**Macroeconomics 2**

**Reseat Exam, June 30, 2021**

* *The exam lasts for two hours (12:00-14:00, except for students with special educational needs).*
* *Read the questions carefully and answer them succinctly, in legible handwriting. Present the calculations, if applicable, and, in the case of theoretical questions, explain your reasoning by answering each of the items.*
* *You can use a calculator without communication capabilities, as well as use the formulae written by you, as indicated in the chair regulations.*
* *Answer each question in a separate exam sheet, and do not forget to write your name and student number in each sheet.*

**Group 1 (6 points)**

Regarding the South Zealand economy, which works according to the assumptions of the Harrod-Domar model, it is known that the total product (Y) rose from 155 million monetary units (m.u.) in 2004 to 203 million m.u. in 2019, with no population variation. Over the same period, the savings rate was 20% and the depreciation rate was 4%.

1.1 (2 points) Calculate the value of the physical capital stock in the year 2019.

1.2 (2 points) If the capital-output ratio had been greater than it was, with everything else constant, would this economy have grown at higher or lower rates? Explain why this is so.

1.3 (2 points) Discuss the differences between the productivity properties of physical capital in the Harrod-Domar and Solow models, and what these differences imply in terms of the models’ conclusions.

**Answers:**

**1.1.** Harrod-Domar model: gw=s/v-δ ;

find K2019 = ?, provided that s=0.2 ; δ=0.04;

v = K/Y, so that K2019 = v \* Y2019. So, we need to calculate v. Because we know the values of s and δ, we need to calculate gw in order to find the value for v [from Harrod-Domar, v = s/(gw + δ)].

gw = r(Y) = exp(ln(203/155)/15=)-1= 0.018~ . So, 0.018 = 0.2/v – 0.04, therefore v = 0.2/(0.018+0.04) = 3.45~

Hence, K2019 = v \* Y2019, K2019 = 3.45 \* 203m mu, K2019 = 700m~ mu

**1.2.** It would have grown less. The capital-output ratio (inverse of the productivity of physical capital) gives us the units of physical capital needed to produce a unit of output. If the ratio had been higher, more units of physical capital would have been needed to produce each unit of product. Therefore, the product resulting from the stock of physical capital existing in each period (from which savings and investment are made that give rise to the addition to the stock of physical capital for the following period) would have been smaller and the pace of economic growth it would also have been smaller.

**1.3.** The productivity of physical capital (and its inverse, the capital-output ratio) is a constant in the Harrod-Domar model (fixed technological coefficient). In the Solow model, the productivity of physical capital is a variable that depends on the level of the stock of physical capital: the addition of more units of physical capital is associated with increasingly smaller increases in the level of product. It is this decreasing marginal productivity of physical capital in the Solow model that, combined with a necessary investment function proportional to the level of physical capital, produces a steady state characterized by the absence of intensive economic growth (in per capita terms): there is a point from which the stock of physical capital does not generate enough units of output to ensure the maintenance of its own stock. In the Harrod-Domar model, we do not have intensive economic growth either, but only because it is assumed that, by sheer chance, the population will grow exogenously at the same rate as the economy and the stock of physical capital.

**Group 2 (5 points)**

2.1 (2 points) If, over the next twenty years, the world population grows on average 1% per year and the world GDP per capita grows on average 2.5% per year, how will the level of emissions of greenhouse gases (GHG) per unit of product have to evolve so that the total level of GHG emissions is halved?

2.2 (2 marks) State arguments for and against carbon emission permit markets as a way of tackling the problem of climate change, and comment on them briefly.

2.3 (1 point) Explain what the social discount rate is and why it matters so much in debates about the economics of climate change.

**Answers:**

**2.1.** r(N)=0,01 ; r(Y/N)=0,025 ; r(E)=ln(0,5)/20=-0,035 ; r(E/Y)=? r(Y)=0,025+0,01=0,035 r(E/Y)=r(E)-r(Y)=-0,035-0,035=-0,07.

The level of GHG emissions per unit of product is expected to decrease by an average of 7% per year over the next twenty years.

**2.2.**

i) It increases total emissions: the richest economies and large companies buy emission allowances from the poorest economies and the net result is an increase, not a decrease, in total emissions.

ii) It deepens development inequality, making it more difficult for poorer economies to access the advantages of new technologies, as they do not have the necessary scale, capital and knowledge and are paid to give up their right to produce and broadcast, leading them to focus on activities with low added value.

**2.3** The social discount rate is a representation of society's intertemporal preferences. Allows you to convert future costs and benefits into updated values. Since the problem of climate change is associated with costs and benefits with different temporal structures (in particular, action to address the problem involves short-term and long-term benefits, while inaction produces huge costs, especially in the medium and long term), the choice and use of different social discount rates in climate change economic models can lead (and has led) to radically different conclusions.

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**Group 3 (4 points)**

In a closed economy that is described by a model in which income is fully shared between two classes, that of owners (profits) and that of workers (wages), admitting for reasons of ease of calculation that there is no State, the owners they consume part of their profits, using the rest for investment, with the total profits being determined by a mark-up on production costs (which are, in this model, composed exclusively of wages), while workers spend the entirety of their wages on consumption, which are exogenously determined by negotiation with the owners.

3.1 (2 values) Formalize the model, obtain its reduced form, explaining your reasoning. Calculate the change in GDP if wages grow by 4%, with no change in the mark-up value.

3.2. (2 points) Explain in which cases, in this model, GDP can grow even when wages are reduced, discuss the cause of this evolution (in the context of this model) and the implications of this process for the distribution of income in this economy.

**Answers**

**3.1**

This simplified version of the Kalecki model is described by the following equations:

Y=C+I

C=Cp+W, where Cp is the consumption of capitalists and W is the wage bill, used entirely in consumption, both exogenous variables

I= Profit-Cp

Profit = kW, where k is a mark-up, parameter such that 0<k<1. The reduced form of the model is then:

Y=C+I

= (W+Cp)+(kW-Cp)

=(1+k)W

(Wage multiplier is dY/dW=1+k, it is greater than one unit)

The growth rate can be calculated, for example, as we did in this course, g(Y)=g(1+k)+g(W). Thus, GDP grows 4% if the mark-up does not change.

**3.2.** GDP can grow even if the wage bill is reduced, if the impact of the rise in mark-up is higher. In this case, the distribution of income changes, with the reduction of the wage share and the increase in the share of profits, and the strengthening of power of the corporations to determine the mark-up should also be noted.

**Grupo 4 (5 points)**

*“In the earlier stages of development of an industry, what we can call its infancy or sunrise stage, industrial policy may be focused on* ***innovation*** *and on* ***coordination*** *of* ***competitive*** *investment and of* ***complementary*** *investment. In fact, it does not matter which specific industry is developed as long as there is enough complementary investment and economies of scale are allowed to develop.”* (Ha-Joon Chang).

4.1. (1 point) Briefly explain and discuss the above sentence.

4.2. (2 points) Which specific policies can be utilised for the purposes mentioned by Chang? Briefly present some examples and discuss the desired effect of those policies.

4.3. (2 points) Is the argument presented in the above sentence consistent with the neoclassical concept of market driven (factor endowment based comparative advantage compliant) industrial policy? Why or why not?

**Model answers**

**4.1.** Earlier stages of industrial development or the sunrise stage of a particular industry are intensive in research, experimentation, innovation, and lack product and process standardization. Thus, industrial policies should focus in supporting these processes, because: (i) private costs and uncertainty of engaging in research may offset private gains, whereas social gains may largely exceed private costs and uncertainty and (ii) these are the critical factors in infant industry development.

Many industries may not develop and may not be viable if there is not enough complementary investment that develops the supply chain, both upstream (suppliers of products and services required for a particular industry to operate) and downstream (consumers of the products of that industry). A very specific aspect of complementarities is related to technological complementarities – new products may or may not be compatible with the existing technologies and standards (for example, the market value of a 5G phone depends also on the availability of a 5G network and 5G products and apps). Market lead coordination costs are just too high.

Infant industries need to build economies of scale in order to become cost efficient and increase productivity. Coordination of competitive investment means that barriers to entry into specific markets and industries are established tom avoid wasteful investment, competition and price wars.

**4.2.** Policies to support innovation can range from patents and intellectual property rights (that guarantee monopoly power for a certain amount of time to the innovator by introducing rigidities and barriers for access to knowledge and information, which enables internationalization of externalities but reduces social welfare), to direct subsidies to lower the costs of innovation, adaptation, adoption and mastering of new technologies (which compensates the innovator but guarantees the universal access to the innovation at low private costs), to the development of the institutional framework (development of science and technology complexes, like the universities and their linkages with the production basis, investment in education, establishment of strong technology related requirements development of technology oriented finance, etc.).

Policies to coordinate complementary investment include the utilization of public investment as a strategic beacon, the formation of for a and association of industries, providing information about future possibilities (demand and supply) that can be utilized for planning of public and private investment, subsidising the adoption of new technological standards to guarantee technological complementarity (for example, subsidising the universal adoption of solar panels for household production of electricity, which will then lower the costs of production and incentivise quality improvements in solar panel production due to scale, and generate excess supply of renewable energy that can be resold into the national or subnational grid).

Policies to coordinate competing investment are barriers for entry, like licensing with stringent requirements, to reduce the number of firms investing in one particular industry (this demands a very good knowledge of the dynamics of the specific market), compensation to investors excluded from one industry by rewarding them with allowances to entry into another industry, development of producer associations that operate like oligopolies to coordinate production, markets, quotas and prices, etc.

All these policies may run the risk of creating crony capitalism, but it has also been argued, on the basis of the analysis of experiences like that of Japan, Singapore, South Korea, Finland, that such policies may reduce rent seeking because they eliminate the markets for rents.

**4.3.** No, the argument of the above sentence is not consistent with neoclassical market driven, factor endowment based comparative advantages led industrial policy. Neoclassical approaches to industrial policy require the assumption that markets are the most efficient resource allocators and, therefore, the most effective beacons for any strategy and policy. The sentence above violates these assumptions in all of their extension, as everyone of the activities and policies suggested creates what neoclassical economists would call market imperfections as a means of enabling the development of industrial capabilities and the industrial fabric deemed necessary, even if not sufficient, for successful industrialization to take place.