Honors General Exam

Solutions

Harvard University

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Part 2: Macroeconomics

**Question 1**

The value of the stock market is one of the most closely watched economic variables in the United States. This question asks you some basic questions about the stock market and how movements in stock prices can either cause or reflect changes in other economic variables. Remember that stocks, or equities, represent shares of ownership in business firms.

1. How do most economists believe that stock prices are determined? In other words, what are the “fundamental” long run determinants of stock prices in mainstream economic theory?

Solution: Equities entitle their owners to profits generated by firms, so one of the fundamental determinations of the stock prices is the future expected profits of firms. These profits are (eventually) paid out as dividends, so future expected dividends also works for this part of the question. Also, because the profit stream occurs in the future, it must be transformed into a present value using discount rates, which can potentially vary over time. Writing that stock prices are the “present value of future expected dividends/profits,” without specifying what a present value is earns most but not all of the points for this question. Writing that the stock prices also depend on the expected capital gain in the stock was not penalized, but the question asks specifically for the “long run” determinants of stock prices. Because we can write down the current stock price as a function of future profits and discount rates, those two determinants are the best answer to this question.

1. In practice, future movements in stock prices are diﬃcult to forecast. How does modern economic theory explain this fact?

Solution: Standard economic theory is quite consistent with the fact that stock prices are diﬃcult to forecast. The eﬃcient markets hypothesis holds (essentially) holds that prices for assets like stocks reflect all information that is currently available. Thus, if a stock price moves, some new information must have arrived that was not available before. But if this information was not available in the past, then the information could not have been reflected in the past stock price. Hence, the eﬃcient markets hypothesis embedded in standard economic theory predicts that future stock-price movements will be diﬃcult to forecast. A complete answer does not have to include the phrase “eﬃcient markets hypothesis,” but it should outline the reasoning above.

1. Do diﬃculties in forecasting near-term movements in stock prices prove that these prices are always very close to their fundamental values? Why or why not?

Solution: Many economists believe that stock prices often stray from their fundamental values, that is, that “bubbles” in the prices of stocks and other assets can occur. In a bubble, people are willing to pay more for an asset than the underlying fundamentals would warrant. One reason that they may do so because they expect a high short-term capital gain—they extrapolate past increases in the price of the asset and assume that these increases will continue in the future, even though these increases are not warranted by fundamentals.

Eventually, however, bubbles burst and the asset price crashes down to something closer to its fundamental value. Unfortunately, it is diﬃcult for economists (or anyone else) to know when the stock market is in a bubble, because the fundamental determinants of stock prices (future profits and discount rates) are not observable. It is also diﬃcult to know when a bubble is going to burst. Because diﬃculties in forecasting near-term movements in stock prices do not rule out bubbles, these diﬃculties do not prove that stock prices are always close to their fundamental values. A complete answer does not need to mention the word “bubble” but it should include the above reasoning.

1. Assume that the value of the stock market has risen. In a closed economy, how would we expect this increase to be related to changes in the individual components of GDP? Discuss short run eﬀects only. For clarity, you should analyze the eﬀects of the stock-market increase on each GDP component in isolation, not all at once. You should also relate your answer to an economic model.

Solution: An increase in the stock market should be correlated with increases in both consumption and investment. Because stocks are an important component of household wealth, higher stock prices make consumers feel richer, and thus should increase their consumption via a wealth eﬀect. In the short run, the increase in consumption should raise aggregate demand and thus raise output. One way that this can be expressed is with an IS-LM model; higher consumer wealth shifts the IS curve out, raising the real interest rate r and output Y in the short run.

Higher stock prices should also be correlated an increase with investment. If (for example) the stock price goes up because the capital embedded in firms becomes more profitable, firms will want to increase their capital stocks, which will increase investment rates. One way to illustrate this is with $q$ theory, where $q$ is defined as the market value of capital installed in firms divided by the replacement cost of capital. Higher stock prices raise the numerator of $q$ so they tend to make installed capital more attractive to firms and thus raise investment. How does this increase in investment aﬀect output? Like the wealth eﬀect, the investment-channel eﬀect on output can also be captured by an outward shift in the IS curve, which increases short-run $r$ and $Y$. A complete answer should mention both consumption and investment, and should include a reference to at least one model, such as IS-LM, $q$ theory, the permanent income hypothesis, etc.

1. From August 2000 to February 2003, the value of the S&P 500 stock-price index fell by 43.6 percent. This decline was accompanied by a mild recession. From October 2007 to March 2009, the S&P declined by comparable amount (50.8 percent), but the later decline accompanied the worst recession since the Great Depression of the 1930s. Why do you think that the recession of 2007-09 was so much worse than the recession of 2001? Specifically, was the 2007-09 recession related to other asset markets besides the equity market, and if so, how?

Solution: The severity of the Great Recession of 2007-09 was driven by declines in house prices. Because houses are also assets, movements in house prices can be analyzed with a framework that is similar to the one used for stock prices. Specifically, in the years before the recession, house prices rose rapidly relative to most estimates of their fundamental determinants, most importantly future housing rents. (Houses generate a stream of rental income for their owners, even owner-occupiers[[1]](#footnote-1), just like firms generate profits/dividends for their owners.) In 2006, U.S. house prices began to fall. Like a decline in the value of stocks, falling house prices make consumers feel poorer, but this eﬀect is obviously stronger for homeowners than for renters. In fact, falling house prices probably make renters feel richer, not poorer, because lower house prices could eventually be reflected in lower rents and because they also reduce the amount that renters have to pay to own homes in the future. Also, falling house prices reduce the attractiveness of new housing investment, for the same reason that lower stock prices do so for installed capital in firms.

Now think about the other eﬀects that falling house prices had on the economy during the Great Recession. Unlike assets like stocks, houses are very often purchased with borrowed money—that is, by using leverage. When house prices fall, homeowners are less likely to repay these loans, called mortgages, so lenders suﬀer losses. In 2007-09, these losses were so severe that a financial crisis ensued, which hindered the ability of the financial system to support economic activity. In 2001, the decline in stock prices did not cause a financial crisis, because stocks are less likely to have been purchased with leverage and thus did not cause large losses to financial firms.

A complete answer should mention the following points:

* The Great Recession involved falling house prices as well as falling stock prices. (You did not have to mention that many people believed that the housing market was in a bubble before 2006.)
* The wealth eﬀect from falling house prices would have reduced consumption, though this eﬀect is strongest among homeowners.
* The investment eﬀect from falling house prices would have reduced new home construction.
* Because house prices are purchased with borrowed money, and because falling house price raise mort-gage defaults, a decline in house prices damaged the financial system in 2007-09 in ways that falling stock prices in 2001 did not.

**Question 2**

This question includes a set of statements about the Solow Model that you should label as either “true,” “false,” or “uncertain.” You should assume that the Solow Model in this question is calibrated in the standard way; for example, that the capital share $α$ is greater than zero but less than one. Capital depreciates exogenously at rate $δ$. Additionally, technical progress is reflected in exogenous growth in labor-augmenting technical progress $E$at rate $g$. The population growth rate $n$ is also exogenous. Most importantly, you should provide an explanation for your answer, because your explanation is the most important determinant of your grade.

1. In the steady state of the Solow Model, neither the growth rate of aggregate output $Y$ nor the growth rate of output per worker $\frac{Y}{L}$ depends on the savings rate $s$.

Solution: True. In the Solow Model, the steady-state growth rate of aggregate output $Y$ is $n+g$, the population growth rate plus the growth rate of technological progress. The steady-state growth rate of output-per-worker is $\frac{Y}{L}$ is $g$. Neither expression involves $s$.

1. In the steady state of the Solow Model, the capital-output ratio $\frac{K}{Y}$ does not depend on the saving rate $s$.

Solution: False. The steady-state capital-output ratio $\frac{K}{Y}$ is $\frac{s}{δ+n+g}$, which does depend on the saving rate$ s$.

1. An increase in the rate of technical progress $g$ is generally bad for future living standards, because it lowers the steady state value of capital per eﬃciency unit of labor, $k=\frac{K}{EL}$.

Solution: False or uncertain. It is true that higher $g$ lowers steady-state $k$. However, $k$ is a theoretical construct that does not directly determine either the level of living standards or the growth rate of living standards. And the benefits of higher $g$ on living standards is likely to swamp any negative eﬀect arising through $k$. To see this, note that in a statistical sense, the most important determinant of long-run living standards $\frac{C}{L}=(1-s)\frac{Y}{L}$ is the growth rate of this variable. Because $s$ is constrant, this growth rate is $g$, the *growth rate* of output per worker. Consequently, in the long run, the positive benefits of higher g on future living standards is likely to swamp any negative eﬀects arising from a lower level of $k$.

1. The recovery of living standards in Germany and Japan after World War II is easy to explain with the Solow Model.

Solution: True. World War II destroyed a lot of German and Japanese capital, but $K$ is endogenous in the Solow Model. The war did not aﬀect the level or growth rate of technology in the two countries ($E$ and $g$, respectively) though the war did reduce their population levels L. In the Solow Model, the reduction in $K$ is endogenously undone by rapid net investment after the wear, so output-per-worker $\frac{Y}{L}$ and living standards $\frac{C}{L}$ return to their prewar values. To the extent that the war permanently reduced population $L$, then we would expect aggregate output $Y$ to be on a lower trajectory than before, but this is a statement about aggregate output Y and not per-worker output or living standards ($\frac{Y}{L}$ and $\frac{C}{L}$).

1. Many economists believe that living standards in diﬀerent countries around the world not converging (that is, incomes per capita of poor countries are not growing faster than those of rich countries). If true, then this fact alone means that we have to change the basic Solow Model in fundamental ways.

Solutions: False. Countries might not be converging because they have diﬀerent steady states, which are determined by $n$, $g$, $s$ and $δ$. To the extent that poor countries are poor because they have diﬀerent values of these variables from rich countries, then we should not expect convergence in an *absolute* sense. Of course, we should still expect convergence in a *conditional* sense; countries should be converging to their own individual steady states.

1. The Solow Model predicts that output $Y$ depends on capital $K$, labor $L$, and labor-augmenting technology $E$. Therefore, the Solow Model is inconsistent with idea that the cross-country income distribution is driven in part by cross-country diﬀerences in geography and climate, in economic institutions, or in cultures.

Solutions: False or uncertain. Research indicates that levels of per-capita income vary in large part because $E$ varies around the world. The Solow Model does not have a good explanation for why this is so; empirically, technology levels are inferred as “residuals” in output after the eﬀect of inputs like capital and labor are accounted for. Thus, economists believe that geography, institutions, and culture can play a role in generating cross-country diﬀerences in income by aﬀecting $E$.

1. If an owner also lives in his house, then the “rental income” of the house is the rent that the owner avoids paying someone else to live there. [↑](#footnote-ref-1)