IQ in the Utility Function: Cognitive skills, time preference, and cross-country differences in savings rates

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Abstract

Social science research has shown that intelligence is positively correlated with patience, while growth theory predicts that more patient countries will save more. In a closed economy, that means high average IQ countries will become more capital-intensive. In an open economy, high average IQ countries will hold a greater share of the world's widely-traded assets. We provide the first empirical evidence that in today's world, presumably somewhere between the closed-economy and open-economy benchmarks, both predictions hold true: Countries whose residents currently have the highest average IQs have higher capital-output ratios and higher ratios of U.S. Treasuries to nominal GDP.

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1. Introduction

Why do some countries save more than others? This question has motivated a vast literature spanning the fields of international economics and economic growth. In this paper, we propose a new answer to this question: that national savings rates differ across countries in part because rates of time preference differ across countries. And time preference differs across countries in part because psychometric intelligence, a key predictor of patient behavior, differs persistently across countries.

Our thesis can be summed up quite simply: Since high-IQ groups are more patient, and since more patient groups are more frugal, high-IQ groups should be more frugal. The first premise is well-documented in empirical social science; the second premise flows from economic theory; and the empirical results of this paper show that the conclusion is well-supported in cross-country data.

We merely take a stylized fact from the world of behavioral economics and psychology—that high-IQ individuals are more patient, less impulsive—and use that fact to estimate key model parameters from a Ramsey growth model, which we then compare to cross-country data on savings rates and national average IQ estimates. This paper is thus another contribution to the emerging field of behavioral macroeconomics. In a world where the Feldstein-Horioka puzzle holds, and thus a country's savings rate is strongly correlated with its investment rate, the fact that smarter groups are more patient allows us to make a further prediction: High-IQ countries will be more capital intensive. And under conventional though restrictive assumptions, we also predict that the marginal product of capital will be lower in high-IQ countries.

We make no claim that IQ differences are permanently intractable, nor that they explain 100% of the difference in savings rates across countries. Instead, we claim that differences in measured cognitive skills—whether proxied by IQ tests, or by math and science tests—are one important driver of cross country differences in savings and hence productivity. Even if all other structural differences between countries were eliminated—if financial institutions were identical across countries, for example—as long as today's IQ differences still remained, then the nations of the world would still have substantial income inequality. In a conventional Cobb-Douglas production function with a broad capital share of 2/3, the high-IQ countries are predicted to be about 50% richer than the low-IQ countries in steady state, just through the time preference/capital accumulation channel.

We begin by discussing the microeconomic and psychological literatures showing a link between patience and IQ. While the IQ-patience link has been repeatedly documented across the social sciences, quantitative measures that focus on long-term decisions are more rare. After collecting these parameter estimates, we insert them into a conventional closed-economy Ramsey growth model with constant relative risk aversion (CRRA) utility. Such a model is comparable to one with a strong Feldstein-Horioka puzzle, where national savings and national investment are tightly correlated. In a quantitative theory exerise, we show that differences in national average IQ will cause substantial differences in savings rates and the capital-output ratio, but that the real-world relationship between IQ and these investment measures is even larger than the relationship predicted by quantitative theory.

In a closed economy, this would be the end of the story: Each country's steady-state savings rate and capital-output ratio would be pinned down by that country's rate of time preference. But we also explore the extreme alternative: One where capital flows frictionlessly across borders. The steady-state in such a world is quite stark, as Barro and Sala-i-Martin (2004, pps. 164-165) show in their textbook: All of the world's capital is owned by the most patient nation, and the less-patient nations mortgage their future incomes to the most patient nation. While the world is certainly far from a friction-free steady state, we provide some evidence that the highest-average-IQ countries—which are far from the richest countries—hold a disproportionate share of the world's safest capital investments.

John Rae (1834) provides a precursor of our approach: Chapter Six of his treatise (cited in Becker and Mulligan (1997)) focuses on individual determinants of savings, including differences in rates of time preference, while his Chapter Seven draws out the cross-country implications. Clark (2006, c. 6) provides an modern restatement of some of these themes, emphasizing the declining rate of time preference across the millenia and the rise of patient behavior among British capitalist elites. However, ours is the first paper to formally quantify the link running from cognitive skills to time preference to national savings rates and capital accumulation.

2. IQ and Time Preference at the Individual Level.

Psychologists have known for decades that higher IQ is associated with greater patience, which they often refer to as lower "delay discounting." (for a review and meta-analysis, see Shamosh and Ray, 2008; for a broad review of IQ's behavioral correlates see also Jensen (1998), c. 9). A recent meta-analysis of 24 studies by Shamosh and Ray concluded: "[A]cross studies, higher intelligence was associated with lower D[elay] D[iscounting]…" And recent work by economists (Frederick, (2005), Benjamin/Brown/Shapiro (2006), Burks et al, (2009)) have demonstrated that low-IQ individuals tend to act in a more "behavioral," more impulsive fashion.

These results establish that IQ and patience are negatively related; but quantitative macroeconomists need more than that. We need a precise number, a coefficient that sums up how much a one standard deviation increase in IQ reduces a person's rate of time preference, ρ, measured for decisions that involve reasonably long periods of a year or more. [1] Fortunately, we have two such estimates of the quantitative influence of IQ on ρ, or $\frac{\partial \rho}{\partial IQ}$. We will summarize the estimates from these two studies, an econometric estimate from Warner and Pleeter (2001), and an experimental measure from Dohmen et al. (2009).

Warner and Pleeter used the results from a unique, high-stakes event to estimate the link between cognitive skill and time preference: The downsizing of the U.S. military at the end of the Cold War. At that time, the military offered over some enlisted personnel a choice between a lump-sum payment and an annuity; the typical lump-sum offer was $25,000, so this was a genuine high-stakes choice. The break-even discount rate was typically close to 18%. Their sample contained over 65,000 enlisted personnel, and they used a wealth of personal characteristics as regressors to estimate the determinants of the personal discount rate.

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[1] A careful study by Burks et al. that used a sample of students in a U.S. truck-driving school, found an estimate of ∂ρ/∂IQ in excess of ¼% per day. However, the time between payoffs was at most one month. As we shall see, this value is an order of magnitude larger than the other two estimates; the vast differences in time preferences when measured over a month versus over a year still deserves futher study.

Among the characteristics were four categories of AFQT (Armed Forces Qualifying Test) score, the score used in the NLSY. The top two "Mental Groups" had statistically significantly lower discount rates: Mental Group I, whose scores were 1.5 to 2.3 standard deviations above the mean, had a discount rate 1.6% lower than Mental Group IV. Mental Group II, 0.5 to 1.5 standard deviations above the mean, had a discount rate 0.6% lower than Mental Group IV. Both were significant at the 5% level. Mental Group III was statisically indistinguishable from group IV, and since the Group III coefficient was itself negligible (+0.2%), we assume that III and IV combined have identical discount rates.

These estimates almost surely understate the influence of general mental ability on time preference, since many of the other statistically significant control variables included in the regression—a career in electronics or medicine, income, college education, and the like—are in themselves tests of mental ability (Gordon, (1997)). Thus, the regression is implicitly including multiple "IQ tests," and our AFQT measure is only one among the throng.[2]

As a result, our parameter of interest, $\frac{\partial \rho}{\partial IQ}$, surely understates the true parameter value. Throughout this paper, IQ is measured in standard deviations—following the widespread convention of 15 IQ points equalling 1 standard deviation within the U.S. population. We assume normality in order to estimate the midpoint between Mental Group I and the combination of Mental Groups III and IV. Since the military does not accept applicants below the 10^{th} IQ percentile, groups III and IV span a range from the 10^{th} to the 69^{th} percentile, and yielding a midpoint of -0.27σ. Mental Group I has a midpoint of $+1.8\sigma$,

[2] Zax and Rees (2002) make a different but related point about including IQ with other controls as explanatory variables: Since IQ causes education, some of the effect of education should be attributed to IQ. This is similar to tracking capital accumulation that is driven by increases in TFP: In a causal framework (rather than an accounting framework) increases in output caused by such endogeous capital should be attributed to TFP, not to capital.

so a 2.07σ rise in mental ability appears to cause a 1.6% fall in the discount rate. Thus, we arrive at our econometric estimate: $\frac{\partial \rho}{\partial IQ}$= -1.6%/2.07 σ = -0.77.

Our experimental estimate is much simpler to calculate. Dohmen et al. gave subjects two portions of typical IQ test (a symbol-matching test and a vocabulary test) during an economic experiment on impatience and risk-aversion run in Germany; the experiment used cash as well as attitude surveys to elicit measures of patience, and the impatience experiment involved a choice between money now (via a check sent in the mail) versus money in 12 months (via a postdated check). They report overwhelming evidence that higher IQ predicts greater patience, even after controlling for income, personality measures, and other demographics.

In their appendix, they go one step further: They assume a CRRA utility function in order to separate out risk aversion from impatience, and they estimate the effect of IQ on the rate of time preference.[3] In these estimates, based on strong functional form assumptions, higher IQ is a statistically significant predictor of greater patience in 3 of 6 estimates, with no incorrectly signed significant results. Their coefficients across various specifcations, reported in $\frac{\partial \rho}{\partial IQ}$ form, are: -1.5, -1.4, -1.2, -0.6, +0.2, +0.4. If we have uniform prior beliefs about the true value of $\frac{\partial \rho}{\partial IQ}$, then a simple average yields us a posterior estimate: -0.68, remarkably close to the Warner and Pleeter estimate.

In the absence of other precise estimates for longer-time time preference, we take the average of these two as our estimate of $\frac{\partial \rho}{\partial IQ}$: -0.73.

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[3] Since IQ is positively correlated with risk tolerance in experimental settings, and since risk tolerance is associated with higher defacto patience in a CRRA-based Ramsey growth model, one could include the IQ-CRRA channel in the work that follows. While we hope that future research includes this channel for completeness, it appeared to be of little practical importance in quantitative theory exercises.

3. IQ and Time Preference in General Equilibrium.

In our quantitative exercises, our goal is to be as conventional as possible. Thus, we follow the Ramsey models covered in the second chapters of both Romer (2000) and Barro and Sala-i-Martin (2004), and use a constant relative risk aversion (CRRA) utility measure, which provides a tractable steady state solution for our key variables. Note that CRRA is routinely used in Dohmen et al., and in much of the choice-under-uncertainty literature as well as in the growth and productivity literature; so this modeling choice is the most conservative possible.

In this section, we assume that each national economy is closed to capital flows; to the extent that the Feldstein-Horioka stylized fact is true—that national savings is strongly and persistently correlated to national investment—little will be lost with this assumption. We will also focus on steady states—an assumption that is false in any particular case, but which may be true on average around the world, since the evidence for unconditional convergence is weak (*inter alia*, Fischer, 2003). Throughout, we suppress time subscripts whenever possible.

As in the standard Ramsey model, we use a Cobb-Douglas production function, $Y=K^{\alpha}(AL)^{1-\alpha}$, and a per-period utility function of $u(c) = c^{1-\theta}$. Under these assumptions, if A (technology) grows at annual rate g, L (labor supply) grows exogenously at annual rate n, future utility is subjectively discounted at rate ρ, and capital depreciates at rate δ, the following is true in steady state:

The Ramsey savings rate is:

$$s^{*}= \alpha(g + n + \delta)/(\rho + \theta g + \delta)$$

And in steady state, the capital/output ratio is

$$(K/Y)^* = \alpha/(\rho + \theta g + \delta)$$

The values we care about most are $ds^*/d(IQ)$ and $d(K/Y)^*/d(IQ)$: We want to know how IQ influences a nation's steady-state savings rate and capital intensity. These values will depend on conventional growth model parameters. Taking the U.S. as a benchmark nation, we take the real return on capital, $\rho + \theta g$, to be 0.04 or 4%, as in conventional RBC models; as average IQ rises in a country and time preference falls, the real return on capital should fall. We assume capital shares, α, equal to 1/3 or 2/3, depending on whether we are considering narrow physical capital or a broader measure that also includes human and organizational capital; recall that the broader capital measure helps explain the canonical 2% rate of convergence found in growth regressions. We also take g=.02, and n=.01 as benchmark values in these comparisons.

Finally, we assume a depreciation rate of $\delta = 0.03$ as in Mankiw, Romer, and Weil (1992); as noted above, for ease of exposition, we assume population growth of 1% per year in the quantitive estimate.

3A. IQ's influence on steady-state values

With these values in hand, we calculate how equilibrium interest rates, savings rates, and capital intensities and capital intensities will differ as IQ differs across the observed range of cross-country variation.

There is little disagreement in the psychological literatrure that national average IQ differs substantially across countries: The disputes instead center on precisely how large these differences are and what causes these differences. In their 2002 book *IQ and the Wealth of Nations,* Lynn and Vanhanen show that going from the 5th percentile to the 95th percentile of the national average IQ distribution takes us across a span of 38 IQ points.

This span, from 68 to 106, is equivalent to 2.5σ within the U.S. population (38/15≈2.5). The highest national IQ scores are found in East Asia, while the lowest are found in sub-Saharan Africa.

Just as GDP is hardest to accurately measure in poor countries, so too is national average IQ. Three recent studies (Wicherts et al, 2009, 2010a,b; see also the response of Lynn and Meisenberg (2010)) have raised questions about the reliability of Lynn and Vanhanen's precise values for the national average IQ estimates in sub-Saharan Africa: Wicherts et al. (2009, 2010) provide some evidence that the Lynn/Vanhanen scores are perhaps 10-12 points too low, and argue that current average sub-Saharan African IQ is closer to 80 or 82 rather than the 70 Lynn and Vanhanen estimate—but even these critics conclude that "There can be little doubt that Africans average lower IQs than do westerners (Wicherts et al., 2010b, 17)." They then proceed to speculate on how environmental influences (including living standards) and test bias could potentially be driving the results, ending with a call for future research. Note that their speculations include both "real" and "nominal" explanations for cross-country IQ differences.

When Wicherts et al. (2010a) use the strictest inclusion criteria possible for national average IQ estimates, they find a median IQ estimate from 8 representative studies of schoolchildren of 75.5, covering a range from 68 to 81. Thus, even academic critics of the precise values of the Lynn/Vanhanen scores find substantial evidence that the lower bound of national average IQ is at least 1.5σ below the U.S. mean, and thus 2σ below the scores in the highest-IQ countries. To span both the Lynn/Vanhanen and Wicherts et. al estimates, we will calculate the effect of both a 1.6σ (24 IQ points: 80 to 106) and a 2.5σ (38 IQ points) rise in IQ; we will also provide a 1σ (15 IQ points) estimate for reference.

Table 1 below shows the effect of changes in national average IQ on steady-state interest rates, capital intensity, and savings rate, starting from IQ=100 and using U.S. parameter estimates as the benchmark.

Table 1: Steady-state effect of an xσ rise in IQ

Effect	1σ	1.6σ	2.5σ
dKY/dIQ (α =1/3)	0.445	0.674	0.975
dKY/dIQ (α=2/3)	0.904	1.369	1.979
dlog(K/Y)dIQ	0.099	0.154	0.232
ds/dIQ (α =1/3)	2.7%	4.0%	5.8%
ds/dIQ (α =2/3)	6.7%	11.5%	20.2%
dlog(s)/dIQ	0.110	0.183	0.302
dr/dIQ	-0.7%	-1.2%	-1.8%

The results are stark: In the world's low-IQ countries, the steady-state interest rate is predicted to be between 1.2 and 1.8% higher; this may sound small, but with 4% as the U.S. benchmark this means 30% to 45% higher real borrowing costs in low-IQ countries. Capital-output ratios will be between 15% and 23% lower in the low-IQ countries, and if α =1/3, the savings rates will fall by 4% to 5.8% of GDP; regardless of the capital share, the savings rate will drop by 18% to 30% from their U.S. benchmark levels.

3B. Steady-state effect on productivity

We can also see how much this will influence steady-state living standards. With a conventional Cobb-Douglas production function, GDP per person=$A(K/Y)^{\alpha/(1-\alpha)}$, so a 1**σ** rise in IQ will raise steady-state GDP per person by 0.099*0.5=0.05 log points if α=1/3, and by 0.099*2=0.2 log points if α=2/3. For a 2.5**σ** rise, the effects are 0.11 log points and 0.46 log points, respectively. The latter implies a 58% rise in steady-state GDP per person.

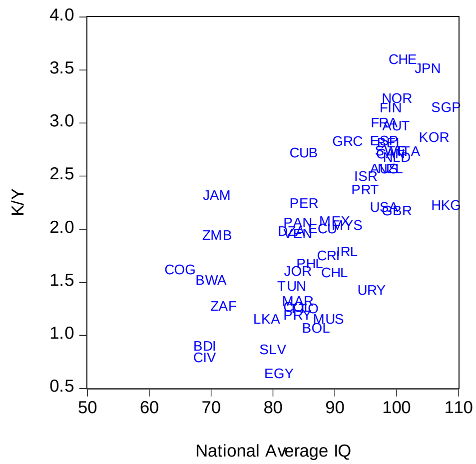
In other words, if the capital share is broad (i.e., including educational and organizational capital), and if those broad forms of capital are accumulated in a similar manner to physical capital (i.e., by delaying gratification) then IQ is likely to have a substantial impact on long-run living standards through the capital accumulation channel.

The results of 3A and 3B establish that using conventional parameters in a Ramsey model, the effect of IQ differences on steady-state savings rates and capital intensity are too big to ignore. In the next section, we fit our model for goodness of fit against cross-country data.

3C. Regression and Parameter Comparison

Taking our model to the data, we begin by reporting some basic correlations. National average IQ estimates are from Lynn and Vanhanen (2006; henceforth LV); these data have been used widely in the economic and psychology literatures, including in Ram (2007), Weede and Kampf (2002), Jones and Schneider (2006, forthcoming) and Rindermann (2007, 2008). Global average IQ (unweighted by country size) is 90 IQ points (compare against the U.S. mean of 98; the highest score in their sample is Singapore with 107). The standard deviation across countries is 11; compare this against the within-country standard deviation of 15 within the U.S. Finally, recall that 15 IQ points is the 1σ measure we use throughout this paper.

Figure 1
National Average IQ and the Capital-Output Ratio



Data on capital per worker, output per worker, and the physical marginal product of capital come from Caselli and Feyrer (2007).[4] Savings data are from the Penn World Tables, and reflect average national savings rates [(I+X)/Y] averaged over 1980-2005 using the *kc, kg, ki* and *openk* constant-price measures to estimate this value; we also ran estimates using the national savings rate as a fraction of non-governmental GDP [(I+X)/(Y-G)] with no substantial changes. Since the Caselli and Feyrer data are somewhat sparse, overlapping with LV's IQ data on only 35 observations, we often report results using Lynn and Vanhanen's interpolations of IQ scores for countries that lack IQ data. When both are used, the differences are negligible, and thus not reported. LV have good evidence that their interpolations are reliable: Their first data base (2002) only included data from 81 countries, while their second (2006) database contained data for an additional 32 countries. Thus, they could compare their interpolated values against later, actual IQ scores. The correspondence was remarkable, with a median absolute deviation of only 3 IQ points. Therefore, we use the interpolations with confidence.

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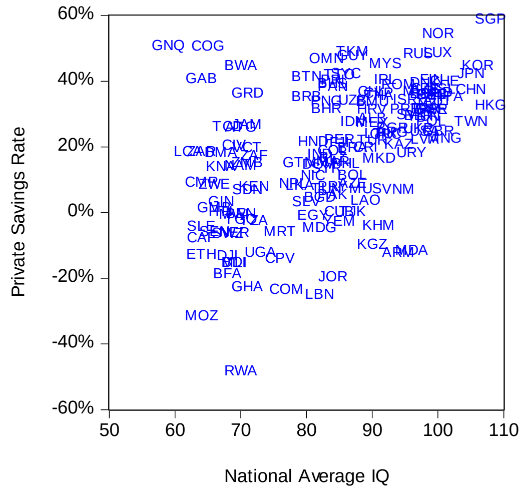
[4] We use Caselli and Feyrer's MPKL marginal product measure for capital.

Figure 2
National Average IQ and the Private Savings Rate



OPEC countries and four countries with savings rates below -50% omitted.

The correlation matrix below shows that IQ always has a correlation greater than 0.6 in absolute value with the variables of interest. Of course, reverse causation and omitted-factor causality could be quantitatively important, but the power of quantitative theory lies in its ability to separate out the influence of one particular causal channel.

Table 2: Correlation matrix

	IQ	IQ(interp)	log(K/L)	log(Y/L)	K/Y	s	r
IQ	1.00	1.00	0.80	0.79	0.64	0.64	-0.67
IQ(interp)	1.00	1.00	0.80	0.79	0.64	0.64	-0.67
log(K/L)	0.80	0.80	1.00	0.94	0.85	0.66	-0.83
log(Y/L)	0.79	0.79	0.94	1.00	0.66	0.54	-0.75
K/Y	0.64	0.64	0.85	0.66	1.00	0.74	-0.88
S	0.64	0.64	0.66	0.54	0.74	1.00	-0.58
R	-0.67	-0.67	-0.83	-0.75	-0.88	-0.58	1.00

We now compare the quantitative theory predictions from Table 1 to the cross-country data. Table 3 presents the comparison: These are univariate regressions of the relevant capital measure on national average IQ. Including the population growth rate—the only other relevant parameter in this quantitative theory exercise—had no substantial impact on these results, and so these results are omitted. Since many countries have negative savings rates over the 1980-2005 period (and a few have extremely negative savings rates), we report results with savings rates greater than -0.5 and for positive savings rates.

Table 3: Empirical relationship between 1σ rise in IQ and capital measures

	s>0	s>-0.5	Predicted
d(K/Y)/dIQ	0.733 (0.106) R^2= 52%, n=46	0.756 (0.104) R^2= 53% n=50	0.90 (α=2/3)
d(ln(K/Y))/dIQ	0.42 (0.060) R^2= 50% n=45	0.40 (0.058) R^2= 49% n=50	0.10
d(s)/dIQ	6.59% (1.42%) R^2= 16% n=119	12.6% (1.7%) R^2=27% n=152	6.7% (α=2/3)
d(ln(s))/d(IQ)	0.368 (0.075) R^2=17% n=119	0.234 (0.0405) R^2=11% n=152 (+0.5 to savings)	0.11
dr/dIQ	-2.95%, (1.13%), R^2=14% n=45	-2.46% (1.09%) R^2=10% n=49	-0.7%

Note: OPEC countries omitted. Standard Errors in parentheses. Countries with average private savings rate (1980-2005) below 0 omitted in first column and below -50% omitted in second column.

In levels, the empirical savings rate and capital-output ratio results are quite similar to the theoretical values if the capital share is broad. In logs, the empirical relationship is two to four times larger than theoretically predicted. Thus, there are likely to be additional reasons for the relationship between IQ and these capital measures beyond the narrow closed-economy Ramsey channel presented here. We consider one such possibility in the next section.

4. IQ and savings in the open economy

In a world where the Feldstein-Horioka puzzle breaks down, and there are no barriers to capital flows across countries, the link between national savings and national investment breaks down. In such a world, how will differences in national rates of time preference influence long-term living standards? Barro and Sala-i-Martin (2004) have answered this question. If all countries are ordered by their rates of time preference, with Country 1 the most patient, they prove the following:

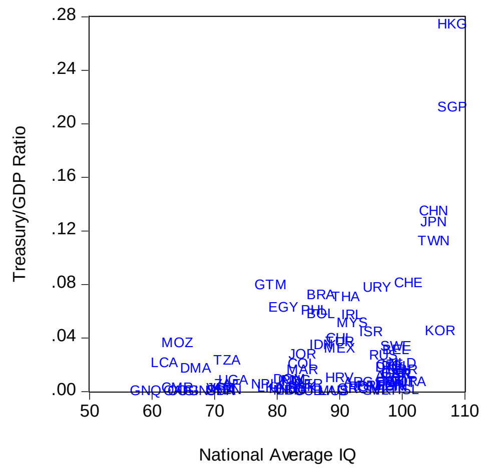
> "Asymptotically, Country 1 owns all the wealth…[all] claims on capital and the present value of the wage income in all countries…All other countries own a negligible amount (per unit of effective labor) in the long run" (164-165).

In our database, using national average IQ as a predictor of time preference, which country is country 1? There is a tie: Both Singapore and Hong Kong have national average IQs of 108. As noted earlier, the highest national average IQs are all currently in East Asia, a fact that has held true for as long as wide-scale IQ tests have existed.

Reality is certainly somewhere between the extremes of the closed-economy and open-economy worlds. One useful proxy for international capital flows is holdings of what is widely considered the world's safest asset, U.S. Treasuries. In an open-economy world, theory would predict that holdings of Treasuries as a percentage of GDP (T/Y) should be positively related to national average IQ. Thus, T/Y is an open-economy, safe-asset extension of K/Y.

Data on overseas holdings of U.S. Treasuries for every country is available at the Treasury's website. These data combine Treasuries held by governments as well as by the private sector. We use nominal GDP measures, measured at current (non-PPP) prices to estimate the actual nominal buying power of each country.

Figure 3
National Average IQ and Treasury Holdings



Note: Bermuda, Luxembourg, OPEC countries and Caribbean tax havens omitted (e.g., for Bermuda, T/Y=5).
ρ=0.39 (p<0.01%).

The measure in Figure 3 is June 2007 holdings of long-term Treasury bonds divided by nominal GDP. Treasury does not separately report bonds held by governments versus private individuals; these values combine both private and public holdings. OPEC countries, Bermuda, Luxembourg, and some Caribbean countries that hold large amounts of assets for investors in other countries are omitted. Indeed, Treasury keeps separate data categories for "Caribbean tax havens" for just that reason.[5] However even if every country with data is included and interpolated IQ values are used to create the largest sample possible, the Spearman rank correlation between IQ and T/Y is 0.48, significant at the 0.01% level (n=129). Omitting OPEC countries and tax havens, the conventional

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[5] The OPEC exclusion is largely imposed by Treasury itself: Treasury does not report U.S. financial investments of major oil exporters by country; investment data are reported in the aggregate as "Middle East Oil Exporters" and "African Oil Exporters."

correlation (using only genuine, non-interpolated IQ data) is 0.39, significant at the 0.01% level (n=82). In the latter case, a 1σ rise in IQ is associated with a 2.2% rise in T/Y (s.e. =0.6%). If log GDP per person is included as an additional regressor the IQ coefficient increases to 7.1% (s.e.=2.1%), and log GDP has a negative sign and a coefficient of 4%, statistically significant at the 5% level (n=40, R^2=27%). Thus richer countries hold fewer Treasuries controlling for IQ, even though there is only a statistically insignificant bivariate correlation (0.25) between T/Y and log GDP per person.

Using Treasury data from 1994, 2000, and 2006 to check for persistence, we find that when controlling for both national average IQ and that year's GDP per capita, IQ is always significant at the 5% level while GDP per capita is never significant at greater than the 25% level. Coefficient sizes remain comparable to those in the previous paragraph.

And are these results driven by the possibly too-low estimates of sub-Saharan African IQ? Windsorizing the IQ data by raising all IQ estimates below 80 up to 80 (slightly above the median results of Wicherts et al. (2010) menetioned above, but still below other continental averages), all of the statements of the previous paragraph still hold. National average IQ, an estimate created by psychologists, is a better predictor of long-term Treasury holdings than GDP per capita.

Figure 3 and these regressions present a new stylized fact for growth and finance researchers: The strong relationship between national average IQ and holdings of safe, globally tradable long-term assets. If the world moves toward freer capital flows, and if East Asian countries continue to have the world's highest average IQs, then the model presented here predicts that the Treasury/GDP ratio and other comparable measures of global asset holdings will grow ever-wider across countries, with East Asian countries holding an ever-larger proportion of the world's financial assets.

5. Conclusion

A vast literature in psychology has shown that average IQ scores differ widely across countries. A separate, recent literature has shown that these differences in national average IQ are robust predictors of national economic performance (Hanushek and Woessmann (2010), Jones and Schneider (2006, 2010), Hindermann et al. (2007,2008), Ram(2007)). In a parallel microeconomic literature, higher IQ scores are shown to be strong predictors of individual rates of time preference. Our paper is the first to quantitatively link these two literatures together. In a closed economy, quantitative theory estimates imply large effects of IQ on savings and capital-output ratios, if the capital share is large. In an open economy, all capital is ultimately owned by the most patient country, which in our database is currently predicted to lie somewhere in East Asia.

These results imply that policies that successfully lift cognitive skills across the world will have sizable payoffs for long-run capital accumulation and long-run living standards. Both theory and evidence support the hypothesis that intelligence is a quantatively important parameter in the utility function.

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