

A Note on the Tinbergen Rule

Peter V. Schaeffer

West Virginia University
Division of Resource Economics and
Regional Research Institute

Contact Information

Division of Resource Economics and Management, West Virginia University, P.O. Box 6108,
Morgantown, WV 26506-6108. peter.schaeffer@mail.wvu.edu

Abstract

The Tinbergen Rule, named after one of the first two Nobel laureates in economics, is a basic principle of effective policy. Distinguishing between policy targets, on the one hand, and policy instruments, on the other hand, Tinbergen (1952) argued that to successfully achieve n independent policy targets at least the same number of independent policy instruments are required. This has become known as the Tinbergen Rule. The purpose of this note is to introduce and explain the Tinbergen Rule and its implications to public policy students.

Keywords: Economic policy, public policy, policy mix, instrument mix, policy design

JEL Code: E00, E61, H11

A NOTE ON THE TINBERGEN RULE

Purpose

The Tinbergen Rule, named after one of the first two Nobel laureates in economics¹, is a basic principle of effective policy. Distinguishing between policy targets, on the one hand, and policy instruments, on the other hand, Tinbergen (1952) argued that at least n independent policy instruments we required to successfully achieve n independent policy targets. This has become known as the Tinbergen Rule. The purpose of this note is to introduce and explain the Tinbergen Rule and its implications to students interested in public policy analysis and administration. It does not introduce new concepts but present implications that are easily overlooked.

Policy Targets and Instruments

Although there is widespread agreement about the meaning of public policy, it may increase clarity if we provide a few definitions based on Tinbergen's (1952) influential book on this topic (see also Tinbergen, 1956). In this work, he briefly reviewed the changing role of government in conducting economic policy, from an earlier approach focused primarily on fiscal policy, to a broader and more comprehensive view of areas considered targets of economic policy. Tinbergen distinguishes three types of variables: (1) Data, (2) Target Variables, and (3) Instruments. In principle, there is a fourth set, namely irrelevant variables which, in our discussion, we can ignore. Data are those variables that we cannot influence but appear to us as givens. They are frequently referred to as parameters. These include world market prices, import tariffs and regulations of other countries, and international industrial norms (e.g., ISO Standards;

¹ The Dutch economist Jan Tinbergen shared the first Nobel Memorial Prize in Economics (1969) with the Norwegian economist Ragnar Frisch.

see ISO, n.d.). Tinbergen (1952) lists output or GDP, employment level, balance of payments, and the real wage rate as examples of target variables.

Since the publication of his book, the number of target variables has changed and on balance increased. Among the additions, environmental targets are noteworthy. Gender equity is another addition with a relatively short history. While international trade is a traditional policy area, the nature of trade issues has changed since the end of World War II. The increased range of public policy makes the discussion of the Tinbergen Rule even more relevant.

Among the instruments, he mentions government expenditures, labor productivity, wage rate, profit margin, and labor productivity. Policy instruments mirror the economic system of a nation, with a socialist economy likely to have more and a free market economy fewer policy instruments, and the types of instruments available to each of them likely to be different. However, because we are interested in a conceptual discussion of interactions among policy instruments, such differences can be ignored for the remainder of this paper.

Even the short list of instruments mentioned in the previous paragraph illustrates the necessity of clear distinctions between instruments and targets. For example, is labor productivity really an instrument and not a target? In general, labor productivity is not an end in itself but a means to reach targets such as higher wages, greater production, improved competitiveness in the world market, etc. Therefore, it is properly regarded as an instrument, even if policy makers cannot influence it directly, but only indirectly through, for example, training programs to increase the skills of a targeted labor force or incentive to invest in the newest and most efficient technologies. In other words, an instruments may consist of different steps to move the instrumental variable in the desired direction.

The Tinbergen Rule should not be confused with a related principle that has become known in monetary economics as the Tinbergen Principle which states that monetary policy should be limited to address economic stability and other policies should be used to address the stability of the financial system². Clearly the two are related with the Tinbergen Principle addressing a specific set of policy issues whereas the Rule is general (e.g., Krug, 2018)

Independence, Neutrality, Complementarity, and Conflict among Policy Instruments

Tinbergen (1952) argued that to successfully achieve n independent policy targets, at least the same number of independent policy instruments are required (for an application of the Tinbergen Rule to macroeconomic policy, see Michl, 2008; Pereira da Silva, 2016). Independence of policy targets means that both can be achieved simultaneously. There can be no logical or empirical contradiction between the two. Geometrically speaking, two targets cannot lie on the same line pointing in opposing directions. In this paper, we assume that the policy target vectors are mutually orthogonal. This is a sufficient but not a necessary condition that facilitates the graphical representation (Figure 1) used in the discussion of policy implications of the Tinbergen Rule. For independence of policy instruments, we only assume that the n instruments span the whole policy space; we do not require orthogonality.

We define a policy instrument as being neutral if its application has no effect whatsoever of all policy targets other than the one it was designed to help achieve. Figure 1 shows that neutral instruments are a subset of independent instruments as neutrality implies independence, but not vice versa. Consider a policy instrument designed to achieve a policy target A. This instrument – call it A, after its target – is defined as complementary to a policy target B, if its

² The term Tinbergen Principle is the one this author learned when he was a student in the 1970s. It seems, however, that Tinbergen Rule has become the standard name.

application moves us closer to achieving both targets A and B. An instrument for target A is defined as in conflict or conflicting with target B, if its application moves us further away from this target.

Presentation and Discussion of Scenarios in Two-dimensional Policy Space

In this section we introduce scenarios in a two-dimensional policy space, which are distinguished based on characteristics of instruments introduced in the previous section (Table 1). If instruments have different characteristics, e.g., one is neutral and the other harmonious, the order plays no role in our analysis, and therefore, three scenarios are duplicates. Thus, there are six scenarios to consider. The case when instrument A completely erases the effect of instrument B on target B is unlikely to occur and would not survive long if it did; it can therefore be ignored.

Table 1: Scenarios in the Case of two Targets and two Instruments

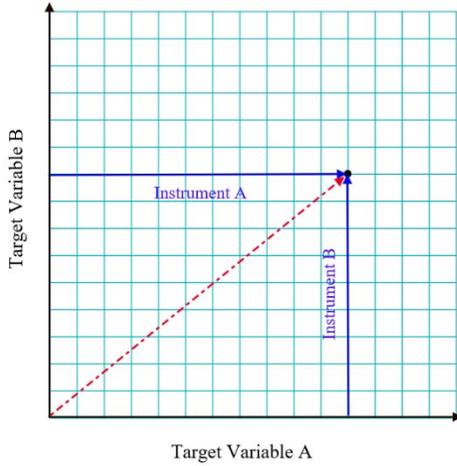
Instrument A \ Instrument B	Neutral	Complementary	Conflicting
Neutral	a	b	c
Complementary	b	d	e
Conflicting	c	e	f

The scenarios are represented in six panels (*a* through *f* as in Table 1) in Figure 1. That is, there are two orthogonal policy targets and two independent but usually not orthogonal policy instruments. The black dot shows the point where both targets are reached. The red broken line is the sum of the application of the two policy instruments that allow us to reach this point. The length of blue instrument vectors can be interpreted as the intensity of the necessary application. The two policy targets (represented by a black dot) are the same in each scenario.

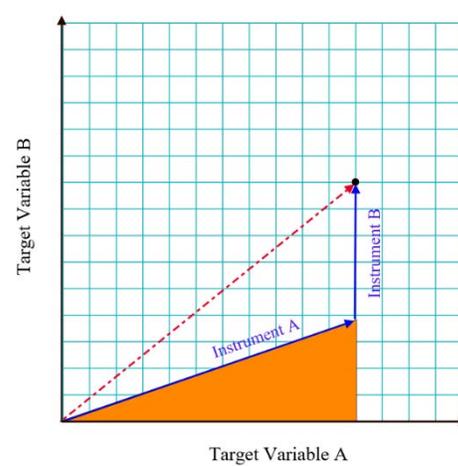
Figure 1: Graphical Representation of Policy Targets and Policy Instruments

- Policy Targets
- Efficiency Loss Due To Conflicting Policy Instruments
- Efficiency Gain Due To Complementary Policy Instruments

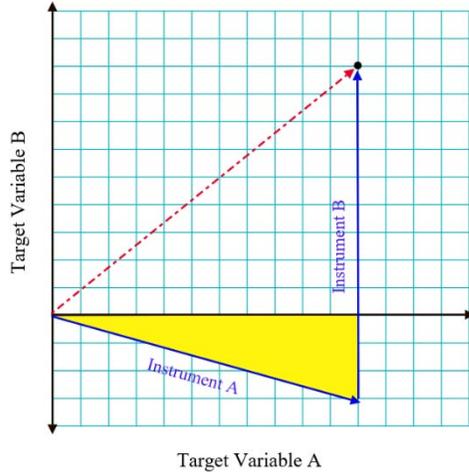
a. Two Neutral Instruments



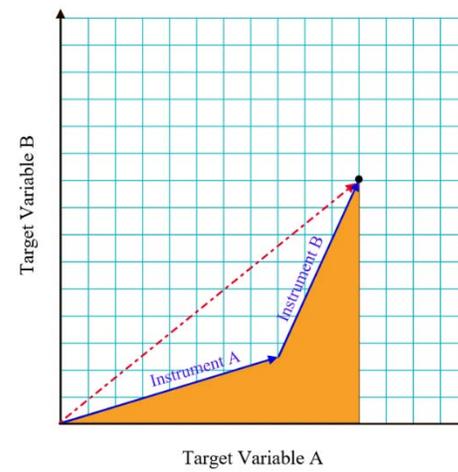
b. One Neutral and One Complementary Instrument



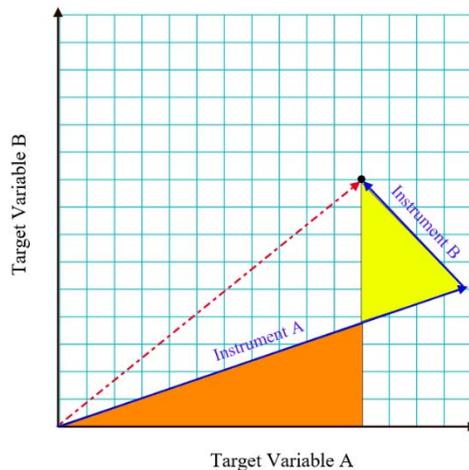
c. One Neutral and One Conflicting Instrument



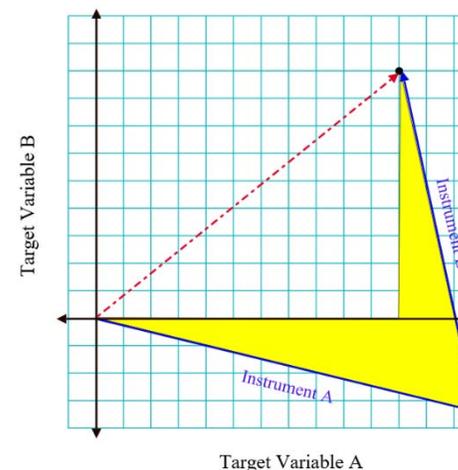
d. Two Complementary Instruments



e. One Complementary and One Conflicting Instrument



f. Two Conflicting Instruments



a. Two Neutral Instruments

This is the simplest of the six scenarios in the two targets–two instruments case because policies to reach target A and target B, respectively, can be designed and administered independently from one another. As we be obvious when we examine the other five scenarios, when instrument A effects target B and not only target A, then coordination between the policies may yield benefits or reduce costs. If instrument A’s spillover effect on target B is small, then implementing and administering the policies independently may be cost efficient, but the stronger the spillover effects, the greater the need for coordination in designing and implementing policies for targets A and B.

b. One Neutral and One Complementary Instrument

In panel b, instrument A is sufficient to reach target A and, in the process, also advances the economy towards target B. Thus, the application of instrument B can be smaller than that shown in panel A, when both instruments were neutral. The brown triangle indicates that savings from instrument A being harmonious with target B could be substantial. However, while the savings will be welcome, to take full advantage, coordination between the policies to reach A and B, respectively, may be required. Specifically, coordination is called for if overshooting a policy target has negative consequences, as when more of a good thing turns into a not-so-good thing.

c. One Neutral and One Conflicting Instrument

The situation in this panel resembles that in panel b. Instrument A is still sufficient to reach target A, but now it moves the economy away from target B. Therefore, we need a larger application of instrument B to compensate and the yellow triangle indicates the extra costs – relative to panel a – that results from the conflict. As in the preceding scenario, this suggests that coordination of the two policies is advisable.

d. Two Complementary Instruments

This scenario shows the benefits (brown area) when both instruments also support the other policy target in addition, of course, the helping achieve their own. However, unless exceeding the target is a good thing and unless the policy implementation does not carry a high cost, coordination between the policies is still necessary to apply them in economically efficient way.

e. One Complementary and One Conflicting Instrument

In this scenario, the additional costs of a conflicting instrument B are compensated by the beneficial impacts of instrument A on target B. As presented in panel e, the net effect is to lower the combined cost of the policies compared to panel a. However, as in all scenarios but scenario a, the policies work most efficiently of their implementation is coordinated.

f. Two Conflicting Instruments

In this final scenario, the costs of conflicting instruments are illustrated. The yellow area shows that the costs can be significant relative to scenario a. The negative effect of instrument A (B) on target B (A) requires a greater application of instrument B (A). In this case, as in all others except scenario a, coordination – at least in the form of an information exchange – may be required to ensure that both targets will be reached.

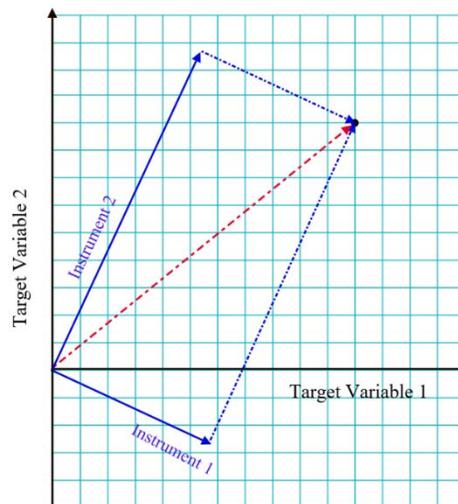
Implications for Policy Implementation and Administration

The preceding section showed that except in the case of independent targets and neutral instruments, policies effects targets beyond those they are designed for. Although in a mathematical sense, the instruments in each of the six scenarios are independent, for policy design and administration, they are interdependent. The greater the influence of an instrument X on target Y, the greater the potential benefits from coordinating the policies for X and Y, up to

combining responsibilities into one administrative unit. The latter is called for if the spillover effects are large. The Tinbergen Rule's immediate concern is the necessary number of policy instruments to reach a set of policy targets, but it also has implications for the organizational structure of policy making and administration.

The argument for policy coordination is based on the interaction of different policies. To avoid any possible confusion, we stress that independence of policy instruments is not the same as instrument neutrality. Only if policy targets and policy instruments, respectively, are orthogonal to each other and, in addition, each instrument is perfectly aligned with its target, are all instruments neutral. This is the only condition that allows separate policies for each target without the potential for spillovers from one policy to other policies. Figure 2 shows that having orthogonal targets and orthogonal instruments is not sufficient if each instrument is not also perfectly aligned with its target. It is likely that this condition is rarely met. Therefore, coordination can only be ignored if spillovers are modest or non-existent.

Figure 2: Orthogonality Does Not Guarantee Neutrality



The need for coordination is less pronounced in a stable economy that is growing incrementally at a modest pace than in one that is changing rapidly. In a stable environment, the

past is a reliable guide to the future and an agency responsible for target A can accurately predict the actions of another agency in charge of policy B, based on experience, and take it into consideration as it makes policy decisions. The same cannot be said for an economy that is changing quickly, such as the People's Republic of China did when it achieved annual growth rates exceeding 10 percent. Consider, for example, the role of the State Environmental Protection Administration, which is responsible for water standards. Water quality depends on the actions of several agencies, including the Ministry of Transportation (shipping), Ministry of Agriculture (agricultural water use; non-point pollution), Ministry of Construction (water supply, wastewater treatment) (Liebenthal, 2008). During periods of rapid growth and a dramatic reshaping of water use and discharges in high-growth regions, the challenge to conduct effective policy is difficult even if there are pre-existing channels of communication and coordination among different agencies.

In conclusion, coordination among policies that mutually affect each other's policy targets should always be considered and is required in a fast-changing policy environment. In the previous sections, although we have looked at interactions between different policies, we constrained considerations to one instrument per target. However, interactions between policies suggest that we should consider policies that influence each other jointly and produce an optimal policy and instrument mix (see del Rio and Howlett, 2013, for an extensive discussion). Unfortunately, Tinbergen himself did not provide much guidance regarding the organization of (economic) policy (see comments by Arrow, 1958).

Summary and Conclusions

In this note we show that the Tinbergen Rule has implications not only for the number of policy instruments relative to policy targets, but also for the administrative organizations of

policies. The discussion also highlights the potential need for coordination among policies administered by different agencies. We assume that coordination between different policies administered by the same agency can be accomplished with relative ease.

The coordinated application of policies is most difficult when it is likely most needed, namely in the case of rapid change when parameters cannot be assumed to be (nearly) constant and when demands on resources increase more than marginally. While in mature economies the past is a reliable guide to the near future, this is not the case in economies in transformation. This may be one of the reasons why we tend to find more governance weakness in the latter than in the former.

During the twentieth century, the range of public policy changed dramatically and added new responsibilities for governments to attend to. For example, in the past social policy was rudimentary by today's standards and designed mostly to deal with the destitute and long-term poor. Beginning in the late nineteenth century when Germany introduced the world's first "social security" program, there has been a growth of the reach of social policy. Gender equity began with campaigns for women's voting rights; they now extend to pay equity and, in the United States, equal access for women to educational programs (see US Department of Education, 2017, for information about areas covered by Title IX legislation).

Another policy area that has seen significant growth is transportation, not least because of new transportation technologies and their wide adoption (automobile, trucking, commercial flights). The environment is another area, linked to the growth of industrialization and the transportation sector, that has attracted greatly increased attention from policy makers.

The growth of the range of public policy combined with implications of the Tinbergen Rule suggest that we may need to develop new policy instruments. While this has already occurred, particularly in the political arena, the sense of this author is that we need more systematic research to be able to meet the challenges of a growing public policy space.

References

- Arrow, K.J. (1958). "Tinbergen on Economic Policy." *Journal of the American Statistical Association* 53(281, March): 89-97.
- del Rio, P. and M. Howlett (2013). "Beyond the "Tinbergen Rule" in Policy Design: Matching Tools and Goals in Policy Portfolios." *Annual Review of Policy Design* 1(December), 1-16.
- ISO (n.d.). *Popular Standards*. Vermier, Switzerland: International Organization for Standardization. <https://www.iso.org/popular-standards.html>, accessed March 18, 2019.
- Krug, S. (2018). "The Interaction Between Monetary and Macroprudential Policy: Should Central Banks 'Lean Against the Wind' to Foster Macro-financial Stability?" *Economics* 12(2018-7), 1-69. <http://www.economics-ejournal.org/economics/journalarticles/2018-7>, accessed March 27, 2019
- Liebenthal, A. (2008). "Critical Needs in China's Water Resources." Chapter 14 in P.V. Schaeffer, editor. *Commodity Modeling and Pricing: Methods for Analyzing Resource Market Behavior*. Hoboken, NJ: John Wiley and Sons, 229-246.
- Michl, T.R. (2008). "Tinbergen Rules the Taylor Rule." *Eastern Economic Journal* 34(3), 293-309. <https://link.springer.com/content/pdf/10.1057%2Fpalgrave.eej.9050037.pdf>, accessed March 26, 2019

Pereira da Silva, L.A. (2016). "Towards an Integrated Inflation Targeting Framework in Middle-income Countries: A Research Agenda. Keynote Speech at 2nd European Central Banking Network Policy Research Conference. Ljubljana, Slovenia, September 29.

<https://www.bis.org/speeches/sp160929.pdf>, accessed March 27, 2019

Tinbergen, J. (1952). *On the Theory of Economic Policy*. New York: North-Holland

_____. (1956). *Economic Policy: Principles and Design*. New York: North-Holland.

<http://hdl.handle.net/1765/16740>, accessed March 19, 2019.

US Department of Education. (2017). *Title IX*. <https://www.ed.gov/category/keyword/title-ix>,

accessed April 1, 2019