Speculation and Tobin Taxes: Why Sand in the Wheels can Increase Economic Efficiency

Abstract

The current paper develops the microeconomic case for a Tobin Tax. It combines the noise trader literature with the Tobin tax policy literature. Noise traders cause economic losses by inappropriately cashing out their investments. A Tobin tax can reduce such activity, thereby conferring a benefit on fundamentals investors. The paper identifies the conditions under which these gains would be largest, and provides guidelines as to whether a tax is warranted. There is a trade-off because Tobin taxes discourage fundamentals investors from trading, and there are occasions when they would rationally choose to trade but do not because of the tax.

Keywords: Noise traders, fundamentals investors, speculation, Tobin taxes

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I Introduction

The economic collapse of east Asia's tiger economies has refocused attention on the potential problem posed by financial market speculation. The argument is that a combination of currency and portfolio speculation triggered the equivalent of a bank run, and this run has now given rise to a regional debt-deflation that risks becoming a global deflation.

A long standing policy proposal for dealing with currency speculation is the Tobin tax (Tobin, 1978) whereby a small tax is imposed on all foreign exchange transactions in order to discourage speculation. Tobin's suggestion for a transactions tax has usually been considered with regard to foreign exchange markets, but it is also applicable to stock markets. Indeed, Keynes (1936, p.159-60) proposed exactly this solution for dealing with speculative excess on Wall Street:

"It is usually agreed that casinos should, in the public interest, be inaccessible and expensive. And perhaps the same is true of stock exchanges. That the sins of the London stock exchange are less than those of Wall Street may be due, not so much to differences in national character, as to the fact that to the average Englishman Throgmorton Street, is compared with Wall Street to the average American, inaccessible and very expensive. The jobber's "turn", the high brokerage charges and the heavy transfer tax payable to the Exchequer, which attend dealings on the London stock exchange, sufficiently diminish the liquidity of the market (although the practice of fortnightly accounts operates the other way) to rule out a large proportion of the transactions characteristic of Wall Street. The introduction of a substantial Government transfer tax on all transactions might prove the most serviceable reform available, with a view to mitigating the predominance of speculation over enterprise in the United States."

The Keynes stock exchange tax and the Tobin foreign exchange tax are both intended to reduce disruptive speculative activity. Both have the additional benefit that they would raise substantial amounts of tax revenue in a progressive manner. However, aside from administrative problems, the case for such taxes remains incomplete owing to the limited theoretical arguments about the consequences of speculative trading. This in turn means that it is unclear how such taxes would improve economic efficiency. Making the case for a Tobin tax therefore requires the articulation of microeconomic models that identify the conditions under which speculators cause economic losses. Judgement can then be made as to whether the "real" world resembles the conditions embedded in these models.

One line of theoretical reasoning supporting a Tobin tax comes from the macroeconomic rational expectations "bubbles" literature which recognizes that the expectation of higher asset prices can become self-fulfilling. A second literature that is microeconomic in character focuses on the real effects of speculation induced increased asset price volatility. De Long et al. (1990) emphasize how the presence of risk neutral noise traders increases volatility and risk. This adversely impacts the well-being of risk-averse fundamentals traders who dislike risk, and causes prices to diverge from the levels of warranted by economic fundamentals. Both the bubbles and the noise trader literatures refute Milton Friedman's (1953b) argument that speculation cannot be systematically destabilizing because speculators would lose money and be driven out of business. Tornell (1990) shows how increased variability reduces investment when it investment is irreversible because investors value the option of waiting for more settled times.

The current paper further develops the microeconomic case for a Tobin tax, and combines the noise trader literature with the Tobin tax policy literature. However, rather than focusing on the effect of speculation on volatility and risk, the paper focuses on the economic losses imposed by

noise traders through their inappropriate cashing out of investments. A Tobin tax can reduce such activity, thereby conferring a benefit on fundamentals traders. However, there is a trade-off because Tobin taxes also discourage fundamentals investors from trading, and there are occasions when these investors would rationally choose to trade but are discouraged from doing so because of the tax. This trade-off means that Tobin taxes can be used to tame the smaller excesses of speculators which are driven by small degrees of speculation, but taming the larger excesses may require such a large Tobin tax that the benefits to doing so are outweighed by the costs.

II The model

This section describes the theoretical model. There are two types of investor, "noise" investors (denoted n) and "fundamentals" investors (denoted f). The proportion of noise traders is z, and the proportion of fundamentals traders is [1 - z]. All traders are risk neutral and maximize their ex-ante expected rate of return. Fundamentals traders use the objective probability distribution governing returns in making their investment decisions: noise traders misperceive the distribution of returns and are systematically "bearish" about returns and under-estimate them.

The model is a two period model, and investors aim to maximize expected wealth at the end of period 2.| At the beginning of period 1 investors cannot tell what type they are. Each investor has one standardized unit of wealth. At the beginning of period 1, investors must decide how to allocate that unit of wealth across two projects. One project (denoted A) is risk-free and characterized by diminishing returns: once invested in the project, the investor is committed to stay and cannot invest more the following period. The other project (denoted B) is risky and has constant marginal expected returns. At the end of period 1, information is revealed to investors about the state of the

risky project, and investors must then decide to stay with the project or switch into cash which has a zero yield. If they switch into cash they get the full investment back.

At the beginning of period 2, fundamentals investors have perfect information about the prospective return on project B, but noise traders have pessimistic information that understates the prospective return. Selling out reduces the return on the project, thereby reducing the return to investors who remain in it. Noise traders who sell out therefore have a negative externality on those who remain in the project.| The sequence of decision making is illustrated in figure 1.

Investors' decision program is as follows:

(1) Max Wi = siRA + [1 - si]Ei(RB) i = n,f

si

where Wi = end of period 2 wealth for type i

si = share of beginning of period wealth of type i allocated to project A

RA = total return on riskless project

Ei(RB) = type i expected total return on the risky project

The return on the riskless project is given by

(2) RA = sic $-1 < c < 0$, i = n,f

Substituting (2) into (1) and differentiating yields the following first-order condition determining the allocation of wealth

(3) [1 + c]sic = Ei(RB)

The left side of equation (3) corresponds to the marginal return to investing in project A, while the right side corresponds to the expected marginal return to investing in project B. The determination

of the allocation of wealth is illustrated in figure 2, and has investors allocating their wealth such that expected marginal returns across the projects are the same.

With regard to project B, there are five different states of the world, each of which occurs with probability pj where j = 1,2,3,4,5.

The pattern of "raw" returns for noise traders and fundamentals traders is described by the following table:

State	j = 1	j =2	j = 3	j = 4	j = 5
Return to type f	r1 < 0	r2 < 0	r3 > 0	r4 > 0	r5 > 0
Return to type n	r1-d < 0	r2-d < 0	r3-d < 0	r4-d < 0	r5-d < 0
State probability	p1	p2	p3	p4	p5

$r1 < r2 < 0 < r3 < r4 < r5$

$p1 + p2 + p3 + p4 + p5 = 1$

where r = return in state j (j = 1, 2, 3, 4, 5)

d = bearish factor of noise traders

$0 < pj < 1 \quad (j = 1, 2, 3, 4, 5)$

Raw returns are returns before taking account of the negative external effects of investors switching out of project B into cash. In three states raw returns are strictly positive: in two they are strictly negative.

When deciding whether to switch at the beginning of period 2, investors compare the available return with the zero return on cash. On the basis of raw returns, fundamentals investors only switch in states 1 and 2. Owing to their bearish outlook, noise traders switch in all states except state 5. Given that noise traders switch in states 3 and 4, this imposes a negative externality on fundamentals investors whose actual (as opposed to raw) returns in these states becomes

(4a) $r3,f = r3 - [zsn/[zsn + [1-z]sf]]h \gtrless 0$

(4b) $r4,f = r4 - [zsn/[zsn + [1-z]sf]]h \gtrless 0$

where z = proportion of type n investors

h = per dollar switching cost imposed on remaining investors

The term in parentheses reduces the return to fundamentals investors who remain with project B. The size of the externality depends on the proportion of investors who are type n, the share of project B initially funded by type n investors, and the dollar switching costs. If $r3,f < 0$, type f investors switch out of project B at the beginning of period 2: the same holds if $r4,f < 0$.

Given the above, the model can be solved to determine the beginning of period 1 investor allocations. For a noise trader, the beginning of period 1 expected return for project B is

(5) $En(RB) = p5[r5 - d]$

For a fundamentals investor the beginning of period 1 expected return is conditional on the size distribution of returns and the scale of the external cost inflicted by noise traders in the event they switch in period 2. This pattern of expected returns is given by

(6a) $Ef(RB) = p3r3,f + p4r4,f + p5r5$ if $r4,f > r3,f > 0$

(6b) $Ef(RB) = p4r4,f + p5r5$ if $r4,f > 0 > r3,f$

(6c) $Ef(RB) = p5r5$ if $0 > r4,f > r3,f$

Equation (6a) holds if fundamental investors only switch in states 1 and 2. Equation (6b) holds if they switch in states 1,2, and 3. Equation (6c) holds if they switch in all states except 5. Note that fundamental investors do not ignore the presence of noise investors: instead, they rationally take account of the latter's' actions in computing expected returns.

The important feature about equations (6a) - (6c) is that the presence of noise traders reduces the expected return on project B for fundamentals investors. If there were no noises traders, their expected return would be

(7) $Ef(RB) = p3r3 + p4r4 + p5r5$

$> p3r3,f + p4r4,f + p5r5$

and $> p4r4,f + p5r5$

and $> p5r5$

The equilibrium for the model involves each agent solving the program given by equation (1). The solution involves satisfying

(8a) $[1 + c]snc = p5[r5 - d]$

(8b) $[1 + c]sfc = Ef(RB)$

where $Ef(RB) = p3r3,f + p4r4,f + p5r5$ if $r4,f > r3,f > 0$

$Ef(RB) = p4r4,f + p5r5$ if $r4,f > 0 > r3,f$

$Ef(RB) = p5r5$ if $0 > r4,f > r3,f$

and $r3,f = r3 - Dh$

$r4,f = r4 - Dh$

$D = zsn/[zsn + [1-z]sf]$

The endogenous variables are sn and sf. The exogenous parameters are p3, p4, p5, r3, r4, r5, c, d, z and h. The solution to the model in [sn, sf] space is shown if figure 3 which shows the investment reaction functions of noise and fundamentals traders. Noise traders holdings of the safe asset (project A) are independent of fundamentals traders' holdings: hence, their investment reaction function is a horizontal line. However, fundamentals investors' holdings are a negative function of noise traders' holdings. The logic is that as noise traders increase their holdings of project A, this

decreases their holdings of project B which reduces the penalty imposed on fundamentals investors. This gives the latter an incentive to increase their holdings of B and decrease their holdings of A.

There are two types of economic inefficiency caused by the activities of noise traders. First, by lowering fundamental investors expected return on project B, noise investors cause fundamentals investors to under-invest in project B and over-invest in project A. This can clearly be seen with the aid of figure 2. The presence of noise traders causes the Ef(RB) schedule to shift down, thereby inducing fundamentals investors to allocate more of their wealth to project A. Second, noise investors cause an actual loss to fundamentals investors by actually cashing out of project B when states 3 and 4 occur. If $r3,f > 0$ and $r4,f > 0$, then type f investors remain in project B but their return is reduced. If $r3,f < 0$ and $r4,f < 0$, then type f investors switch into cash and get a lower return then they would have in the absence of noise investors.

III Tobin taxes

The above model highlights the problem posed by the presence of noise traders who switch in states 3 and 4 when economic fundamentals suggest that they should not. Tobin taxes represent a means of discouraging such switches. The economic logic is that the imposition of a Tobin tax of t per dollar means that switching to cash earns a negative rate of return rather than zero. This can discourage noise investors from investing in B to begin with, and discourage them from switching once in.

Stopping noise investors from switching in state 4 requires satisfying the following condition

(9) $- t4 < r4 - d$

which implies a tax of

(10) $t4 > d - r4$

Stopping them from switching in state 3 requires satisfying

(9a) $-t3 < r3 - d$

which implies a tax of

(10a) $t3 > d - r3$

Comparing equations (10) and (10a) then reveals that

(11) $t3 > t4$

Inspection of equations (10) and (10a) shows that the size of the Tobin tax is a positive function of the degree of noise investor bearishness as proxied by the parameter d. The more noisy is noise investor behavior, the larger the tax has to be. Equation (11) also reveals that stopping inefficient trading by noise investors requires a a higher Tobin tax as the fundamental return falls ($r3 < r4$). The reason is that as the fundamental return falls, the bearishness of noise investors comes to dominate their perception, so that the Tobin tax (without any assistance from the underlying return) has to fully offset their bearishness to prevent them switching.

The equilibrium conditions are:

(12a) $[1 + c]snc = En(RB)$

(12b) $[1 + c]sfc = Ef(RB)$

where $En(RB) = p5[r5 - d] - [1 - p5]t$ if $t > d - r4$

$En(RB) = p5[r5 - d] + p4[r4 - d] - [1 - p5]t$ if $t > d - r3$

$Ef(RB) = p3r3,f + p4r4 + p5r5 - [p1 + p2]t$ if $p3r3,f > 0$ and $t > d - r4$

$Ef(RB) = p4r4 + p5r5 - [p1 + p2 + p3]t$ if $0 > p3r3,f$

and $t > d - r4$

$Ef(RB) = p3r3 + p4r4 + p5r5 - [p1 + p2]t$ if $t > d - r3$

and $r3,f = r3 - Dh$

$r3,f = r3 - Dh$

$D = zsn/[zsn + [1-z]sf]$

The appropriate set of equilibrium conditions is contingent on the level of the Tobin tax. Consider the case $t > d - r4$ and $p3r3,f > 0$. The Tobin tax now makes fundamentals investors better off to the extent that (i) they now get the full return in state 4 whereas before they did not, and (ii) the return in state 3 is higher because the negative externality (Dh) caused by noise investors is reduced owing to their reduced investment in project B. However, fundamentals investors are hurt by the fact that they must pay a Tobin tax in states 1 and 2. If these two states occur with frequency, then fundamentals traders could actually be made worse off and Ef(RB) could fall.

IV Policy implications

Inspection of the first order conditions is revealing of the conditions when a Tobin tax will yield the greatest benefit to fundamentals investors. These conditions can be used to guide policy makers as to whether real world conditions warrant a Tobin tax.

First, the larger the proportion of noise investors (z), the larger the external cost (D) inflicted on fundamental investors. Increases in the proportion of noise investors therefore favor a Tobin tax.

Second, increases in the cashing out cost (h) increase the external cost on fundamentals investors, and this also favors a Tobin tax.

Third, when the middling return states 3 and 4 occur with high probability (p3 and p4 are large), a Tobin tax is likely to be most beneficial. States 3 and 4 are when the actions of noise and fundamentals investors diverge, and it is in these states that noise investors do damage. If these states occur with high frequency, then noise investors do damage frequently and a Tobin tax will have a large benefit by saving fundamental investors from the negative cashing out externality.

Fourth, a Tobin tax is more likely to be inefficient when the extreme bad states (1 and 2) occur with high probability (p1 and p2 large). In these states fundamental investors legitimately want to cash out. A Tobin tax imposes a cost on such actions, and could induce them to inappropriately stay in project B.

Fifth, the lower the level of noise trader bearishness (d small), the smaller the Tobin tax needed to discourage noise investors from pursuing their damaging course. The negative impact comes from their cashing out. This is a dichotomous decision involving "hold" or "sell". The cost inflicted on fundamentals investors (which may be quite large) can occur even if noise investors have only a small amount of bearishness: all that is needed is that noise investors satisfy the sell condition. A small Tobin tax may be sufficient to discourage noise investors from selling, and thereby save fundamentals investors from potentially large costs.

Sixth, the more elastic the marginal return on project A (the certain project), the greater the potential benefit of a Tobin tax. A Tobin tax lowers the return to project B for noise investors, and raises the return on project B for fundamentals investors. If the marginal return on project A is highly sensitive to the amount that each investor invests, then small changes in the return on B will induce large portfolio adjustments. This is easily seen from figure 2, where a shift of Ei(RB) induces a large change in si* if the schedule governing the marginal return to project A is relatively flat. This benefit of a Tobin tax is easily understandable in terms of optimal tax theory. The

conventional result is do not tax activities which are highly price elastic as this gives rise to large distortions. However, if activities have negative externalities, then it is especially good to tax those which are price elastic as this will greatly reduce their extent.

Seventh, there is a trade-off between the economic effectiveness of a Tobin tax and its revenue raising capacity. The more economically effective the tax, the less speculators switch out of project B into cash and the less revenue raised. However, even if the tax is economically ineffective in the sense of leaving speculators' behaviors unchanged, it can still be justified on the grounds of optimal tax theory since it raises revenue without changing economic allocations. A small Tobin tax is therefore a win - win proposition. If it has no effect, then speculation is price inelastic and should be taxed as a non-distortionary way of raising revenue: if it diminishes speculation, then it contributes to realizing the socially optimal investment allocation.

Finally, the public finance argument for a Keynes security tax and a Tobin foreign exchange tax can also be made on the grounds that this is a cost - effective way of raising tax revenue. Such trading is geographically confined and generates a clear paper trail, which facilitates and lowers the cost of tax collection. This contrasts with income taxes which require a more elaborate apparatus, and can be evaded by switching to cash transacting. Many developing countries lack an effective income tax apparatus and are plagued by inadequate revenue raising capacity that forces a reliance on the inflation tax. Keynes and Tobin taxes therefore represent a potentially important means of resolving this problem. This public finance virtue is over and above any argument constructed in terms of their beneficial effect in reducing the disruptive activities of noise investors.

V Further reflections on the nature and impact of speculation

Formally modelling and analyzing the impact of speculation requires identifying "what is a speculator" and "how speculation affects economic outcomes". In the current paper speculators have been defined as traders who trade on the basis of inaccurate knowledge about project returns. A variation of this construction could have had them trading on inaccurate information about ex-ante state probabilities and inaccurate information about realized states of the world. This would have generated similar results to those contained in the above model. In both cases speculators are defined as persons acting on beliefs rooted in imperfect information.

However, there are other constructions of speculators. One possibility is that speculators have shorter investment time horizons, and this suggests a link with the literature on managerial short termism in which short termism leads to rational but inefficient outcomes (Stein, 1989: Palley, 1997). In this case an efficient Tobin tax would need to be time dependent: if an investor holds for a short period, she pays the tax; if she holds for a long period, she does not.

Another possible construction is that speculators adhere to a fundamentally different model of how the economy works. For instance, speculators might be identified as stock market chartists who trade on market signals. In this case, the Tobin tax would need to be contingent on the particular trading rule that chartists use, thereby discouraging them from trading when they get a market signal. Of course, as in all cases, the tax would also adversely impact fundamentals traders so that its benefit in terms of restraining speculative trades has to be balanced against its costs in restraining fundamentals driven trades.

The second modelling issue concerns how speculators negatively impact economic outcomes. In the current model they have two impacts. First, they affect the ex-ante allocations of fundamentals traders by lowering the expected rate of return on the risky project. Second, they affect ex-post

allocations by causing fundamental investors to sell out in certain states of the world. These impacts arise from the external cost imposed on fundamental investors.

In the current model all investors are risk neutral and state returns are exogenously given. Introducing risk aversion amongst fundamental investors and having asset prices (i.e. asset returns) endogenously determined by a market clearing requirement introduces another channel of impact. Speculative cashing out by speculators will cause larger price swings, and if there is some probability that fundamental investors also have to cash out to meet unanticipated private expenditures, then the latter will allocate less to the risky investment to avoid this risk.

Finally, it is possible that speculators can also have negative growth effects. Suppose the rate of growth is positively related to the realized economy-wide rate of return. To the extent that the activities of speculators discourage risk averse fundamentals investors from investing in high risk - high return industries, then they will lower the economy-wide rate of return and lower growth. This provides a growth theoretic argument for discouraging speculative trading.

VI Conclusion

The above model shows how the activities of speculators can give rise to real economic inefficiencies. A Tobin tax is a way of reducing these inefficiencies, and the model identifies the conditions under which it is most likely to be beneficial. Discretionary interventions to counter the effects of speculation, such as exchange rate interventions, are often criticized on the grounds that there is little reason to believe that policy makers have any special knowledge that allows them to do better than the market. The Tobin tax does not suffer from this problem. It does not tell traders when to trade, and nor does it have government engaging in discretionary market interventions

against speculation. Rather, it sets rules of the game that induce market participants to privately reduce speculation.

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| .Palley (1998) provides the following account of the east Asian crisis. In the early 1990s, portfolio investors began to develop a taste for "emerging markets". Equities are denominated in local currencies, and portfolio investors are therefore concerned with the exchange rate since it determines the dollar value of their investments. Confronted by speculative attacks against east Asia's currencies, equity investors lost confidence in existing exchange rate settings and sought to protect themselves by selling out and repatriating funds back home. This drove the exchange rate further down, thereby increasing the burden of east Asia's foreign currency denominated debt. Since much of this debt was of a short term nature, investors were given additional reason to sell. East Asia therefore found itself locked in a vicious spiral with exchange rate depreciation causing increased debt burdens, which in turn threatened bankruptcy, giving investors additional reasons to bail out.
| .Felix and Sau (1996) provide estimates of the revenues that would be raised by a globally enforced Tobin tax. Baker, Pollin and Schauberg (1995) estimates that a U.S. securities transaction tax would raise $30 billion annually.
| .Such a perspective contrasts with Friedman's (1953a) claims regarding the irrelevance of the realism of assumptions. Microeconomic models must not only account for observed phenomena, but their assumptions regarding economic structure must be plausible. The reality of assumptions is therefore an important test criterion.
| .In the current model noise traders earn systematically less than fundamentals traders. In a N period context, the argument for survival of noise traders would be that pessimism is a psychological phenomenon, and each period a certain proportion of the population undergoes a wave of pessimism. Consequently, there are always some pessimistic noise traders, though who they are varies from period to period.
| .This negative externality captures the currency dimension of the east Asian crisis where a sell-off has increased the foreign currency denominated debt burdens of east Asian companies.