Introduction  In his pioneering 1978 article "The Theory of Interstellar Trade," Nobel Laureate Paul Krugman considered how interest charges on goods in transit between the stars should be computed. This article seeks to expand on Krugman's seminal work -- and establish my claim to a Nobel Prize -- by considering whether income earned in
flight should be subject to the federal income tax. I conclude that in-flight income is clearly subject to tax under current law and prevailing theory, but administrative concerns warrant excluding that income from the tax base until the intrepid taxpayer returns to Earth. To account for deferral, an interest charge should be imposed on any interstellar tax liability.

Krugman's Work In his 1978 article, Krugman considered how interest charges should be computed when the goods travel close to the speed of light. Krugman first notes that as trading space vessels approach the speed of light, the perception of time for those in transit differs from that of those remaining behind. Thus, a voyage of several hundred years, from the perspective of those remaining on Earth, may appear to take far less time for one who went on the voyage. This, in turn, raises the question of which frame of reference should be used to determine interest charges on loans to or from those in transit.

Krugman proves two theorems. First, when trade occurs between two planets in the same inertial frame, interest costs should be determined using time measured by clocks in the planetary frame. Second, assuming inhabitants of both planets can hold goods on each world, the interest rates on both worlds will be the same.

While this article was a good start toward developing a robust theory of interstellar trade, any good business person will attest that it is the after-tax return that matters most. Accordingly, it is necessary to develop a theory of interstellar tax. Should interest or other types of income earned while in flight be subject to tax, and, if so, when? Despite the 30 years that have passed since Krugman's contribution to the field, the literature has been shockingly silent on this important issue. This article seeks to fill the gaping -- dare I say interstellar? -- void, and move us closer to a unified theory of interstellar finance.

I have developed three postulates of interstellar tax that I believe should govern our thinking and indeed pave the way as we sally forth to conquer the stars.

The Adventures of Darf McKibble When we last saw our intrepid hero, Darf McKibble, he was busy loading the Argo, his interstellar spaceship, with a much needed cargo of rutabagas to be delivered to the residents of Deep Space 1, a station in orbit around Gliese 876, a star about 15 light-years from Earth. Relying on ramscoop technology, the ship travels close to the speed of light. After dropping off his cargo, Darf plans to return to Earth. As a result of the wonders of relativity, only 40 years will have passed in subjective terms for Darf. However, 400 years will have passed on Earth.

[ Fade in . . . ] This episode begins with Darf filling in the flight report, the last chore before embarking. The camera focuses in as Darf checks the box indicating that he is a cash method taxpayer who receives $100,000 per year (ship subjective time) for his services as captain. He further notes that the money is kept in the ship's safe and disbursed on the last day of each year. Having finished the report, he emails it to Govcentr, bids Earth adieu, closes the hatch, and blasts off.

[ Fade to black . . . ] Should Darf be taxed on his interstellar income? If so, when? For the answers to these questions, stay tuned for the next exciting episode. OK, forget the suspense. Let's just answer them now.

To Boldly Tax Where No Man Has Taxed Before? The first question that must be addressed is whether, as a matter of current law and tax theory, income earned during an interstellar flight should be included in the tax base. If the answer to that question is yes, the second question is, "When?" Should space travelers be required to file annual returns? Or can they wait until they return to Earth? Assuming that current law and theory tell us tax should be owed currently, the third question is whether the particulars of interstellar travel at relativistic speeds pose any special administrative problems that might nonetheless warrant deferral of tax until the taxpayer returns to Earth. Finally, if one allows for deferral for administrative reasons, how should it be done?

First, let us consider the correct answer under the code. Section 61 imposes a tax on income "from whatever source derived," and it specifically includes compensation. U.S. citizens owe tax on their "world-wide" income, which apparently includes income earned in space, as Congress has deemed income earned in space by U.S. persons to be U.S.
sourced for purposes of our international tax rules. Thus, there is little doubt that Darf's earnings should be subject to tax, at the very least, when he returns to Earth. The question we have to answer next is whether Darf should be taxed on the income as he earns it.

Income is generally subject to tax in the year acquired. However, several provisions, such as section 409A (deferred compensation), section 83 (restricted property), and subpart F (controlled foreign corporations), allow for deferral. Sadly for Darf, the drafters of section 409A and its regulations did not include being paid aboard a starship under qualified deferred compensation plans. Given that Congress specified that income earned in space is U.S. sourced, we can only assume that Congress carefully considered and then rejected deferral here. Section 83 applies only to "property," and property does not include cash. Subpart F applies only to CFCs, and Darf is an individual. In the absence of an applicable deferral statute, it seems that Darf will owe tax currently on any income earned between the stars. But, as a matter of tax theory or policy, should he?

Underlying the first two deferral provisions described above is a concern regarding the taxpayer's ability to use the income when earned. If Darf can somehow communicate with Earth during the flight and use his money to acquire items on Earth, there are no restrictions on his use of the funds and no cause for deferral. But what if Darf must remain incommunicado during the trip or can communicate but not use the money he earns onboard outside the confines of the ship? In other words, what if the boundaries between the Argo and the world outside are not readily permeable? Should we amend the code to allow for deferral?

If there are no or limited uses for the money, its mere receipt does not feel like a taxable event. However, if the ship operates as a small city and Darf is free to spend his money at the onboard McStarbucks, deferral feels wrong. While our intuitions about the proper tax result are affected by the nature of consumption available aboard the ship, it is hard to turn these intuitions into a principled theory requiring or precluding deferral. Tax law does not distinguish between different types of consumption. Thus, whether Darf uses the income for entertainment or uses it to purchase a McLatte Grande, he is still consuming it, and therefore has current income under most commonly accepted income definitions.

Ah, but what if Darf were a paying passenger on the Argo and organized an annual poker game with the other passengers or crew members, winning $100,000 each year? Does that affect our reasoning? Gambling winnings are considered income, and he cannot escape taxation on that ground. Nor would it matter that Darf was merely playing for entertainment but just happened to win. Intent is irrelevant for purposes of determining what to include in the tax base.

What about the fact that Darf paid for his flight? At some level of abstraction, he can be thought of as having paid for the opportunity to win, and the winnings represent the consumption value he has purchased. Denying a deduction for the purchase and including the value purchased in income arguably amount to a double tax on consumption. If Darf buys a tribble while on Deep Space 1, we wouldn't include the value of the tribble in income. However, purchasing the opportunity to win something or earn income is different from normal purchases. If I purchase a lottery ticket, I can't exclude my winnings on the ground that I purchased them. At most, I can deduct the cost of the ticket. The same applies to Darf's onboard income.

OK, you say. But, what if, instead of cash, Darf is paid in -- or wins -- ship credits? And what if Darf is prohibited from using his credits outside the confines of the ship, at least while in flight? Surely he cannot be taxed on those receipts. The difficulty with the credits argument from an "is it income?" perspective is that substituting property for cash will not defeat tax liability. If he has received value, he has income. The difficulty from a deferral perspective is that if Darf can use the credits on the flight for current consumption, the income is not deferred. If he actually consumes it, the argument for deferral disappears entirely.

This leads to the First Postulate of Interstellar Tax: As a matter of current law and tax theory, U.S. citizens who earn income while on interstellar flights should pay tax currently on their interstellar income. Sorry, Darf.
Really? Accepting that Darf should pay tax currently on his in-flight income as a matter of current law and tax theory, the next question is whether the special nature of relativistic interstellar space travel, compared with, say, a cruise in international waters, affects the analysis. Three features of interstellar travel suggest themselves as possibly relevant: the duration of the cruise, the distances involved, and the fact that the taxpayer experiences time flow at a rate different from that on Earth. I address each in turn.

The first issue is duration. Setting aside the S.S. Minnow and its ill-fated three-hour tour, most cruises in international waters last at most a few weeks. Interstellar flight lasts hundreds of Earth years -- possibly longer. However, this is a difference of degree, not kind. Darf should not be exempt from tax because he is on a really long trip, while others on shorter trips should be required to pay tax on their onboard income.

The second issue is distance. Cruises in international waters are never more than a few thousand miles from the United States. However, Darf will be 15 light-years away from earth at his farthest point. At first blush, this also seems to be nothing more than a difference in degree. However, distance creates administrative difficulties that duration does not. Section 6072 requires individual calendar year taxpayers to file their taxes on April 15, 3-1/2 months after the close of their tax year. Corporate taxpayers must file 2-1/2 months after the close of their tax year. Taxpayers can get limited extensions, but the extension of the time to file does not extend the time to pay. Unless we somehow breach the light barrier for communications with some sort of wormhole technology, taxpayers on ships more than one light-year from Earth will likely be unable to file their returns or transfer payments in a timely manner, even with extensions.

This leaves us with the third issue posed by relativistic travel, the possibility of multiple tax years. Section 441 provides that taxable income is determined on the basis of a taxpayer's "tax year," which is generally defined as a 12-month period. Section 451 requires taxpayers to include income in the tax year in which it is received. Recall that for each year on the spaceship, 10 years pass on Earth. Conversely, for every year that passes on Earth, 1/10th of a year passes on the Argo. Thus, Darf arguably has two tax years.

Should Darf be required to file taxes every Earth year or every Argo year? If the answer is every Earth year, that is, if we use the Earth's frame of reference as Krugman says we must for computing interest charges, Darf must file taxes 10 times in each of his subjective years, a significant burden for Darf. In contrast, if the answer is every Argo year, he gets significant deferral, at least from an Earth perspective. And what if Darf has investments on Earth at the same time he earns income on the ship? In that case, regardless of which year is chosen, Darf will either get significant deferral on his terrestrial income or he will be required to pay taxes on interstellar income at unreasonable intervals. The code is surprisingly silent on this pressing issue.

We could, of course, amend the code to allow interstellar taxpayers to have two tax years, one for their terrestrial income and one for their interstellar income. However, this raises difficulties if expenditures in one time frame can arguably be associated with income in another. Some system of allocation must be developed, similar to those that apply in the current international tax setting. Moreover, the original issue discount rules present particular difficulties. Krugman demonstrated that interest costs should be determined using time measured by clocks on Earth. However, if Darf borrows money from a terrestrial lender and files using his subjective tax year, he would be able to deduct interest payments once every 10 Earth years, while the terrestrial lender would have to report income annually.

Finally, requiring people to file taxes based on a relative space year would raise a host of administrative and enforcement issues for the IRS. What if the Argo slows down? And then speeds up? Relative time would change. How would the IRS ever know? And what about those who are on other ships traveling at other relativistic speeds, such that their time passes at a rate different from that on the Argo? Each spaceship could have its own tax year or years. Given that the IRS can barely manage its current workload, adding an interstellar element at this time seems ill-advised.

While each of these concerns is important, perhaps the most salient for tax purposes is Darf's inability to use his income earned onboard to pay current taxes associated with that income. As I have argued in another context, the
ability to pay should be a key factor in deciding whether to tax Darf currently on his earnings. If Darf is unable to pay during the flight, deferral until he returns to Earth may make sense because it seems unwise to impose tax liabilities on those unable to pay them. If he is precluded from paying even on his return to Earth, the income will never increase his ability to pay terrestrial taxes, and a stronger argument for nontaxation exists, even though he has received income. The right answer may depend on the nature of on-board consumption and whether it displaces consumption off the ship.

Sadly, we cannot expect guidance from other spacefaring races regarding these issues, or at least from those we know about. According to top secret records I recently discovered, when one of the aliens found at Roswell, N.M., was defrosted for questioning, he revealed that his culture had adopted a planetary approach to interstellar tax, thus obviating the need to address those issues.

Thus, the Second Postulate of Interstellar Tax: On second thought, trying to currently tax income earned on interstellar trips traveling at relativistic speeds isn't such a hot idea, regardless of the theoretically correct result. Instead, it may be better to devise a separate tax system or to tax people on their return to Earth.

So, How Is This Supposed to Work? This second postulate and the deferral it suggests raise a few questions. The first is whether spacefarers should be taxed on all the income they earn or only on the income they bring back to Earth. If the latter, they will have engaged in significant consumption without bearing any tax. If the former, they may run into problems if they have spent all their money during their flight. As the latter approach discourages taxpayers from bringing money back to Earth, I would opt for the former, despite potential hardships for the profligate.

The second question is how to account for the benefit that deferral affords. Given the time value of money -- and the time involved -- deferral could be a tremendous advantage to space travelers. To account for this, Congress should consider imposing an interest charge, similar to that imposed on large installment sales, on deferred interstellar income, however determined.

This leads to the final question, and one that brings us back at last to Krugman. Which time frame should we use when determining the interest charge? Krugman argued that when goods are in transit between two planets in the same time frame, the proper frame of reference is the planetary frame. If deferral is conceived of as a loan from the government to the taxpayer, the same logic should apply.

Thus, the Third Postulate of Interstellar Tax: When determining interest charges for deferred tax liabilities for those engaged in relativistic interstellar travel, one should use the planetary time frame.

Conclusion As Albert Einstein -- another Nobel laureate -- is reported to have said, "The hardest thing in the world to understand is the income tax." Combining it with the theory of relativity doesn't make it any easier. Nonetheless, I am proud to have been able to build on the work of both Einstein and Krugman in the pursuit of a unified theory of interstellar finance. With this thorny issue out of the way, let the exploration of the heavens begin!

To the members of the Nobel committee, my home phone number is (602) 555-1212. Please do not call before 7 a.m. Phoenix time. I need my beauty sleep.


/2/ All references to the code are to the Internal Revenue Code of 1986 as amended.

/3/ See section 863(d). Section 911 permits those living abroad to exclude a specified amount of foreign earned income. However, that section does not apply here because it requires that income be earned in a "foreign country." Space is not a foreign country. Even if it were to apply, Darf earns more than the excludable amount.

/4/ Section 451.

/5/ Section 863(d).
/6/ Reg. section 1.83-3(e).

/7/ See section 951 et seq.

/8/ The rationale for deferral under subpart F is less clear and indeed is under some scrutiny at present.

/9/ McStarbucks is a registered trademark of the McStarbuck's Corp.

/10/ McLatte Grande is also a registered trademark of the McStarbuck's Corp.


/12/ Danger, Will Robinson! Danger, Will Robinson! Step away from the tribble!

/13/ Section 6081. Reg. section 1.6081-3 grants an automatic six-month extension.

/14/ See, e.g., reg. section 1.6081-3(b) (addressing automatic extensions for corporations); reg. section 1.6081-4(c) (addressing automatic extensions for individuals).

/15/ See, e.g., section 864(g) (discussing the allocation of research and experimental expenses); sections 873 and 882 (allowing deductions respectively to nonresident aliens and foreign corporations only to the extent they are connected with income that is effectively connected with the United States).


/17/ If on-ship consumption substitutes for off-ship consumption, he may have more cash in his bank account than he otherwise would have, thus giving him a greater ability to pay his taxes. However, that is a taxpayer-specific question that cannot be answered broadly. For a discussion of this issue in the context of whether Jewish law requires tithes on gifts, see Adam Chodorow, "Maaser Kesafim and the Development of Tax Law," 8 Fla. Tax Rev. 153 (2007).

/18/ Of course, at some point, were we to adopt this approach, we can expect serious lobbying for reterritorization of interstellar income, similar to that urged for subpart F income.

/19/ See section 453A.

/20/ The difficulty with this conclusion is that Darf's first year of income will bear 390 years of interest charges, likely swamping the tax due and, indeed, the income itself. The same would hold true for any money Darf borrowed to finance his trip. If it bears interest using the Earth's time frame, interest will accrue for 400 years. Those Deep Space 1 residents had better be willing to pay a lot of money for their rutabagas so that Darf can pay back his lender and still make a profit. However, as Krugman has won the Nobel Prize and therefore cannot possibly be wrong, the impact of using the planetary frame of reference on interstellar trade and income tax is Darf's concern and not ours.

END OF FOOTNOTES

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