Exam 1: Intermediate Macroeconomics ECON 3150
Summer 2018

1. (10) Gross Domestic Product is the value of all goods and services produced within a country in a time period, typically a year. Write out the equation of GDP as a sum of four basic uses, hint one of these four is net exports, X-M.

$Y = C + I + G + X - M$

2. (10) Suppose that foreign firms producing output in the US equal to 10% of the US GDP. Of this production foreign firms earn profits equal to 10% of their output and return these to the shareholders outside of the US. Further suppose that US households own firms that produce output outside of the US equal to 20% of the US GDP. Assume that these firms earn profits equal to 15% of their output abroad and return these profits to the US households. Write out the adjustment to GDP to produce Gross National Income, where Y is the GDP of the US.

Foreigners: $.10Y*.10 = .01Y$

US owners of foreign production: $.20*Y*.15 = .03Y$

$GNI = Y - .01Y + .03Y = 1.02Y$

For the next few questions use the information in the following Table about the US and a few other countries. Real output per worker (living standards) are contained in the columns marked with ypw. Years of schooling in the workforce are in the columns marked with E.

Year	USA	USA	France	France	Germany	Germany	UK	UK	Japan	Japan
	ypw	E	ypw	E	ypw	E	ypw	E	ypw	E
1800	4920	4.30	2651	1.03	3236	1.46	4589	1.23	1452	0.61
1810	5268	4.64	2706	1.30	3279	1.97	4760	1.70	1483	0.84
1820	5079	4.76	2761	1.63	3323	2.34	4920	1.99	1440	1.00
1830	5706	4.80	2904	2.01	4096	2.67	5168	2.17	1505	1.13
1840	6135	4.83	3489	2.54	4245	2.91	5374	2.28	1514	1.23
1850	6432	4.74	4546	3.36	4398	3.11	6797	2.56	1479	1.31
1860	7661	5.26	4876	3.69	5077	3.41	7986	3.43	1577	1.38
1870	9309	5.96	5286	4.14	5731	3.60	9256	4.27	1685	1.48
1880	11091	6.86	5664	4.47	6251	3.83	10144	4.94	2001	1.58
1890	11047	7.46	6142	4.71	7078	3.99	11054	5.23	2191	2.08
1900	13086	7.85	6696	4.86	8662	4.25	12126	5.57	2669	2.78
1910	15160	8.12	7463	4.98	9928	4.52	12479	5.78	3330	3.90
1920	17213	8.47	6726	5.09	8090	4.71	12749	6.00	4312	4.98
1930	18887	8.92	9911	5.22	8621	5.01	13233	6.28	4980	5.96
1940	21630	9.46	9616	5.43	13263	5.26	19336	6.53	7860	6.90
1950	29160	9.92	12522	5.76	10731	5.39	18408	6.99	5496	7.62
1960	35412	10.4	23540	6.14	20483	5.57	23865	7.64	10451	8.73
1970	43205	11.1	35205	7.32	30271	6.66	29756	8.67	23525	9.38
1980	48912	12.0	45260	8.94	40928	8.69	38818	9.72	33062	10.4
1990	56375	12.7	49405	9.97	40935	10.0	40271	10.5	47273	11.0
2000	69291	13.1	56199	10.9	47936	11.1	52859	11.1	51281	11.4
2010	76578	13.7	57572	11.5	49552	12.0	58637	12.2	57393	11.9

3. (10) For France, Germany, UK and Japan compute the year the US attained their living standard in 2010. For example if a country had real output per worker in 2010 of 69250, we would say the US attained that value in 2000. Do this for years 2010, 1970, 1950 and 1940.

4. (10) Repeat the exercise, but for years of schooling. So if a country had 10.5 years of schooling in 2010, we say that the US attained that value in 1960.

5. (10) Using the 2010 *Housing Statistics of Europe 2010* compute the square feet per household for France, Germany, UK for 2010 (closest year in the Table), using 10.76 square feet per square meter, and dwellings completed column. Also construct the estimate for Japan, which has 94.85 sq. meters per household in 2012.

To help answer the next question use the following Table for the US.

Year	Sq ft per new home	ypw	E
1920	1048	17213	8.47
1930	1129	18887	8.92
1940	1177	21630	9.46
1950	983	29160	9.92
1960	1289	35412	10.4
1970	1500	43205	11.1

1980	1740	48912	12.0
1990	2080	56375	12.7
2000	2266	69291	13.1
2010	2400	76578	13.7

6. (10) Using your answer to 5. above, compute for each country, their US living standard year, that is in what year did the US have the same square footage of housing as that of the foreign country. Also report the years of schooling of the US in that year. How does your answer compare with respect to the ypw calculations from 3., and years of schooling calculations from 4?

For the next question, we take information from the 1993 and 1997 Annual Report of the Dallas Federal Reserve Bank.

Year	1929	1957	1970	1997	2017
Twin mattress	161 hrs.	78 hrs.	42 hrs.	24 hrs.	13 hrs.
King mattress	321 hrs.	156 hrs.	84 hrs.	61 hrs.	30 hrs.
Year	1910	1950	1970	1997	2017
Electric range	345 hrs.	292 hrs.	113 hrs.	22 hrs.	25 hrs.
Year	1913	1954	1970	1997	2017
Dishwasher	463 hrs.	140 hrs.	69 hrs.	28 hrs.	17 hrs.
Year	1916	1958	1970	1997	2017
Refrigerator	3162 hrs.	333 hrs.	112 hrs.	68 hrs.	34 hrs.
Year	1911	1956	1970	1997	2017
Clothes washer	553 hrs.	138 hrs.	72 hrs.	26 hrs.	22 hrs.
Year	1916	1958	1970	1997	2017
Clothes dryer	198 hrs.	118 hrs.	57 hrs.	26 hrs.	22 hrs.
Year	1908	1955		1997	2017
Ford sedan	4696 hrs.	1638 hrs.		1365 hrs.	1085 hrs.
Year		1954	1971	1997	2017
Color television		562 hrs.	174 hrs.	23 hrs.	22 hrs.
Year	1947	1967	1975	1997	2017
Microwave oven	2467 hrs.	176 hrs.	97 hrs.	15 hrs.	5 hrs.
Year	1944	1970	1984	1997	2017
Computer	197824 hrs.	1395272 hrs.	435 hrs.	76 hrs.	66 hrs.
Million operations/second	.000003	12.5	8.3	166	300000

7. (10) For each of the items, construct the rate of decline per year of the price of the item between 2017 and the first year of the observation. For the computer, also compute the rate of growth of the speed of operation from 1944 to 2017

8. (10) Now compute the annual growth rate of real output per worker in the US over similar years. So for example compute the growth rate from 1930 to 2010 and compare it to the absolute value of the rate of price decline in mattresses. For those appliances that you observe first in the 1910s, compute the US growth rate in real output per worker from 1910 to 2010 and compare.

9. (20) Consider the intergenerational human capital that we discussed in class is defined as follows (in this version we ignore the return to experience):

$hcnew_{it+20} = A\bar{h}_t^{\rho_{it}} hcnew_{it}^{\beta-.1\rho_{it}} exp(.1 * E_{it})$, and the degree of the spillover is:

$\rho_{it} = min\{.35, \frac{E_{it}}{30}\}$, and we assume restriction: $\beta + .9\rho_{it} \leq 1$,

where i represents country i, and t represents year, E_{it} represents the years of schooling of the young worker cohort showing up in the labor force 20 years from today (think of them as 5 years old in year t), $hcnew_{it}$ is the human capital of the parents (or teachers) of the children, $\bar{h}_t$ is the state of the art human capital in the world at time t.

i. (5) How do you interpret the coefficient on schooling of today's children in other words, what meaning does the .1 in the equations have?

ii. (5) How do you interpret the expression $\rho_{it} = min\{.35, \frac{E_{it}}{30}\}$. What is it trying to capture? Does it make any sense at all?

iii. (10) Put into words a description of the following component of the definition of hcnew: $A\bar{h}_t^{-\rho_{it}} hcnew_{it}^{\beta - .1\rho_{it}}$. How does it take into account the difference between a country that educated all of its workers as high school graduates by 1940, compared with a country that is only today, 75 years later having the youngest workers be high school graduates, also make use of your answer to ii. above. Focus on what, $\bar{h}_t$ is the state of the art human capital in the world at time t, is trying to capture, what is $hcnew_{it}$ in relation to the child, and also explain $\beta - .1\rho_{it}$.