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Growth and Poverty Traps: Examples from Literature

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1. INTRODUCTION

Data from the International Monetary Fund show that the highest GDP per capita in 2015, Qatar, is more than 210 times larger than that of the lowest GDP per capita, Central African Republic (World Economic Outlook Database 2016). The capital, labor, and technology available to a country's residents are among the factors that determine their economic output, and thus income. Therefore, differences in these factors can help to explain different standards of living across countries. GDP per capita and its variation across countries capture economic performance. But, economic growth can allow poor countries to improve their standard of living, closing or perhaps even eliminating the gap between rich and poor nations. When countries do not achieve growth and the accompanying improvement in welfare, economists look to explain these failures and offer policy prescriptions.

One potential explanation for a persistent lack of economic growth among poor countries is the possibility of poverty traps. As defined by Kraay and McKenzie (2014), a poverty trap is "a set of mechanisms whereby countries start poor and remain poor: poverty begets poverty, so that current poverty is itself a direct cause of poverty in the future." Most of the economic literature regarding poverty traps considers macroeconomic performance at a national scale, and uses indicators such as GDP per capita. For example, Sachs et al. (2004) argue poverty traps are pervasive in regions of tropical Africa because of the negative effects of war, disease, and civil conflict. Combined with low savings rates, poor infrastructure and minimal foreign investment, escaping from poverty is highly unlikely.

Although poverty traps are typically used to explain country-level differences in macroeconomic performance, the general principle can also be applied at the micro level of households and individuals. For instance, Marx, Stoker, and Suri (2013) argue that inhabitants of slums have poor sanitation facilities, which can often lead to often debilitating illness. Illness can cause days off work and expensive medical bills, which cut into to already meager means of saving and investment. Without saving to purchase better housing, residents of slums are unable to escape their source of poverty. And, lacking funds to invest in the education of their children, poverty becomes an intergenerational phenomenon.

This project also examines poverty traps at the household level, using literature from the Victorian era as a source of data, drawing from examples of realistic fiction that portray life during the time period.

The remainder of the article is organized as follows. In section 2, I provide a model of growth using the Solow growth model. In section 3, I model contraction and offer a possible explanation for why countries do not conform with the Solow growth model. In section 4, I adapt the macro model for use at the micro level and explain how examples can be drawn from representative works of literature. In section 5, I use examples from literature to illustrate the poverty trap. In section 6, I conclude.

2. A MODEL OF GROWTH

Differences in capital can cause differences in income for countries. Physical capital are goods that are used to generate income through the production of other goods. For example, machinery in a candy factory is physical capital. These machines are not directly consumed, but they are used to produce a good that will be sold, generating income that can be used for purchasing consumer goods. Capital goods improve labor productivity. For example, a worker at a candy factory can wrap 100 candies by hand in one hour. A worker operating a machine might be able to wrap 1000 candies in one hour. Scaling up, countries with machines will be able to produce and sell more candies and will thus have higher incomes and more consumption potential than countries without machines.

Savings rates also affect income and consumption. Aesop's parable of the ant and the grasshopper demonstrates this concept. The ant worked diligently all summer, gathering seeds and crumbs and whatever else it is that ants eat. The grasshopper, in contrast, feasted on the bountiful provisions, played all day, and incessantly teased the ants for working. When the leaves fell, the weather changed, and winter came, the ants were at ease, for they had accumulated a plentiful store of things to eat. Soon however, the grasshopper came to the anthill, starving and pleading for help, for his enjoyment of the summer had not given him anything to eat during the winter.

The ants had a high savings rate. They had low consumption during the summer (the current period) and saved their output (crumbs and seeds) for later consumption in the winter (the future period). The grasshopper had a low savings rate, and had high consumption during the plentiful summer months and low consumption during the winter months. By saving for the future, the ants will be able to ration their stores and survive the winter. The grasshopper will spiral towards poverty and ultimately death without external assistance.

a. The Solow Growth Model

In the example above, the ants store seeds, but they do not use their current output to generate future income. In other words, there is savings, but no investment.

Imagine instead that the ants cultivate some of the seeds collected during the summer in a greenhouse they have constructed in their anthill.[1] The future period will have higher income because a single seed will have grown into many more. Now, seed that goes uneaten is not only saved, it is turned into capital to yield future income, i.e. saved seeds are invested. The Solow growth model formalizes this anecdote to model how saving and investment in capital affect income growth and long-term standards of living.

In a simple Solow model with a constant return to scale production technology[2] output (income) (Y) depends on capital stock per worker (K).

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[1] Before a skeptical reader objects to the presence of a greenhouse, if a grasshopper can play a fiddle, ants can surely construct a greenhouse.

[2] Constant returns to scale means that doubling all the inputs doubles the outputs.

$$Y=f(K)$$

The graph plotted in Figure 1 shows a production technology with diminishing marginal product of capital. The slope of this function is the marginal product of capital, MPK. For every additional unit of K, MPK is the additional amount of output produced. When K is low, an additional unit of capital is useful to a worker and enables the production of much additional output. When K is high, however, the extra unit increases production by much less. For example, if a worker is sweeping a room, the first broom greatly increases output and productivity. The second broom will also increase production, as the worker can use one broom in each hand. However, the additional output as a result of the second broom is less than the additional output from the first broom. The addition of a third broom likely offers very little additional production capacity, as the worker is constrained by the number of arms and hands she possesses.
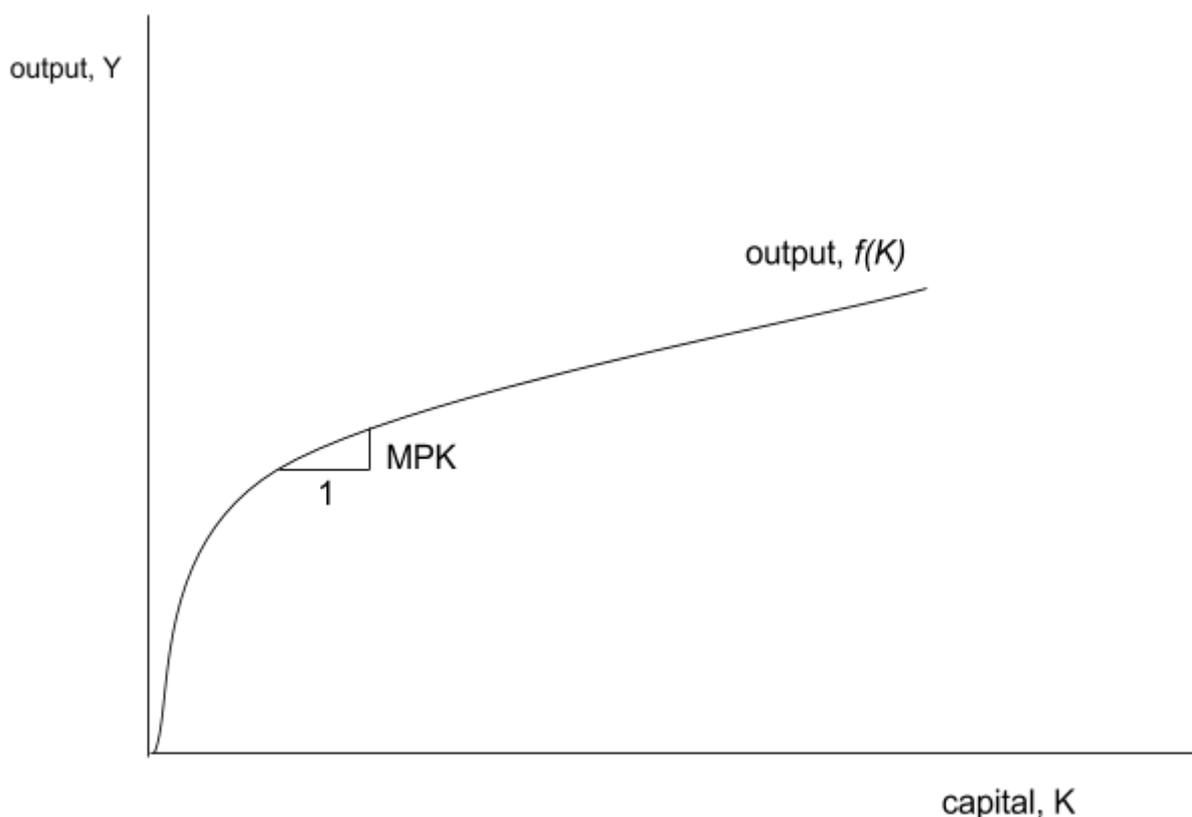

Figure 1

Workers can allocate their output in two ways; they can consume it, denoted by C, or they can save it, denoted by S.

$$Y \equiv C + S$$

Further, all savings is used to purchase new capital (i.e. investment):

$$S = I$$

Thus, output per worker, *Y*, is divided between consumption per worker, C, and investment per worker, I.

$$Y = C + I$$

In this simple model, workers save a constant proportion of their income;

$$S = sY$$

So that

$$C = (1-s)Y \text{ and } I = sY$$

Thus, a higher savings rate decreases current consumption, but increases investment. As investment leads to additional capital and additional capital increases output, a higher savings rate leads to higher future income. These relationships are illustrated in Figure 2.
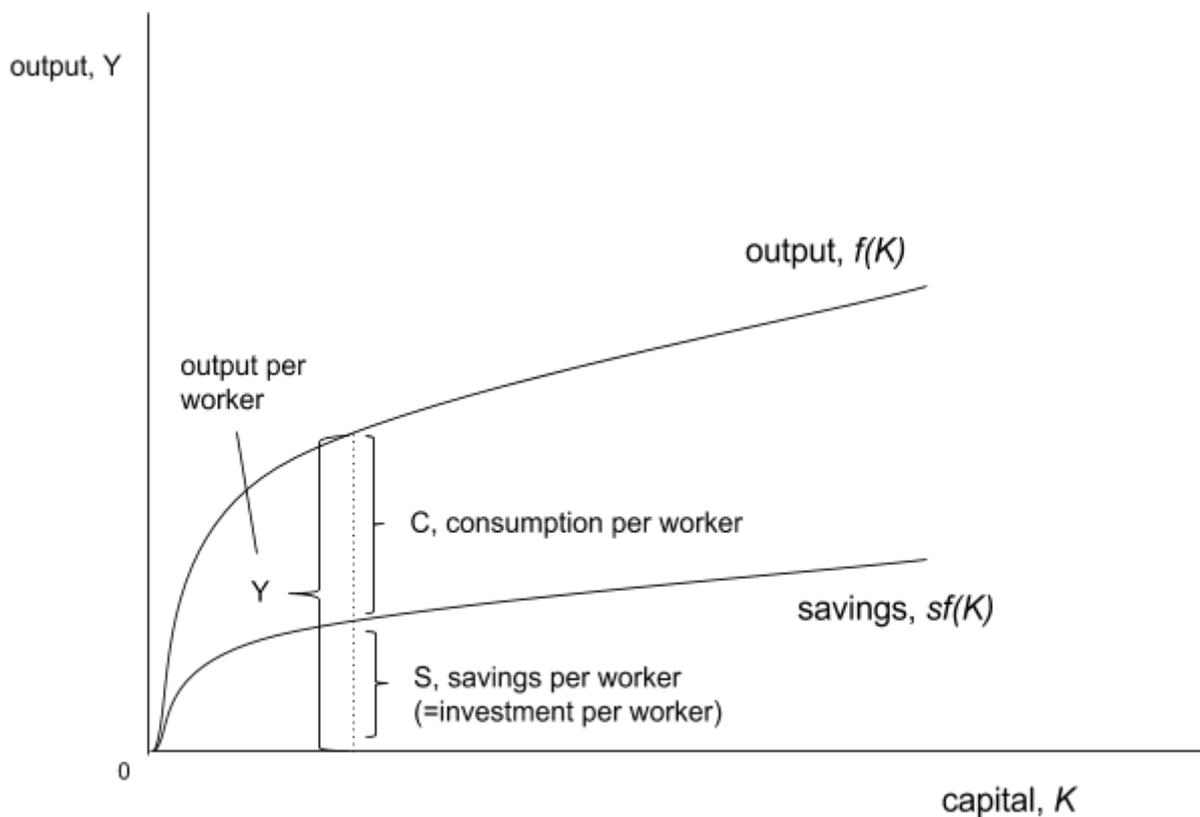

Figure 2

As Figure 2 shows, the amount of output is determined by the level of capital, and division of output between consumption and investment/savings is determined by the savings rate s.

Investment is expenditure on new capital, which causes an increase in the capital stock. But, capital can wear out over time, a process which is called depreciation. For example, the bristles on the broom will become damaged over time. They will fray, break, and steadily disappear. As the bristles get shorter and more worn, the broom becomes less effective. The

broom's productivity has been diminished by depreciation. Therefore, depreciation leads to a decrease in capital stock. In this model, depreciation, denoted as d, is assumed constant. Hence, the amount of capital lost to depreciation is proportional to capital stock.

Thus, the change in capital stock can be represented by the following equation.

$$\text{change in capital stock} = \text{investment - depreciation}$$
$$\Delta K = I - dK = sf(K) - dK$$

Whether capital increases over time depends on the relative magnitude of depreciation and savings. If depreciation is less than savings, than capital will increase over time. If, however, depreciation is greater than savings, then capital will decrease over time.

Notice that higher levels of capital stock mean greater output and investment, which leads to more saving and investment. But, it simultaneously is subject to greater depreciation. These trade-offs are summarized in Figure 3.
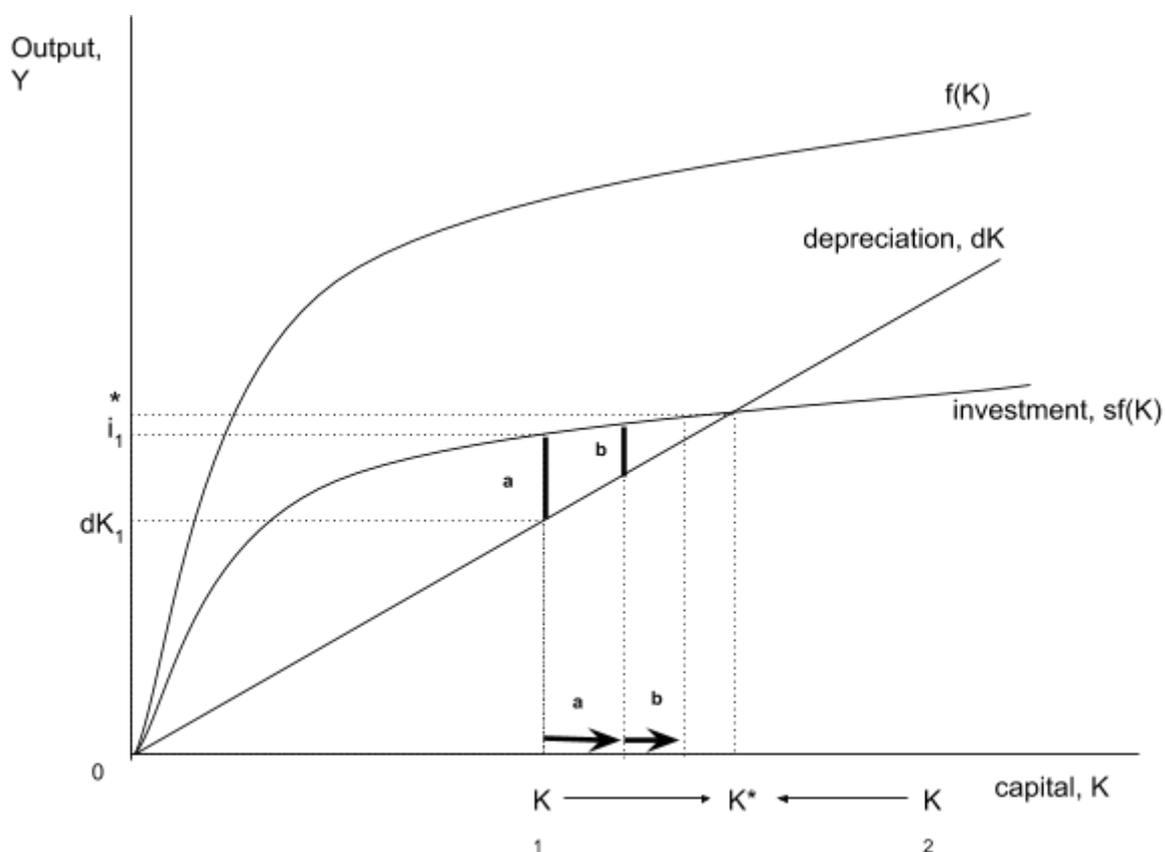

Figure 3

The level of capital where investment and depreciation are the same, denoted by K^*, is an important point in this model. At K_1, investment i_1 is greater than depreciation dK_1, so the level of capital stock will increase and move towards K^*. At K_2, depreciation is greater than investment, so the capital stock decreases, again moving towards K^*. Thus K^* is the equilibrium level of capital that economies will tend towards in the long run. By implication,

f(K*) is the equilibrium level of output/income per worker that economies will tend towards in the long run.

Let's consider a poor country with K = K_1. At K_1, the level of investment is larger than the amount of depreciation by *a*. Therefore, capital grows by *a* and moves rightwards from K_1 to K_1+*a*. At capital K_1+*a*, investment is again larger than depreciation by *b*, thereby increasing capital by *b*. This is the mechanism by which the level of capital moves towards K* and how poor countries should grow over time to eventually match the economic performance of currently rich countries. Notice however, that *a>b*. As K increases and incomes rise, the growth rate falls.

Table 1 presents statistics for several countries that illustrate the general implication of the Solow model.

Table 1

GDP per Capita	1960	2015	% change
China	$192	$6,498	3288
South Korea	$1,103	$25,023	2170
Japan	$8,608	$47,150	448
United States	$17,037	$51,638	203

The Solow model predicts that countries' income, represented by GDP per capita, should converge. Japan and the United States show this convergence. In 1960, Japan's GDP per capita was 51% of the United States'. In 2015, Japan's GDP per capita was 91% of the United States'. The two countries' economies have converged over time.

Additionally, the Solow model predicts that the poorest countries will show the fastest growth. In 1960, China's GDP per capita was 1% of the United States' GDP per capita, while South Korea's was 6%. In 2015, China's GDP per capita had grown to be 12% of the United States', while South Korea's had grown to be 48%. While the United States GDP per capita tripled in size between 1960 and 2015, South Korea's GDP per capita increased by 2170% and China's increased by 3288%. The countries that started poorer (China and South Korea) grew faster than the United States.

3. A MODEL OF CONTRACTION

Although the Solow model predicts convergence, some countries appear perpetually poor. For example, the countries seen in Table 2 do not show significant change in GDP per capita between 1960 and 2015. China and the United States are included for comparison.

Table 2

GDP per Capita	1960	2015	% change
China	$192	$6,498	3288
Malawi	$241	$494	105
Sierra Leone	$396	$491	24
The Gambia[3]	$423	$536	27
Central African Republic	$602	$292	-51
Dem. Republic of the Congo	$989	$385	-61
United States	$17,037	$51,638	203

In 1960, China had the lowest GDP per capita. By 2015 however, China had seen the largest percent change in growth. As the poorest country, this is what the Solow model predicts. The other countries are all poorer than the United States. According to the Solow model, they should have grown at a faster rate than the United States. Malawi, Sierra Leone, and the Gambia show minimal growth, while the Democratic Republic of the Congo and the Central African Republic are actually poorer. These countries have not followed the trajectory proposed by the Solow model.

Figure 4 illustrates a possible explanation.

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[3] The Gambia gained independence from the British Province of Senegambia in 1965.
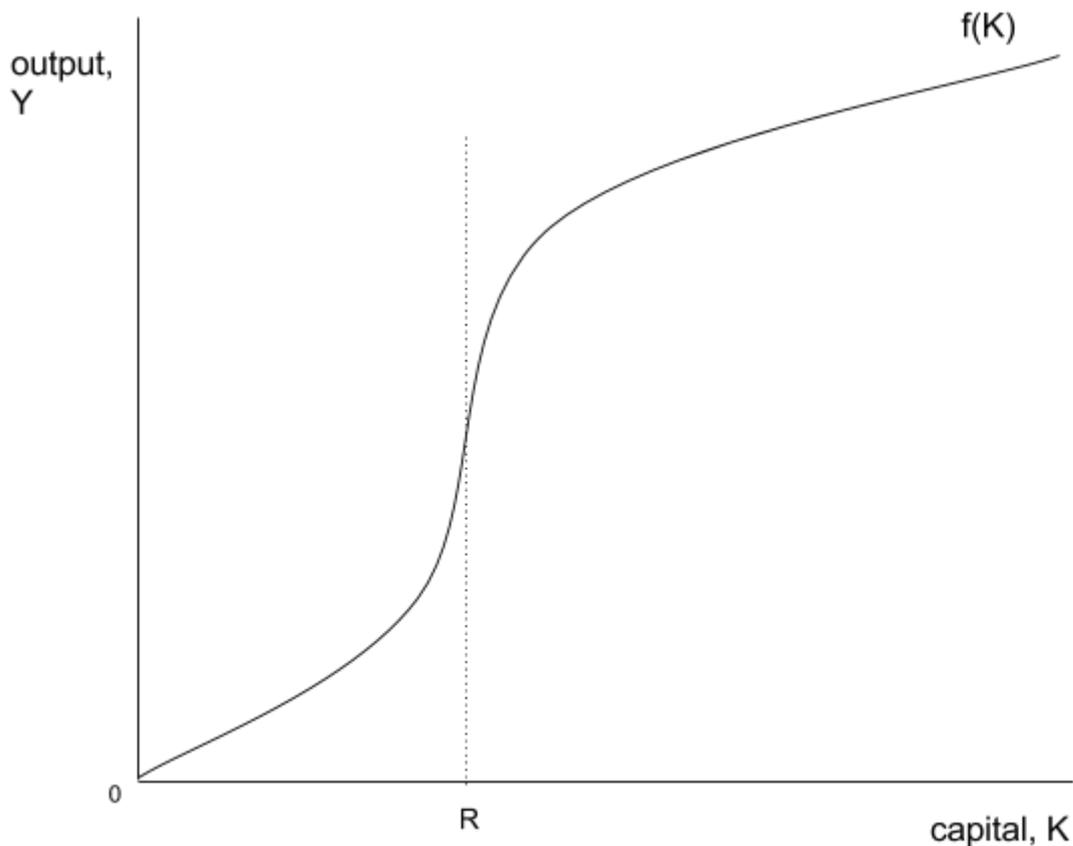
Figure 4

This production function exhibits a region of increasing returns to capital (0 to R), where the production function in Figures 1-3 everywhere exhibited decreasing returns to capital. Increasing returns to capital can arise if K is low when the benefits of specialization have not yet been exhausted.

The ant greenhouse can illustrate the increasing returns to capital in the model shown in Figure 4. Suppose the ants begin selling seedlings to other insects. The seedlings need to be transplanted and wrapped. One ant can transplant and package 50 plants every hour. If the ant specializes, it can package 200 plants in one hour. A machine can transplant 1000 plants every hour. The addition of one unit of capital, in the form of a transplanting machine, permits the greenhouse to produce an additional 150 plants per hour if the ant worker specializes on packaging. However, there will be 800 plants per hour that are transplanted, but not packaged, and therefore not saleable. By adding another unit of capital in the form of a packaging machine that is capable of packaging 1000 plants per hour to the enterprise, the greenhouse can produce an additional 800 plants per hour. This is an example of increasing returns to scale.

Poverty Trap

Figure 5 illustrates how a production function with a region of increasing returns to capital can generate a poverty trap. If an economy starts below K* level of capital, it will converge to 0 because depreciation is greater than investment at K* and below. If an economy starts at

K_1, there is a difference of a between the amount of depreciation and the amount of output, which moves the level of capital to the left by a. From level of capital K_1-a, there is a disparity of b, which again decreases the level of capital, this time by b.
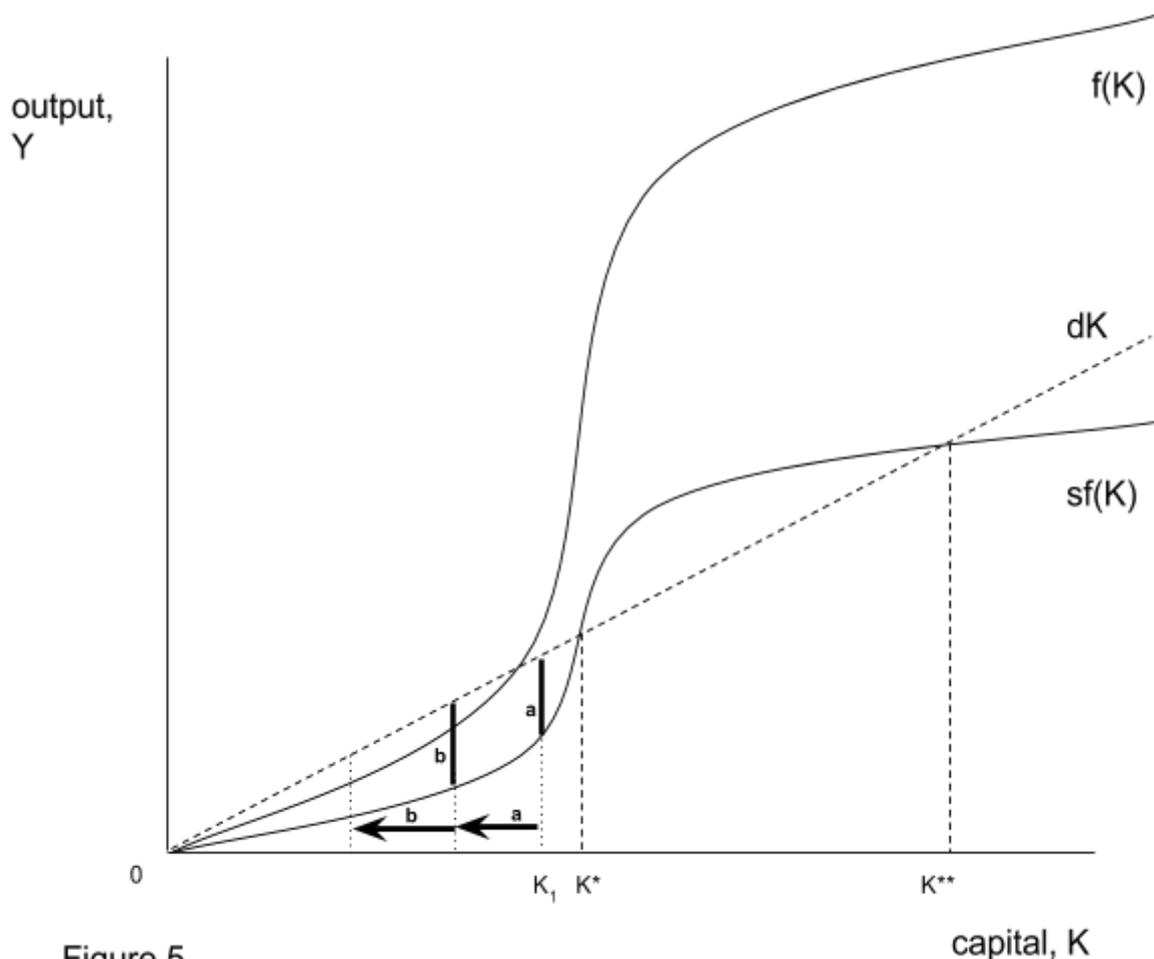

Figure 5

Solow and neoclassical growth theory suggest that the economic growth of low income and high income countries will converge, since low income countries will have initially higher returns to investment and will accumulate capital.[4] With a poverty trap, however, the economy remains poor because it starts off where the marginal product of capital is low and can never benefit from the higher returns that accrue at slightly higher income levels.

Although these models are typically used to explain the lack of economic growth of countries, but they can also be used to explain the behavior of individuals and households. For example, Marx, Stoker, and Suri[5] show how poverty traps may develop in slums around the world. People from rural areas often move to cities seeking economic opportunities and economists have argued that shantytowns and slums allow this process to occur. As Marx,

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[4]

https://www.stlouisfed.org/publications/regional-economist/october-2015/trapped-few-developing-coun tries-can-climb-the-economic-ladder-or-stay-there#endnotes

[5] https://www.aeaweb.org/articles?id=10.1257/jep.27.4.187

Stoker, and Suri show, however, living in a slum is actually a form of a poverty trap (2013). Most notably, the data show that slum inhabitants are more likely to have lower incomes the longer a family has lived in a slum. Poor hygienic conditions are one explanation, as slum dwellers are at higher risk for illness, which leads to more days off work and expensive medical bills that further impede accumulation of capital, and prevent an escape from poverty. As the authors conclude, "slums and poor people may not just co-exist; some people may be stuck in poverty because they live in slums"(2013).

As demonstrated by poverty traps in slums, health and fitness have major implications in productivity. On the macro scale, capital stock and investments are inputs into a country's economy and generate income based on the country's production function. This can be adapted to the micro level, where an individual's health will take the place of capital stock, and the different stages of poverty and wealth will be illustrated by examples of realistic fiction.

4. POVERTY TRAP ON A MICRO LEVEL

From the previously constructed model, physical capital is replaced with an individual's health stock or health capital, and output becomes productive capacity.

Grossman' Model of Health Capital Investment

In the Solow model, countries invest in physical capital, but "the notion that individuals invest in themselves has become widely accepted in economics" (Grossman 223). Specifically, Grossman develops a model where individuals invest in their respective "health stocks". There are two components of health stocks, consumption and investment. "As a consumption commodity, it directly enters their preference functions[6], or, put differently, sick days are a source of disutility. As an investment commodity, it [health] determines the total amount of time available for market and nonmarket activities"(Grossman 225).

Eating offers a specific mode of health capital accumulation because individuals eat for two reasons. The first is for nourishment or fueling one's body. This can be seen as investment in one's health stock. The second is for taste or basic consumption. An individual will choose to eat food that tastes good, and is not necessarily nutritious because it may add to utility in the form of "life enjoyment". Any consumption of food will usually have at least some nourishment capacity and therefore can also be considered investment for future consumption.

Figure 6 is an adaptation of the physical capital model shown in Figure 3.
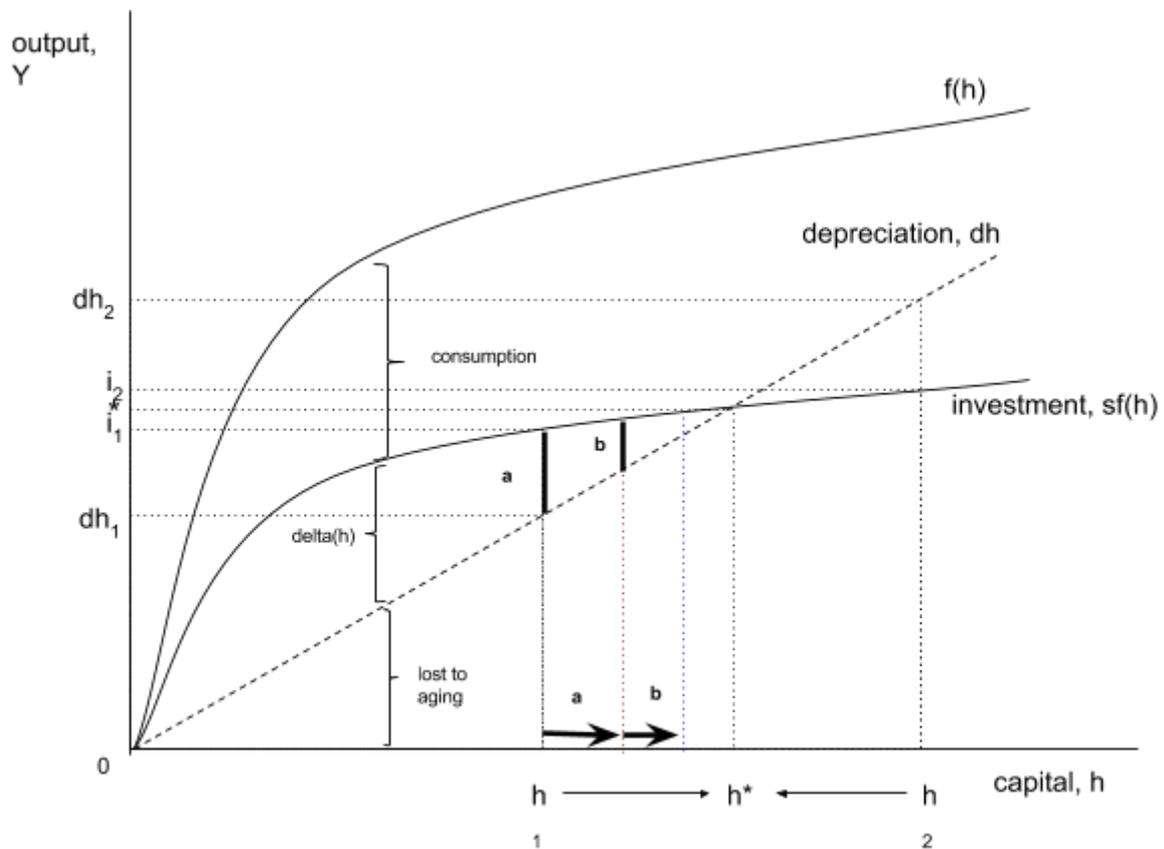
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[6] Utility function or indifference curve

Figure 6

Figure 6 demonstrates that output is a function of health capital, h. Output is defined as productive capacity. This is simultaneously the money an individual has to spend and the time an individual can allocate among work and leisure. Individuals can divide their output between consumption and investment. The division of output between consumption and investment is determined by savings rate s.

Investment is expenditure on new capital, resulting in an increase in an individual's health stock. A high savings rate means that an individual chooses to allocate time towards exercise, regular physicals, and spend money on vegetables and whole grains to cook nutritious and balanced meals. A low savings rate indicates that an individual is not putting much time or money towards future income generation. They may spend time partaking in risky behaviors, such as motorcycling without a helmet or bridge jumping, and spend money on alcohol, cigarettes, and deep fried butter.

Investment in health capital is countered by depreciation. In individuals, depreciation is the proportion of health that is lost through natural aging, denoted by d. For example, as muscles, tendons, and ligaments become less flexible, individuals are at higher risk of injury as they age.

Thus, the change in health stock can be represented by the following equation.

$$\text{change in health stock} = \text{investment - depreciation}$$

$$\Delta h = I - dh = sf(h) - dh$$

How health capital changes over time depends on the relationship between depreciation and investment. If the depreciation rate is greater than the savings rate, then health stock will decrease over time. In reverse, if the savings rate is greater than the depreciation rate, then health stock will increase over time.

Although higher levels of health stock allow for higher productive capacity and thus higher income, it is simultaneously subject to greater depreciation.

As in the Solow model, individuals will tend to move towards equilibrium, denoted in this model by h^*. At h_1, investment is greater than depreciation, so the level of capital stock will increase and move towards h^*. At h_2, depreciation is greater than investment, so the capital stock decreases, again moving towards h^*. Thus h^* is the equilibrium level of health stock that individuals will tend towards in the long run. By implication, $f(h^*)$ is the equilibrium level of productive capacity that individuals will tend towards.

Let's consider an individual with $h = h_1$. In the same manner that a country's economy moves toward K^*, an individual's health will tend to move towards h^*. The level of investment in the form of daily yoga, running, and kale smoothies, is higher than the depreciation of health caused by aging by a. Therefore, the health stock grows by a, moving to the right of h_1 by a. At health stock h_1+a, investment is greater than depreciation by b. Health stock thus moves from h_1+a to the right by b. This is how health stock tends towards the equilibrium point of h^* over time.

Again, a slight change in the production function to allow for a segment of increasing marginal returns to health has important implications for income growth as a possible poverty trap arises. This is illustrated in Figure 7.
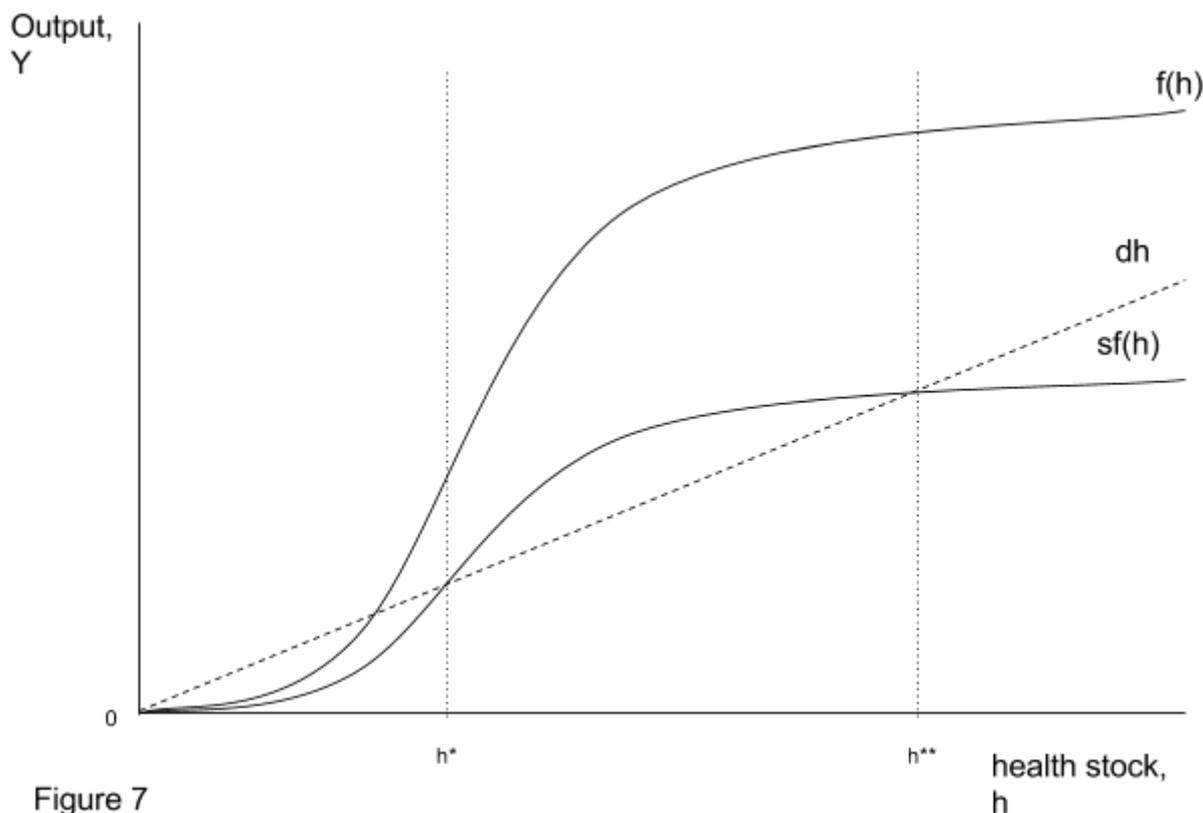
Figure 7

Health stock levels to the left of h* have a depreciation rate higher than the savings rate. In this region, health capital will move towards 0, ultimately leading towards death. However, if health stock is greater than h*, the savings rate is higher than the depreciation rate, and an individual will be able to increase their health stock and move toward the equilibrium point of h**. Above h**, the depreciation rate is again higher than the savings rate, and the individual will move towards h**.

5. POVERTY TRAP IN LITERATURE

The writings of Charles Dickens, Emile Zola, Knut Hamsun, and Laura Ingalls Wilder capture humanity on the page. The characters in the works of these authors are confronted by realistic or autobiographical situations and make choices based on history, personal preferences, societal pressures, and economic constraints, just as real-life individuals do. They can thus serve as data for illustrating the implications of economic models, specifically poverty traps. To do so, I will draw from *Great Expectations* (1861) by Charles Dickens, *The Fat and the Thin* (1873) by Emile Zola, *Hunger* (1890) by Knut Hamsun, and *The First Four Years* (1971) by Laura Ingalls Wilder. A brief synopsis of each of these works follows.

Why these authors?

While fiction, all of these authors capture realistic scenes of everyday life in a variety of socioeconomic settings. Focusing on a short time period in Victorian era literature is an effort to minimize the number of variables that could be driving the differences between the examples.

The Victorian era was the time when Queen Victoria was the reigning British monarch (1837 to 1901).[7] It was a time of progress in the United Kingdom and the United States. According to historical statistics from Angus Maddison, the countries where the novels are set demonstrate consistent economic growth throughout the era, as seen in Figure 8 (2013).

Figure 8.

In 1875 for example, Norway had a GDP per capita of $1,551, France $2,219, UK $3,434, and the United States had a GDP per capita of $2,599. The characters examined in this paper correspond with the relative economic standings of their respective countries. In *Great Expectations,* Pip, arguably the richest character at the end of his story, comes from Great Britain, the richest country at the end of the Victorian era.

In 1875, the United States was a rural country. The US Census of 1870 shows that 74.3% of the total population lived in rural areas(1993). While new farming machines were invented, live power such as horses, oxen, and people did most of the work on farms. Cash crops gained traction, but most farmers were self sufficient (Library of Congress).

In France, the country faced political turmoil, as the revolutionary Paris commune failed and the Third Republic was established in 1871 (Bruce). Florent, in *The Fat and the Thin*, is caught up in these changes, which contribute to his economic trajectory.

In Norway, although a constitution was established in 1814, independence from Sweden following 400 years of rule by Denmark was not recognized until 1905. Between these years,

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[7] Officially, Victoria was Queen of the United Kingdom of Great Britain and Ireland. From 1849, she was also Empress of India.

Norway struggled to establish its own institutions after the Napoleonic wars. While it did have large stocks of natural resources, it did not have domestic capital or much material support from the government in Stockholm. Nonetheless, the economy grew until the mid 1870s, at which point stagnation drove many people to emigrate, particularly to the United States. Indeed, only Ireland had higher emigration rates than Norway between 1836 and 1930, when 860,000 Norwegians emigrated from the country (Grytten 2008).

In addition, the Victorian era coincides with the end of the Industrial Revolution and the resultant changes in production technology. Scientific advancement and technological innovation drove growth in agricultural and industrial production as well as economic expansion (Manolopoulou 2008). Capital became increasingly important during this period. "[T]he modern world economic system reached the far corners of the globe as workers and farmers on every continent came to participate in a worldwide division of labor. . .Certain dogmas, such as a belief in progress, standards of civilization, popular sovereignty, and nationalism, gained almost universal currency as a result of European global dominance. . .Finally, new social classes - the bourgeoisie and the working class - appeared on the world stage for the first time as a result of the twin processes of urbanization and industrialization"(Gelvin 347).

In Victorian era literature, the drive for social advancement appears frequently. In *Great Expectations*, this change is financial, but the theme appears in other forms, such as social mobility through marriage or intellectual and education based social movement (Kirschen 2011). The novel became the central focus of literature and its dominant form in the Victorian era, replacing poetry and drama. Novels included characters and stories set in the working class, addressing the concerns and lives of its readership (Melani 2010).

The books chosen for this project encompass different genders and different geography, but they are all set well within the Victorian era and represent various aspects of life throughout the world.

Plot summaries

The following summaries are presented to demonstrate the relationship of the respective plots of the novels to the core analysis in the next section of this paper; health, nutrition, and well being.

<div align="center">

Great Expectations

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Charles Dickens is widely recognized as a literary giant who brought such characters as Oliver Twist (of "Please sir, I want some more" fame) and Scrooge to life. His keen sense of observation of character and society shaped a body of work that is known for its realism and social criticism.

Published in 1861, *Great Expectations* follows the escapades of orphaned Pip, who is raised by his abusive sister Mrs. Joe and her kind hearted husband Joe Gargery. The family is solidly working class, even poor by some standards. The novel opens as Pip is accosted

while visiting the graves of his parents by an escaped convict, who asks the youngster to steal food and a file for him. A year or two later, Pip is invited by the wealthy spinster Miss Havisham to Satis House, where she lives as an eccentric recluse. Pip visits Miss Havisham regularly, until he apprentices as a blacksmith under his brother-in-law Joe's tutelage. Four years later, a lawyer visits Pip to tell him that he has "expectations"[8] from an anonymous benefactor. Pip leaves for London, sets up house at Barnard's Inn, and the lawyer disburses the necessary monies. While living in London, Pip and his roommate Herbert spend freely and build up debts. It comes to light that Pip's anonymous benefactor is not Miss Havisham, as assumed, but the escaped convict that Pip helped in the opening pages of the novel.

The Fat and the Thin

Emile Zola is considered the founder of the genre of naturalism, which began as an offshoot of realism and emphasizes observation and the scientific method in depicting reality in fiction.

Published in 1873, *The Fat and the Thin* is the third novel in a twenty volume series following the lives of a fictional family under the Second Empire in France. The novel's protagonist is Florent, who was mistakenly arrested after the coup of 1851 and is an escaped political prisoner. Florent returns to Paris from Cayenne[9] to his charcutier[10] brother Quenu and Quenu's wife Lisa, who welcome the young man, much weakened by his long imprisonment. With their help, Florent finds work in the market of Les Halles as a fish inspector, before he gets entangled with a plot against the government, arrested, and deported again.

Hunger

The book is a quasi-autobiographical work by Norwegian Knut Hamsun, who believed that writers should describe the human mind (Hamsun 1890).

Published in 1890, *Hunger* follows the trials and tribulations of an unnamed young man in Christiania (present day Oslo). Destitute and starving, the narrator struggles to find work as a writer, barely managing to survive. The novel follows the protagonist's downward spiral socially, mentally, and physically until he takes a job on a sailing ship. His ordeal is exacerbated by his lack of employment and income, and his conformation to a self-imposed moral code that results in the unnamed narrator giving away money, food, and clothes to other poor people

The First Four Years

Laura Ingalls Wilder grew up in an American settler and pioneer family. Her books capture the reality of everyday life in such a household.

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[8] prospects of inheritance (Merriam Webster)
[9] The capital city of the former penal colony in present day French Guiana
[10] A type of butcher specializing in cold cooked meats.

Although it was not published until 1971, *The First Four Years* is based on events that happened in the 1880s. The book is an autobiographical account of Laura Ingalls Wilder's early marriage to Almanzo Wilder and follows the young couple as they start their married life together and confront the struggle of homesteading. Laura keeps house, Almanzo tends the land, and all is well until the wheat harvest, when a severe hailstorm destroys the crop, leaving the Wilders unable to pay off their debts. The second year has a fair wheat crop, and they are able to pay some of their debts. Both Laura and Almanzo contract diphtheria, which leaves Almanzo with physical handicaps. Despite these setbacks, the couple continue to persist, although after two more years of ruined crops, and a devastating house fire, they ultimately move from the Dakotas to Missouri.

6. EXAMPLES OF THE POVERTY TRAP

In this section, I discuss how each of the novels illustrates key characteristics of the poverty trap model described above. These are presented in order of increasing initial capital stock.

Hunger

In Figure 8, the unnamed narrator of *Hunger* has a starting level of health capital at N. This graph is a closer look at low levels of capital shown in Figure 7.

Figure 8
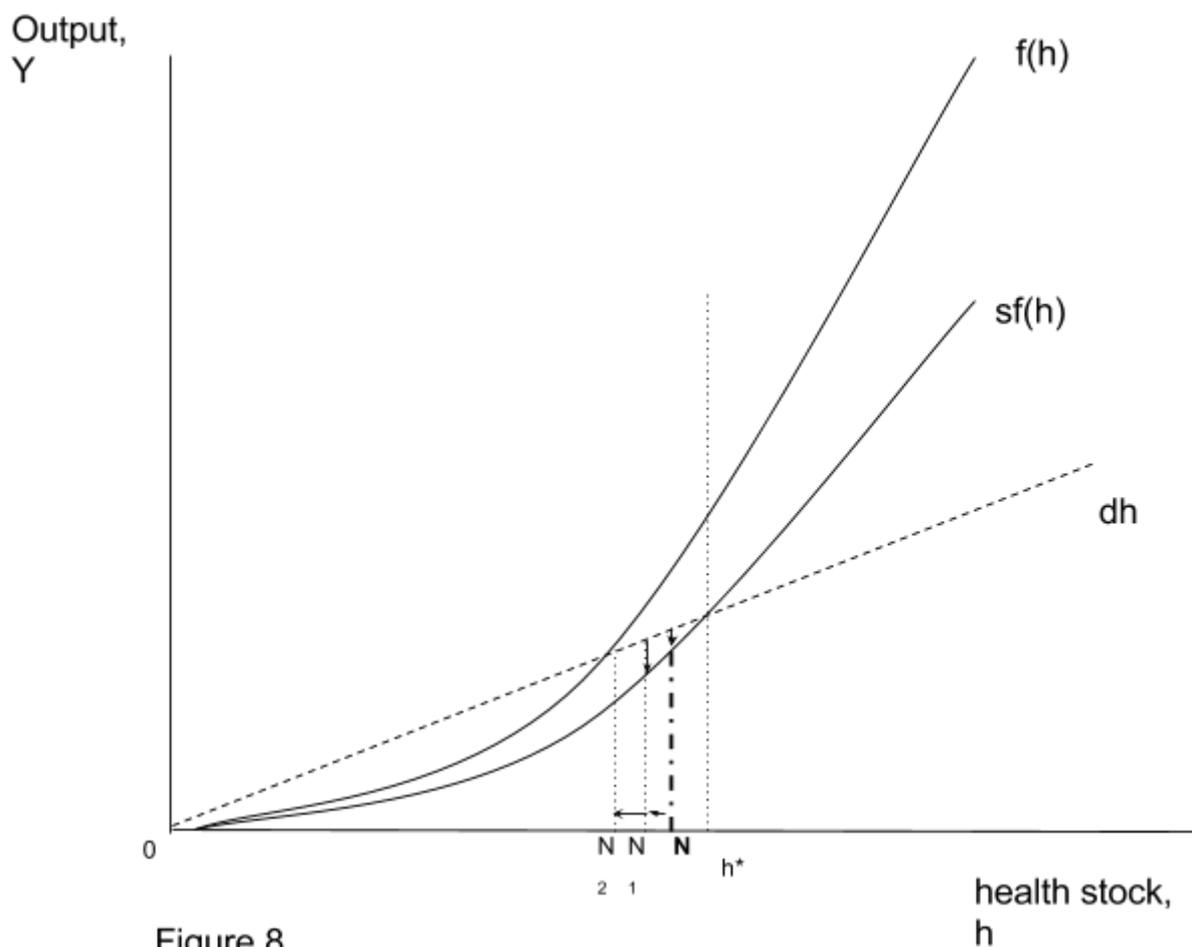
At N, the unnamed narrator has a health stock less than h*. As depreciation rate is greater than the savings rate, there will be an initial decrease that moves the unnamed narrator from N to N_1. At N_1, the depreciation is again greater than the savings rate, and health stock will decrease again, to N_2. This cycle will eventually cause the unnamed narrator's health stock to fall to 0. At this point, output has increasing returns to scale from health capital. A decrease in health stock means a lower level of output. The phenomenon that productivity decreases with lower levels of health has been studied.

For example, Dasgupta and Ray (1986) describe the effects of malnutrition; "Chronic malnutrition in adults diminishes their muscular strength, immunity to disease and the capacity to do work. Persons suffering thus are readily fatigued. There are also marked psychological changes, manifested by mental apathy, depression, introversion, lower intellectual capacity and lack of motivation." These characteristics appear frequently throughout *Hunger*.

In the opening of the novel, Hamsun lays out the reality of the unnamed narrator's life, showing the beginning of his decline:

> "The instant I opened my eyes I began, from sheer force of habit, to think if I had anything to rejoice over that day. I had been somewhat hard-up lately, and one after the other of my belongings had been taken to my 'Uncle.'[11] I had grown nervous and irritable. A few times I had kept my bed for the day with vertigo."

The unnamed narrator clearly sees his own frailties. His struggles with depression and apathy alternate with desperate bursts of pointless activity:

> "How regularly and steadily things had gone downhill with me for a long time, till, in the end, I was so curiously bared of every conceivable thing. I had not even a comb left, not even a book to read, when things grew all too sad with me...Strange ideas, quaint fancies, conceits of my restless brain; in despair I had often chosen the most remote themes, that cost me long hours of intense effort, and never were accepted."

He hints at the paradoxical challenge of malnutrition and decreasing health stock. The use of "intense effort" uses energy resources. If, however, there is no payoff for the expended energy in the form of a paycheck or a meal, the energy expenditure merely serves to lower the unnamed narrator's health capital and diminish his output and productive capacity. This process happens progressively:

> "From the day in May when my ill-luck began I could so clearly notice my gradually increasing debility; I had become, as it were, too languid to control or lead myself whither I would go. A swarm of tiny noxious animals had bored a way into my inner man and hollowed me out."

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[11] pawnbroker

The changes in ability are significant as the novel progresses. Whereas there was some hope of escape in the beginning of the novel, by the middle, the bleakness of the unnamed narrator's situation is undeniable:

> "I was hungry--very hungry. The ten shillings had...lasted all too short. It was now two, ay, nearly three days since I had eaten anything, and I felt somewhat faint; holding the pencil even had taxed me a little."

As a journalist and writer, the damage to the unnamed narrator's intellectual capacity is arguably most problematic. The following quotes show the physiological and psychological challenges posed by the unnamed narrator's lack of food:

> "I had remarked so plainly that, whenever I had been hungry for any length of time, it was just as if my brains ran quite gently out of my head and left me with a vacuum--my head grew light and far off, I no longer felt its weight on my shoulders, and I had a consciousness that my eyes stared far too widely open when I looked at anything."

> "It was three o'clock. Hunger began to assail me downright in earnest. I was faint, and now and again I had to retch furtively...A singular sense of confusion suddenly darted through my head. I stumbled on, determined not to heed it; but I grew worse and worse, and was forced at last to sit down on a step. My whole being underwent a change, as if something had slid aside in my inner self, or as if a curtain or tissue of my brain was rent in two."

In addition to the mental effects, there is are physical effects:

> "I had been pinched, too, for food for ever so many weeks before this last period set in, and my strength had diminished considerably of late. When I had been lucky enough to raise five shillings by some manoeuvre or another they only lasted any time with difficulty; not long enough for me to be restored to health before a new hunger period set in and reduced me again. My back and shoulders caused me the worst trouble. I could stop the little gnawing I had in my chest by coughing hard, or bending well forward as I walked, but I had no remedy for back and shoulders. "

The unnamed narrator understands innately the benefits that health investment would have and how an increase in health capital would increase his productive capacity. However, his constant decline in health and mental clarity prevents the unnamed narrator from attaining the necessary increase in health capital:

> "Besides, I commenced to feel dizzy. There was no mistake about it; I was about to break down in earnest. Office hours from 12 to 4. I had knocked at the door an hour too late. The time of grace was over. . .I did not cry; I was too utterly tired, worn to the last degree. I sat there without trying to arrive at any conclusion, sad,

> motionless, and starving. My chest was much inflamed; it smarted most strangely and sorely--nor would chewing shavings help me much longer. My jaws were tired of that barren work, and I let them rest. I simply gave up. A brown orange-peel, too, I had found in the street, and which I had at once commenced to chew, had given me nausea. I was ill--the veins swelled up bluely on my wrists. . .My mind was clear for a moment. Now I was to die. It was in the time of the fall, and all things were hushed to sleep. I had tried every means, exhausted every resource of which I knew. I fondled this thought sentimentally, and each time I still hoped for a possible succour I whispered repudiatingly: 'You fool, you have already begun to die.'"

From this low point, the unnamed narrator is granted a brief reprieve, and not all hope is lost:

> "I had got over the worst this time, too. I had had food every day, and my courage rose, and I thrust one iron after the other into the fire. I was working at three or four articles, that plundered my poor brain of every spark, every thought that rose in it; and yet I fancied that I wrote with more facility than before."

Thus, we can clearly see the restorative nature of food, as a form of investment in health capital. Minor changes, or exogenous inputs would have a significant impact on the unnamed narrator and allow him to move just above the starvation level and provide tremendous economic mobility. With a little push, the unnamed narrator would be in a position to work his way to greater economic stability and freedom.

The Fat and the Thin

In *The Fat and the Thin*, Florent starts with a similar level of health capital as the unnamed narrator but has a different trajectory. His story illustrates both the importance of the savings rate and foreign investment to the likelihood of a poverty trap.

Because Florent chooses a high savings rate, he is just able to stay above the poverty trap threshold where dh*=f(h*), as seen in Figure 9.
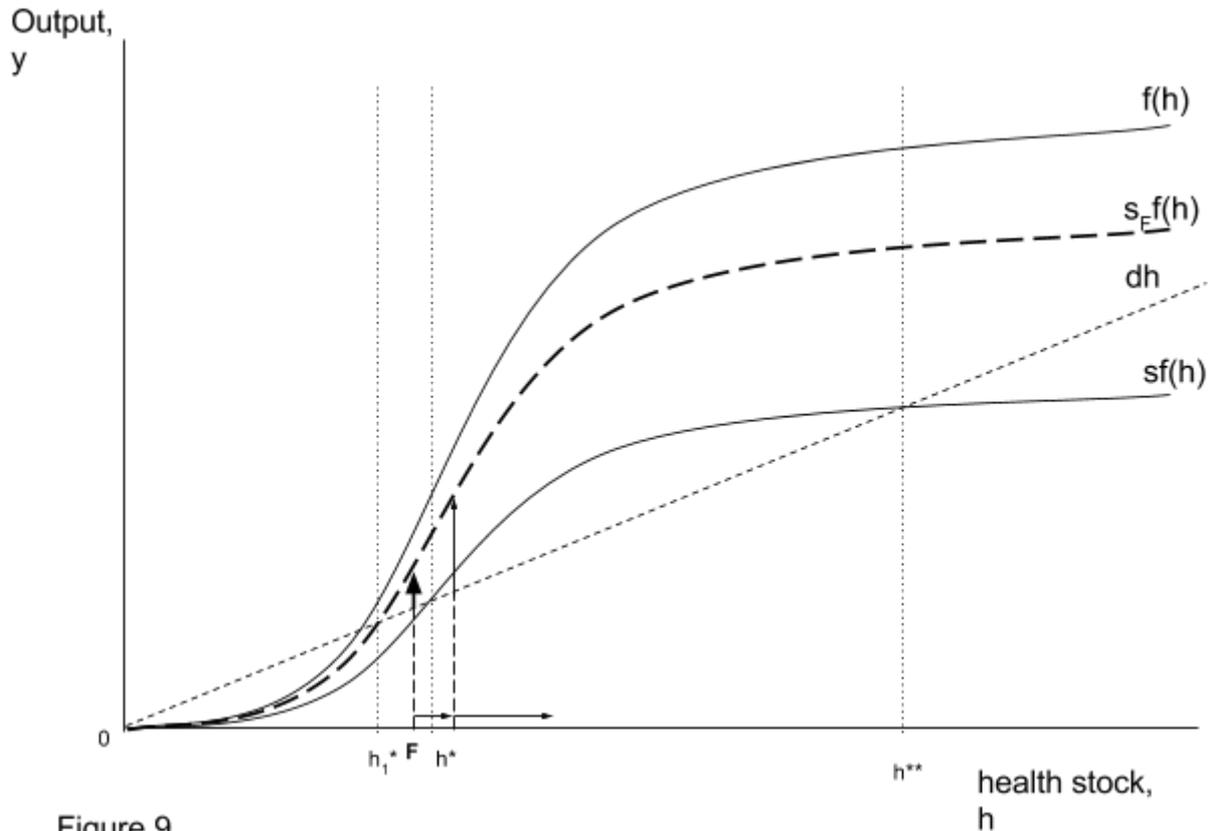
Figure 9

With a higher savings rate, Florent's investment curve is $s_Ff(h)$. This moves the critical point where $sf(h)=dh$ from h^* to h_1^*. Given Florent's initial level of health stock, F, a savings rate of s would have caused his health to deteriorate as in *Hunger* because depreciation is greater than investment. With the savings rate s_F, depreciation is now less than investment, so he is able to build health capital and work towards economic stability. For example, upon his arrival in Paris, Florent, although very weak and hungry, has eaten enough over the past several days to be able to pay Madame Francois for the ride she provided by unloading her cart. In the end, he earns a carrot for his trouble, which he eats "slowly and gently," and which provides some caloric input and ameliorates his malnourishment, before setting off in search of his brother. There is a very small margin of error in this calculation, however, as a decrease in the savings rate would return Florent to poverty, perhaps to follow the same downward trajectory as the unnamed narrator.

However, there is another crucial difference between Florent and the unnamed narrator than just their savings rates. Florent, arriving at Le Havre with "fifteen francs tied up in the corner of his handkerchief," is trying to get to Paris and his brother's house, where he will presumably be welcomed and fed. This relationship is the outside support that the unnamed narrator in *Hunger* desperately needs to escape the poverty trap, i.e. foreign investment.

As a resident in Quenu and Lisa's house, Florent benefits from their generosity and wealth. Upon his arrival, he takes to bed, but under the care of his relative. A similar illness befalling the unnamed narrator would have a different outcome:

Quenu had cut some slices of bread and ham, but Florent was scarcely able to eat. He was overcome by dizziness and nausea, and went to bed, where he remained for five days in a state of delirium, the outcome of an attack of brain-fever, which fortunately received energetic treatment. When he recovered consciousness he perceived Lisa sitting by his bedside, silently stirring some cooling drink in a cup. As he tried to thank her, she told him that he must keep perfectly quiet, and that they could talk together later on. At the end of another three days Florent was on his feet again.

Great Expectations

There are other types of capital investment that lead to changes in health capital. Pip, in *Great Expectations*, benefits from an influx of external capital in a classic story of this "rags-to-riches" change in economic standing.

As seen in Figure 10, income from an outside source, in this case the convict's sponsorship of Pip, moves the individual in question from h_1, a point where capital is less than h^*, to h_2 a point where capital is greater than h^*. This influx of capital moves output from y_1 to y_2, increasing output and income.
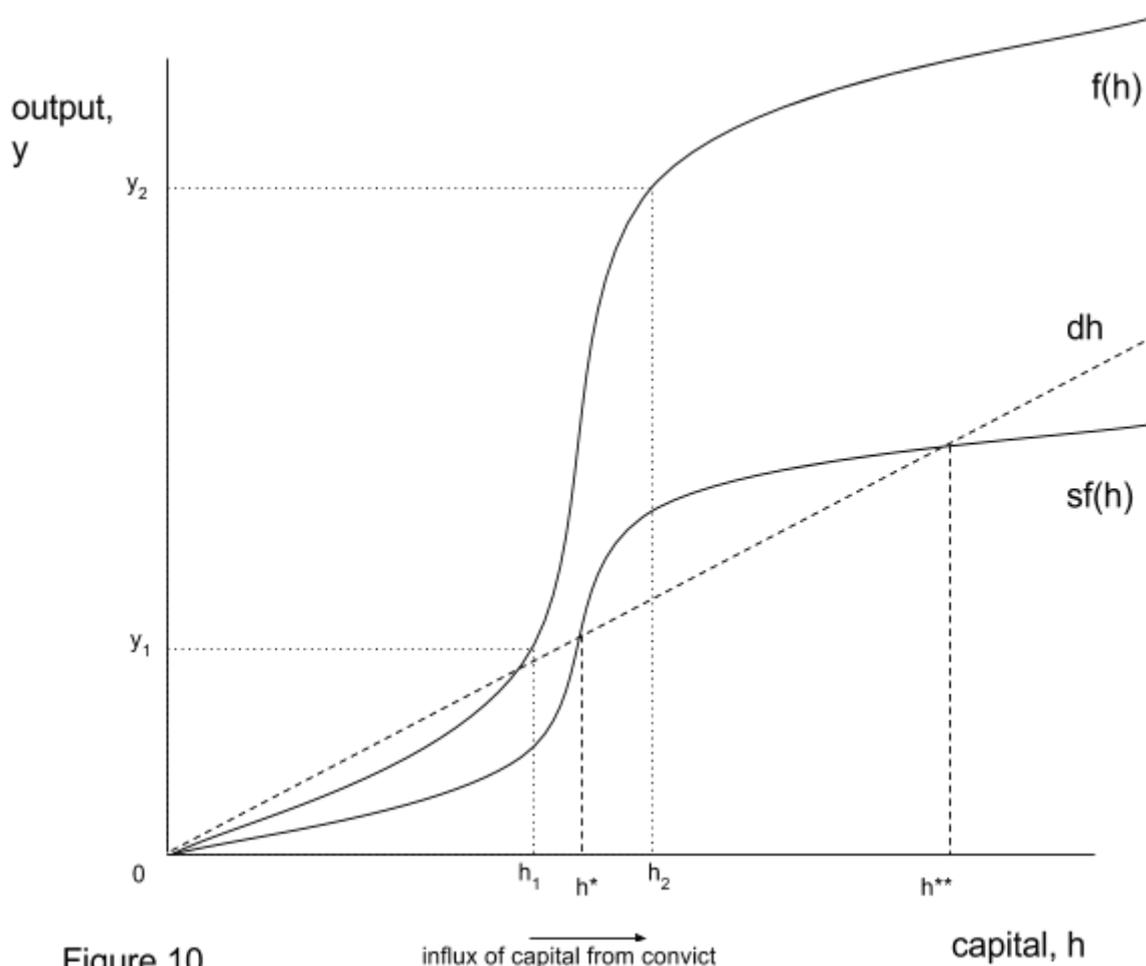

Figure 10

When Pip, fresh from visiting "the hatter's, and the bootmaker's, and the hosier's," goes to Miss Havisham to announce his departure for London, their exchange summarizes the economic implications.

> "I start for London, Miss Havisham, to-morrow," I was exceedingly careful what I said, "and I thought you would kindly not mind my taking leave of you." ...
>
> "This is a gay figure, Pip," said she, making her crutch stick play round me, as if she, the fairy godmother who had changed me, were bestowing the finishing gift.
>
> "I have come into such good fortune since I saw you last, Miss Havisham," I murmured. "And I am so grateful for it, Miss Havisham!"
>
> "Ay, ay!" said she... "So you go to-morrow?"
>
> "Yes, Miss Havisham."
>
> "And you are adopted by a rich person?"
>
> "Yes, Miss Havisham."
>
> "Not named?"
>
> "No, Miss Havisham."
>
> "And Mr. Jaggers[12] is made your guardian?"
>
> "Yes, Miss Havisham."
>
> ..."Well!" she went on; "you have a promising career before you. Be good—deserve it—and abide by Mr. Jaggers's instructions."

By referring to Miss Havisham as his fairy godmother, while ultimately erroneous, Pip demonstrates his implicit understanding of the necessity of outside investment to move above K* and escape the poverty trap. Having witnessed his sister's constant and apparently fruitless work at running the household and bringing up Pip "by hand," the boy has no illusions about upward mobility without some sort of divine intervention.

Pip's lunch with Mr. Pumblechook also demonstrates this phenomenon. The general assumption, based on observed evidence of the usual course of events, is that Pip, being born into the life he was born into, will remain in the same low social class for his entire life.

> Mr. Pumblechook helped me to the liver wing, and to the best slice of tongue (none of those out-of-the-way No Thoroughfares of Pork now), and took, comparatively speaking, no care of himself at all. "Ah! poultry, poultry! You little thought," said Mr. Pumblechook, apostrophizing the fowl in the dish, "when you was a young fledgling, what was in store for you. You little thought you was to be refreshment beneath this humble roof for one as—Call it a weakness, if you will," said Mr. Pumblechook, getting up again, "but may I? may I—?"

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[12] The lawyer in charge of the money.

Mr. Pumblechook's sudden change in attitude towards Pip is a social marker of Pip's change in economic fortune. With the outside investment, Pip can experience social mobility, and has increased economic mobility.

The First Four Years

Pip's case is an example of a positive shock. The Wilders, in *The First Four Years*, experience negative shocks and a different sort of downward trajectory from the unnamed narrator in *Hunger.* At the start of the book and their married life, Laura and Almanzo own a homestead claim[13], a tree claim, and the house on the tree claim, but have gone into debt to pay for farm equipment and to build the house. Homesteading on the Dakota prairies was heavily reliant on weather and the fitness of the homesteader, as mechanical farm equipment was not widely adopted nor affordable to most farmers. "If the weather wasn't right they had nothing, but whether they had anything or not they must find it somehow to pay interest and taxes and a profit to the businessmen in town on everything they bought, and they must buy to live" (Wilder 119).

The Wilders, like many homesteaders, grew wheat. Had the crop been successful, it would have provided sufficient income for the Wilders to pay their debts incurred on farm equipment and building the house. In the first year, a hailstorm destroys the wheat, and the Wilders are forced to rollover their debts for another year. To do so, Almanzo mortgages the homestead claim and rents out the house on the tree claim. With the profits from the wheat harvest, the Wilders can afford to pay "all of the interest and some of the smaller notes, those for the mowing machine and horse rake and for the sulky plow, and the first payment was made on the harvester"(Wilder 83).

It is in this precarious financial situation that the health implications are fully realized in the third year of married life. Laura and Almanzo both contract diphtheria. They are cared for by Almanzo's bachelor brother Royal, and "at last they were both up and around again, but the doctor had given his last advice and warning against overexertion"(Wilder 88). Almanzo, however, disregards the doctor's warning, "and one cold morning he nearly fell as he got out of bed, because he could not use his legs properly. They were numb to his hips and it was only after much rubbing that he could get about with Laura's help"(Wilder 89). He is diagnosed with a "slight stroke of paralysis" (89). Although Almanzo makes gradual improvement, he "still would fall down if he happened to stub his toe. He could not step over a piece of board in his way but must go around it. His fingers were clumsy so that he could neither hitch up nor unhitch his team, but he could drive them once they were ready to go" (90). His limitations mean that Laura must take time from her work to help him, and the couple's productive capacity is reduced. Almanzo's paralysis leaves him permanently physically impaired. No matter the investments he makes to his health, he will never be able to attain the same level of physical productive capacity he had before the paralysis. This shock is shown in Figure 11.

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[13] The Homestead Act of 1862 turned over significant public lands in the United States to private citizens. A homesteader made a bet with the government that they could live on the property, build a home, make improvements and farm for five years. Upon the successful completion, the homesteader "proved up" and became the outright owner of the claim.

Figure 11   reduction in health from diphtheria/paralysis
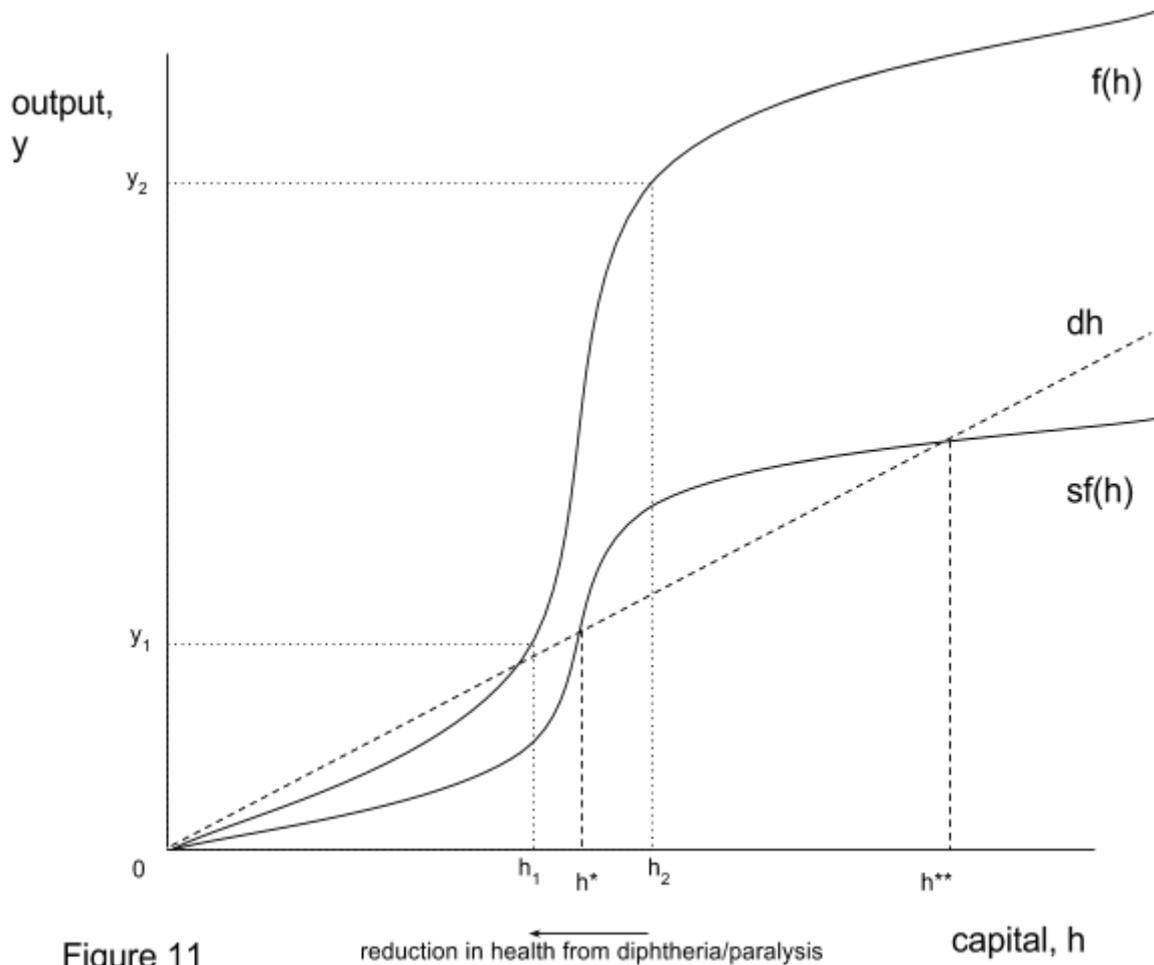
This negative shock is the opposite of what happens to Pip. Almanzo's health capital declines from h_2 leftward to h_1. This point is to the left of the equilibrium point h^*, and depreciation is greater than savings. Capital will decline over time as the Wilders are trapped in poverty. By increasing their savings rate, as Florent did, the Wilders would be able to move to move h^* to the left of h_1. In that case, they would be able to work their way out of poverty.

However, the Wilders are unable to increase their savings, as they are beset with additional negative shocks. After another two years of failed crops and topped off by a destructive house fire, leaving the couple with "the silver wedding knives and forks and spoons...the deed-box, a few work clothes, three sauce dishes from the first Christmas dishes, and the oval glass bread plate around the margin of which were the words, "give us this day our daily bread'"(130-131), Laura and Almanzo move to Missouri in the hopes of better weather for Almanzo, abandoning their life on the Dakota prairie and starting over, from scratch.

7. CONCLUSION

This project adapted a model of country income and output based on capital investment to show household or individual productivity as a result of health capital or health stock. The

Solow growth model is used to show economic growth as a result of investment in capital goods. This model predicts that economies will converge over time and that poor economies will grow faster than wealthier ones, as shown in the comparison of Japan, China, South Korea and the United States between 1960 and 2015. There are economies, such as those in Sub-Saharan Africa, however, that do not show convergence or growth as predicted by the Solow model. One explanation for this lack of growth is a poverty trap, wherein poor countries stay poor simply because they are too poor to grow. The models that reflect macroeconomic changes can be used to reflect microeconomic changes at the individual level as well. These microeconomic models can show how individual productivity is affected by health capital. Depending on the level of health stock, the depreciation rate and the savings rate of an individual, changes in economic standing occur over time, either gradually or as the result of a sudden shock. Data was found in representative examples of fictional literature. Characters in realistic fiction are faced with choices characteristic of the historical time period, and thus were used to illustrate economic growth.

Ultimately, although Dickens, Zola, Wilder, and Hamsun are not formal students of economics, their literary works capture the intricacies of economic decision making in literature. The decisions of the characters and their realistic responses to outside pressures clearly show various aspects of the growth model developed and show the accuracy of the microeconomic model of health capital. The unnamed narrator in *Hunger* demonstrates an individual's decline into poverty, while Florent in *The Fat and the Thin* shows how changes in the savings rate can affect economic outcomes. Pip's catapult into upper levels of society shows an individual's response to outside input of capital, while the Wilders in *The First Four Years* demonstrate how changing depreciation rates affect a household's income and wellbeing. Thus, literature and other such works can provide valuable economic data for investigation and further research.

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