A_i}\right)\left(\frac{\gamma_i P_K}{(1-\gamma_i)P_L}\right)^{1-\gamma_i} \qquad (4)$$

and

$$K_i = \left(\frac{x_i}{A_i}\right)\left(\frac{(1-\gamma_i)P_L}{\gamma_i P_K}\right)^{\gamma_i} \qquad (5)$$

These results link the firm's demand for labour and capital to the firm's output x_i. More generally, the results show that the factor market is closely related to the commodity market. Besides production, the firm needs to make a decision on investment. Assuming that firms can identify consumption ceilings as well as the impact of the distributional effect on consumption, investment decisions can be expressed as follows:

$$I = B(\sum_{i=1}^{n} \theta a_i) * C^M = B(\sum_{i=1}^{n} \theta a_i - \sum_{i=1}^{n} c_i) = \sum_{i=1}^{n} I_i \qquad (6)$$

$$I_i = \beta_i * I \qquad (7)$$

5. Implications

Using the above model, we can discuss how and when an economic recession will occur, as well as its features. The discussion here focuses on the commodity market and the factor market.

A. The commodity market

The supply of commodities is determined by the output of production. The total output of a commodity can be categorized as either consumed or unconsumed (saved). Consequently, the supply of commodity x_i is the sum of consumed and unconsumed commodity x_i, namely, $x_{Si} = c_i + S_i$. On the other hand, the demand for commodity x_i comprises consumption demand and investment demand, so that total demand for x_i can be expressed as $x_{Di} = c_i + I_i$. Thus, the excess demand function for x_i is: $ED_i = I_i - S_i$.

This equation indicates that the equilibrium of the commodity market (ED_i=0) hinges on the balance of saving and investment. If total investment demand for commodity i is equal to total saving of commodity i, then the market for commodity i will be at equilibrium. Otherwise, there will be either excess demand or excess supply in this market.

Summing up the excess demand functions for all commodities, we arrive at $\sum_{i=1}^{n} ED_i = \sum_{i=1}^{n} I_i - \sum_{i=1}^{n} S_i$. This equation describes the overall excess demand in the commodity markets. If total investment demand is greater than total savings, there will be overall excess demand for commodities in the economy. On the other hand, if savings cannot be fully used for investment purposes, there will be an overall excess supply of commodities.

Recalling the functions for investment and savings, we can write the excess demand function as:

$$\sum_{i=1}^{n} ED_i = I - Savings = B(\sum_{i=1}^{n} \theta a_i) * C^M - Savings = B(\sum_{i=1}^{n} \theta a_i - \sum_{i=1}^{n} c_i) - Savings \quad (8)$$

Using this equation we can discuss disequilibrium in the commodity market and the performance of the economy. We start with a scenario where household consumption level is low. In this case, there is considerable space for household consumption to grow, and thus consumption growth momentum and investment demand are both high. Meanwhile, at a low household consumption level, the marginal utility of consumption is higher than the marginal utility of saving, i.e. $(\theta a_i - c_i) = \alpha_S / 2\alpha_i$. This means that saving will continuously decrease until consumption reaches such a level that $(\theta a_i - c_i) = \alpha_S / 2\alpha_i$. Given high investment demand and continuously decreasing savings, the economy will feature a shortage of savings (capital) and an excess demand for investment. This excess demand will speed up economic growth and push up price levels. As household consumption continues to increase, the gap between the consumption ceiling and the actual level of consumption becomes small enough to satisfy $(\theta a_i - c_i) < \alpha_S / 2\alpha_i$. Under such circumstances, investment demand is low but savings will continuously increase. This will result in excess supply of savings (capital) and a shortage of investment demand. This in turn will lead to low, or even negative, profitability, and thus contraction of the economy.

It is also relevant to discuss the effect of distribution through the distributional parameter θ. When distribution is unequal (that is, some households have much higher income), the value of θ is small and the overall consumption ceiling (θa_i) is low. In this situation, household consumption will easily meet the consumption ceiling, household savings will increase sharply, and investment demand will be small and decreasing. Consequently, an unequal distribution (a low value of θ) will cause the economy to go into a recession more rapidly. Lending and borrowing will be an easy but temporary approach to increase distribution equality. As money transfers from more wealthy people to poorer people, the value of θ will increase, and thus the consumption ceiling θa_i will become higher. This will delay the arrival of economic recession. Lending will, however, only have a temporary effect

on distributional equality. When borrowers are required to pay back their loans, or lenders stop lending due to concern over loan defaults, the value of θ will reduce sharply. This will lead to a sudden drop of the consumption ceiling, which in turn will cause a large economic recession. This was demonstrated dramatically by the GFC.

B. the factor market

Household supply of labour and capital is determined by household willingness to obtain income. So, the output of good i is equal to the sum of good i consumed and good i saved by the household. Substituting $x_i=c_i+S_i$ into equations (4) and (5) we have:

$$L_{Si}=\left(\frac{c_i+S_i}{A_i}\right)\left(\frac{\gamma_i P_K}{(1-\gamma_i)P_L}\right)^{1-\gamma_i} \qquad (9)$$

and

$$K_{Si}=\left(\frac{c_i+S_i}{A_i}\right)\left(\frac{(1-\gamma_i)P_L}{\gamma_i P_K}\right)^{\gamma_i} \qquad (10)$$

On the other hand, demand for labour and capital is determined by final demand c_i+I_i. Therefore, including $x_i=c_i+I_i$ into equations (4) and (5) we have:

$$L_{Di}=\left(\frac{c_i+I_i}{A_i}\right)\left(\frac{\gamma_i P_K}{(1-\gamma_i)P_L}\right)^{1-\gamma_i} \qquad (11)$$

and

$$K_{Di}=\left(\frac{c_i+I_i}{A_i}\right)\left(\frac{(1-\gamma_i)P_L}{\gamma_i P_K}\right)^{\gamma_i} \qquad (12)$$

Excess demand in the economy is the sum of excess demand for labour and capital in producing each commodity, namely:

$$ED_L=\sum_{i=1}^{n}ED_{Li}=\sum_{i=1}^{n}L_{Di}-\sum_{i=1}^{n}L_{Si} \qquad (13)$$

$$ED_K=\sum_{i=1}^{n}ED_{Ki}=\sum_{i=1}^{n}K_{Di}-\sum_{i=1}^{n}K_{Si} \qquad (14)$$

Substituting equations (9) to (12) into the above equations, we have:

$$ED_L=\sum_{i=1}^{n}\left(\frac{I_i-S_i}{A_i}\right)\left(\frac{\gamma_i P_K}{(1-\gamma_i)P_L}\right)^{1-\gamma_i}=\sum_{i=1}^{n}M_i I_i-\sum_{i=1}^{n}M_i S_i, \qquad (15)$$

$$ED_K=\sum_{i=1}^{n}\left(\frac{I_i-S_i}{A_i}\right)\left(\frac{(1-\gamma_i)P_L}{\gamma_i P_K}\right)^{\gamma_i}=\sum_{i=1}^{n}N_i I_i-\sum_{i=1}^{n}N_i S_i \qquad (16)$$

where

$$M_i = \left(\frac{A_i^{\gamma_i - 2} \gamma_i P_K}{(1-\gamma_i) P_L} \right)^{1-\gamma_i}, N_i = \left(\frac{(1-\gamma_i) P_L}{A_i^{\gamma_i + 1} \gamma_i P_K} \right)^{\gamma_i}$$

The above two equations show that the excess demand for both labour and capital is the difference between weighted total investment and weighted total savings. This is very similar to the excess demand function in the commodity market. Thus, when there is an excess demand (supply) in commodity markets, there will be an excess demand for (supply of) labour and capital. The size of excess demand (supply) in different markets will, however, differ due to the weights. Since demand for primary factors closely links to demand for commodities, the reasons for excess supply in the commodity market may also be the reasons for excess supply in the factor market.

The above derivation concerns the real term (the amount of labour and capital in the economy), so it does not take account of changes in rental prices of factors (P_L and P_K). If these prices do change, the term related to prices changes by the same degree for both supply and demand. So, the nominal value of excess demand for factors may change when P_L and/or P_K change, but the nominal change will be the real change multiplied by price-related term.

One may argue that the change of factor rental prices (e.g. wages and/or returns to capital) may equalize the demand for and supply of factors. To further demonstrate the possibility of unemployment factors, the author illustrates the possibility of involuntary unemployment in Figure 4.

Figure 4: The Possibility of Involuntary Unemployment

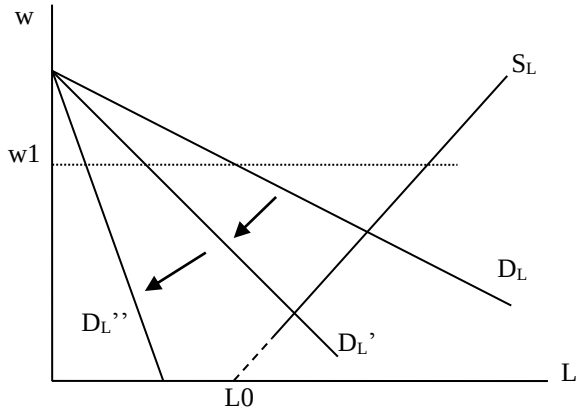


Figure 4 is quite similar to Figure 3, but it concerns the labour market. The labour supply curve has a starting point with a positive minimum labour supply and a positive minimum wage. The positive minimum labour supply is based on the fact that people have to do a minimum amount of work to make a living (or at least keep alive). The positive minimum wage is needed to reproduce labour. It is often argued that unemployment in the economy is largely voluntary due to the wage floor imposed by the Union or the government. While it is true that a wage floor (e.g. w1 or the dotted line in Figure 4) can cause voluntary

unemployment, Figure 4 also shows that even if the wage floor is abolished, there is still a possibility of unemployment. When the demand for labour decreases due to a decrease in investment demand (which is in turn due to a lack of profitable opportunity), the labour demand curve pivots left from D_L to D_L'. This leads to an equilibrium of labour supply and demand at a lower level of employment and lower level of wages, so there is no involuntary unemployment. As the labour demand curve pivots further from DL' to DL'', however, due to a further decrease in investment demand, the labour demand curve cannot meet with the labour supply curve and thus labour demand falls short of labour supply. This will cause involuntary unemployment. Even the minimum wage can be approaching zero (the starting point of SL approaches the point on the horizontal axis at L0), there still exists involuntary unemployment because the labour demand can fall short of the minimum labour supply L0.

6. A Dynamic Perspective

The above discussion shows that, as household consumption increases, the economy will shift from excess demand for investment, commodity, labour and capital to excess supply of savings, outputs and primary factors. Thus, economic growth will slow down, and the economy will go into and stay in recession. Increased equality in income distribution arising from lending and borrowing behaviour may delay this process, but will not change the trend. Real world economic cycles, however, have a pattern of occasional recession followed by eventual recovery. Can this model explain such economic cycles?

The model can explain cyclic economic growth, but a dynamic approach is required. In the above analysis, we assume n commodities in the model, without changing the commodity amount. Due to invention and innovation, new products are often being released. For a new product, the gap between a_i and c_i is large. This will lead to a widened gap between overall consumption ceiling and actual total consumption in the economy. Based on theorems regarding savings and investment, this widened gap will cause savings to fall and investment to rise. These savings and investment behaviours will lead to excess demand for commodities, labour and capital, thereby speeding up economic growth. Since new products become old products over time, however, the gap between the consumption ceiling and actual consumption closes, and the economy will go into recession once again.

Bearing this in mind, we can conclude that lack of new products, or slowing rates of product innovation, is the fundamental factor behind cyclic economic growth, and economic recession. If product innovation is rapid enough to bring about new products in a timely fashion, household consumption will never reach the consumption ceiling. Thus, the economy will continue to grow rather than experience stagnation. By this reasoning, the cyclic economic growth experienced in the real world economy shows that the speed of product innovation is lagging behind the speed of increase in production capacity. To determine the

reasons for this lag in product innovation, we need to consider the obstacles to innovation activity.

One such obstacle is the high risk of investment in innovation. Innovation by definition involves the creation of something new. Inventors are continuously stepping into uncharted territory, so it is understandable that many successful innovations come only after numerous failed experiments. Although statistics on innovation failure and success are difficult to obtain, it is widely accepted that much R&D investment does not actually lead to a new product. There are two types of innovations: product innovation, of which the goal is to invent new products; and production innovation with an effort to improve production efficiency. Compared with production innovations, product innovation has much higher risk because it normally involves much larger (or more radical) change and there is much less information available for this activity to inform investment decisions.

Facing the distinct possibility of innovation failure, risk-averse investors are reluctant to invest their money in innovations. Rather, they prefer to invest in production that has a relatively certain investment return. Innovation investments, or R&D funds, are therefore quite scarce, which in turn leads to scarcity of innovation activity.

The other factor hindering innovation is innovation imitation. Innovation requires hard and intelligent work, takes a long time, and requires a great deal of money. Imitating an innovation is, however, very easy. For example, software that takes several years and costs millions of dollars to develop, may take only a few minutes to copy. Compared to production innovation, product innovation is much more vulnerable to imitation. Because production innovations are applied to production procedures or machinery, imitating these innovations requires knowledge about the production environment., Imitating a new product does not, however, require this knowledge. In short, the externality of product innovation is enormous. Just as public goods are under-invested due to the free-riding problem, product innovation is under-invested and becomes scarce.

Although intellectual property (IP) laws, such as patent laws, have been enacted to prevent unauthorized use of innovation, inappropriate use of innovation rights happens from time to time due to the limitations of current IP laws. A full discussion of the limitations of IP laws is outside the scope of this paper, but it is possible to discuss briefly a few limitations of current patent laws. On one hand, current patent laws impose limited duration and a compulsory license rule on patent rights, aiming at moderating the monopoly power of the patentee and at forcing the patentee to implement patented technology. The maximum duration for a patent is about 20 years currently[4], which limits the return to the patentee. The

[4] In some cases, it even prohibits the patentee from profiting from innovation. e.g. innovation in medicine takes a long time and patentees are required by law to conduct animal and human trials before

compulsory license rule goes further. It stipulates that, 3 years after the date of the grant of the patent, anyone can apply to the comptroller for a license under the patent. On the other hand, the patent laws allow granting exclusive patent licenses, which transfer monopoly power of patentees to licensees so that the patent monopoly power magnifies in the economy.

These clauses have not addressed the core nature of the patent system that leave them open to abuse. On the contrary, they cause considerable stress for inventors and discourage innovation. The problem of patent monopoly power abuse can be overcome in a positive way. For example, the discouraging rules discussed above could be abolished, and replaced with a licensing system. Under this system, anyone could use the innovation by applying for a license from the inventor. Furthermore, the inventor would have a right to refuse licensing, but only on the grounds of license price. With the product (the right of patent licensing) accurately specified and the property right of patent licensing established and clearly defined (infinite duration of patent right) in the new system, a patent market may come into reality and it will automatically channel funds into innovation activities.

In short, under current patent laws, inventors are confronted with high costs arising from the high risk that innovation may not lead to creation of a product. They are also confronted with potentially low returns even if a new product is created, due to limited IP protection from imitation. Thus, investors are more likely to shy away from innovation investment. If the patent laws were revised thoroughly to form a patent market and to compensate for the high cost of innovation activity, innovation activities may become attractive, new products are more likely to be created, and economic stagnation would be much less likely.

7. Conclusions

Based on observations and reasoning in the real world, this paper proposed three theorems. (1) There is a consumption ceiling for each commodity per household. (2) Savings can generate utility for households directly and immediately. (3) Investment demand is critically determined by profitability and, at the macroeconomic level, the latter is indicated by growth of household consumption.

In including these theorems in a multi-commodity model, the paper explains economic recessions around the world. An economic recession can be attributed to stagnation of household consumption due to the existence of consumption ceilings. Using growth of household consumption as an indicator of profitability, investors tend to increase investment when household consumption increases, and decrease investment when household consumption stagnates. Stagnation in both household consumption and investment demand will drive the economy into a deep recession.

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making drugs publicly available.

The dynamic analysis in the paper goes further to explain cyclic economic growth and the vital role of product innovation. The author suggests that scarcity of product innovation underpins the cyclic growth pattern, and is a major obstacle to long-run economic development. The author also discusses the reasons for innovation scarcity and calls for strengthening of laws regarding intellectual property rights. Strong intellectual property rights law would facilitate a more appropriate balance between investment in product innovation and investment in production, and thus avoid scarcity of product innovation. If the pace of product innovation is sufficient, faster and smoother rates of economic growth should be achievable, and economic recession less likely to occur. This conclusion may appear speculative, but it is a logical one as long as the following statements are true: economic recessions stem from a lack of new products and thus a lack of investment opportunities, the scarcity of new products is due to underinvestment in invention and innovation, and a thorough revision of patent laws will lead to formation of patent market which will channel funds into innovation activities automatically.

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