



PROJECT MUSE®

---

## Commitment to Equity Handbook

Nora Lustig

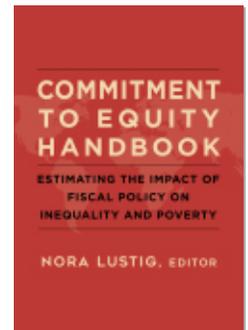
Published by Brookings Institution Press

Lustig, Nora.

Commitment to Equity Handbook: Estimating the Impact of Fiscal Policy on Inequality and Poverty.

Brookings Institution Press, 2018.

Project MUSE.[muse.jhu.edu/book/61437](https://muse.jhu.edu/book/61437).



➔ For additional information about this book  
<https://muse.jhu.edu/book/61437>

## Chapter 5

# MEASURING THE EFFECTIVENESS OF TAXES AND TRANSFERS IN FIGHTING INEQUALITY AND POVERTY

Ali Enami

One of the key questions to be addressed by a *CEQ Assessment* is how effective taxes and government spending in reducing inequality and poverty are. This chapter introduces new Commitment to Equity (CEQ) effectiveness indicators to evaluate the effectiveness of taxes and transfers in reducing inequality and poverty. The main goal of the effectiveness indicators defined here is to provide policymakers with meaningful but easy-to-interpret indexes that measure fiscal interventions’ “bang for the buck” in terms of inequality or poverty reduction relative to the amount collected and spent. Special attention has been given to the design of these indicators to fulfill the mathematical requirements of “proper ordering”: specifically, the design of the indicators ensures that, keeping the maximum potential of two interventions in reducing inequality (or poverty) constant, an intervention with higher marginal contribution to the reduction of inequality (or poverty) has a higher ranking. By contrast, an intervention with higher potential to reduce inequality (or poverty) but with lower realized effect receives a lower ranking. A brief description of the effectiveness indicators can also be found in chapter 1 by Lustig and Higgins. Chapter 8 by Higgins describes how these indicators are calculated with the *CEQ Stata Package*. All the effectiveness indicators are calculated by the *CEQ Stata Package* and automatically pasted in Section E. Output Tables of the *CEQ Master Workbook (MWB)* (which is in part IV of this Handbook, available online only).

This chapter begins by introducing two general indexes, the Impact and Spending Effectiveness indicators, which are designed to measure the effectiveness of fiscal policies in reducing poverty and inequality. The chapter then reviews the fiscal impoverishment and gains effectiveness indicator (FI/FGP) designed by Enami, Higgins, and

Younger (2018), based on the concepts of fiscal impoverishment (FI) and fiscal gains to the poor (FGP) introduced by Higgins and Lustig (2016). This effectiveness indicator can better capture the poverty-reducing or -increasing effects of fiscal interventions. An application of these indicators for the case of Iran's fiscal system is presented in Enami (2018), chapter 17 of this Handbook.

Before introducing these indicators, the next section will briefly review the concept of marginal contribution (MC), which is central to the construction of the CEQ effectiveness indicators here, as well as the notation used throughout this paper. Then the shortcomings of the previous CEQ effectiveness indicator are reviewed, and, finally, the new effectiveness indicators are introduced.

## 1 Notation

This chapter uses  $T$  and  $B$  to refer to taxes and benefits, where  $T$  can refer to any combination of direct and indirect taxes, and  $B$  can refer to any combination of direct transfers, indirect subsidies, and in-kind transfers from public spending on health and education. The indicators can also be defined as combinations of taxes and transfers, which is why  $T$  (and/or  $B$ ) is used throughout. One can calculate the marginal contribution (MC) of any combination of taxes or benefits as follows:

$$MC_{T \text{ (and/or } B)}^{End \text{ income}} = Index_{End \text{ income} \setminus T \text{ (and/or } B)} - Index_{End \text{ income}}$$

*Index* refers to any inequality or poverty indexes that may be used to calculate the marginal contribution. For example, this chapter uses the Gini index as a measure of inequality. The subscript of the *Index*, *End income*, refers to the income concept used to calculate the marginal contribution to the index of a tax or benefit. For example,  $Gini_{Disposable \text{ Income}}$  refers to the Gini coefficient of Disposable Income, and using  $Gini_{Disposable \text{ Income}}$  for  $Gini_{End \text{ Income}}$  implies that we are interested in calculating the marginal contribution of a tax or benefit to the Disposable Income Gini. *End income* \setminus  $T$  (and/or  $B$ ) refers to the income concept that is equivalent to *End income* prior to the tax or benefit of interest. For example, *Disposable Income* \setminus *Direct Taxes* equals Disposable Income plus direct taxes (to find the income concept *prior to* subtracting out direct taxes). Intuitively,  $MC_{T \text{ (and/or } B)}^{End \text{ income}}$  is the change in the value of  $Index_{End \text{ income}}$  if  $T$  (and/or  $B$ ) is removed from the fiscal system or replaced with a tax (or benefit) of the same size that has no effect on inequality (or poverty) when it is added to the fiscal system. It should be noted that *End income* does not have to be one of the CEQ core income concepts. For example, if we wanted to calculate the marginal effect of indirect taxes with respect to Disposable Income, because indirect taxes have not yet been subtracted out of Disposable Income, the end income concept would be *Disposable Income minus Indirect Taxes*. The MC in this case would be calculated as follows:

$$MC_{Indirect \text{ Taxes}}^{Disposable \text{ Income minus Indirect Taxes}} = Index_{Disposable \text{ Income}} - Index_{Disposable \text{ Income minus Indirect Taxes}}$$

On the other hand, if we were calculating the MC of *direct* taxes with respect to Disposable Income, because Disposable Income is already net of direct taxes, the end income would be Disposable Income, whereas the end income without the fiscal intervention would require taking Disposable Income and *adding back in* direct taxes, as follows:

$$MC_{Direct\ Taxes}^{Disposable\ Income} = Index_{Disposable\ Income\ plus\ Direct\ taxes} - Index_{Disposable\ Income}$$

In calculating MC, the important point is that we have two income concepts that are different from each other only because of one component or a bundle of taxes or transfers. In other words, one can use components of a fiscal system separately and also in different combinations (or bundles) to perform a marginal contribution analysis. An example would be to evaluate the inequality-reducing effect of different taxes in a system separately first and then of the whole taxation system together as one entity. Regardless of how a component or bundle is set up, we consider the MC of a fiscal intervention to be the difference between these two income concepts (the *End income* with and without that specific component or bundle) for a particular inequality (or poverty) index.

Although the preceding examples are all related to the Gini index, the concept of MC is applicable to any inequality or poverty index.

## 2 New CEQ Effectiveness Indicators

Before introducing the new indicators, it is helpful to review why they have replaced the previous CEQ effectiveness indicators. Following this review, the new indicators will be discussed.

### 2.1 Shortcomings of the 2013 Effectiveness Indicator

The effectiveness indicator introduced in the previous handbook (2013) was defined as follows:

$$CEQ\ Old\ Effectiveness\ Indicator = \frac{MC_{T\ (or\ B)}^{End\ income}}{[T\ (or\ B)]/GDP}$$

This indicator suffers from some shortcomings. The most important one is that it could fail to rank the taxes and transfers properly, or at least it would fail to properly describe how taxes and transfers are performing in comparison to each other. That is because many indicators of inequality and poverty do not have a linear relationship with the size of the taxes and transfers.

An example can help to clarify this point. Assume we are interested in measuring the impact of a tax on reduction in inequality and we allocate that tax in a way that mathematically maximizes the reduction in traditional Gini index. As we increase the

size of this tax, despite the fact that we use the most inequality reducing method of allocating the tax, the power of the next dollar to reduce inequality decreases. In other words, doubling the size of a tax does not double its impact on Gini (note that Gini is bounded between zero and one). The point of this example is to show that the “maximum potential” of the next dollar in reducing inequality decreases as the size of a tax (or transfer) increases. Dividing the impact of a tax (i.e., its MC) by the size of that tax implies that the “maximum potential” of that tax is constant. Therefore, everything else being equal, bigger programs would be evaluated as less effective ones.

The second problem with the above-mentioned index relates to the mathematical interpretation of this indicator. The indicator in the equation above states how much the marginal contribution of a tax (or transfer) would change if that tax (or transfer) were scaled up to the size of GDP (note that one can rewrite this indicator to be  $\frac{MC_{T(or B)}^{End\ income}}{[T(or B)]} \times GDP$ ). Because this is a linear interpolation, the values could easily exceed the reasonable boundaries. For example, values beyond unity (in absolute terms) are meaningless for the power of a tax (transfer) to reduce inequality simply because the change in Gini cannot exceed unity (in absolute terms).

With respect to poverty reduction, the indicator is not problematic in ranking the taxes and transfers individually if a proper indicator (such as poverty gap) is used. However, this indicator is not developed adequately to assess bundles of taxes and transfers. In the case of poverty reduction of a bundle, the two concepts of *fiscal gains to the poor* (FGP) and *fiscal impoverishment* (FI) should be accounted for separately. Note that taxes cannot decrease poverty while transfers cannot increase it.

## 2.2 Impact and Spending Effectiveness Indicators

The two new CEQ effectiveness indicators are introduced in this section. These indicators have three main properties. First, they rank taxes and transfers properly with regard to how much of their maximum potential in achieving inequality or poverty is in fact achieved. In addition to the proper ranking, the difference between the effectiveness values of two alternative taxes shows how much one is actually performing better than the other one (i.e., the relative difference between various values of these indicators is meaningful). Second, the indicators satisfy the normalization property, meaning that their values equal one when a tax or transfer reaches its maximum effectiveness. Finally, the indicators have an intuitive and independent interpretation. The effectiveness values show not only how well a tax or transfer performs relative to other taxes and transfers, but also how well they do relative to their own maximum potential.

### 2.2.1 Impact Effectiveness

Impact effectiveness (IE) is defined as the ratio of the observed MC of a tax (transfer) to the optimum MC of that tax (transfer) if it is distributed in a way that maximizes its

inequality- or poverty-reducing impact. The following equation shows how this indicator is defined mathematically:

$$\text{Impact Effectiveness}_{T \text{ (and/or B)} }^{\text{End income}} = \frac{MC_{T \text{ (and/or B)}}^{\text{End income}}}{MC_{T \text{ (and/or B)}}^{\text{End income}^*}},$$

where  $MC_{T \text{ (and/or B)}}^{\text{End income}^*}$  is the maximum possible  $MC_{T \text{ (and/or B)}}^{\text{End income}}$  if the same amount of  $T$  (and/or  $B$ ) is distributed differently among individuals. For example, for the Gini index we deduct taxes from (add benefits to) the richest (poorest) until her income becomes equal to the second richest (poorest), then deduct taxes from (add benefits to) these two richest (poorest) until their incomes become equal to the third richest (poorest), and we continue this procedure until we end up with the same total value of  $T$  ( $B$ ) that we observe in the actual system.<sup>1</sup> If the indicator of interest is a Gini or S-Gini index, the impact effectiveness indicator is identical to what is proposed by Fellman, Jäntti, and Lambert (1999).<sup>2</sup>

This indicator shows the relative realized power of a tax or transfer in reducing inequality, or of a transfer (or combined tax-transfer system) in reducing poverty. There are two important issues to note. First, the choice of the poverty indicator is crucial. For example, if one chooses to focus on the poverty headcount ratio, then to maximize the IE indicator, the policymakers should focus the financial resources on those who are right below the poverty line and ignore those who are in deep poverty. This is not an optimal policy implication from the social welfare perspective, and we discourage the use of the poverty headcount ratio. Squared poverty gap, on the other hand, encourages targeting the transfer toward the poorest first, and, therefore, it is an indicator that we specially recommend for policymakers to utilize. Second, because taxes can only increase poverty, the poverty-reduction indicator is only defined for benefits and combined tax-transfer systems that have a positive marginal contribution.

An example shows how to interpret this indicator: if the impact effectiveness of a transfer is equal to 0.7, it means the transfer has realized 70 percent of its potential power in reducing inequality. Therefore, the higher the value of this indicator, the more effective a tax (transfer) is in fulfilling its potential to reduce inequality.

One can calculate this indicator for taxes and transfers with both positive and negative MC for inequality. To see why this indicator properly ranks taxes and transfers with a positive MC to inequality or poverty, assume taxes A and B cause the same reduction in inequality but A is larger than B. In this case, B is preferred to A because both taxes do good (by reducing inequality), but A has a higher (unrealized) potential to reduce inequality because it is larger. So when  $MC_{T \text{ (and/or B)}}^{\text{End income}} > 0$ , the Impact Effectiveness indicator abides by this ranking because  $MC_{T \text{ (and/or B)}}^{\text{End income}^*}$  is in the denominator and is increasing in the size of  $T$ . Now to see why the indicator properly ranks taxes and transfers with a negative

<sup>1</sup> See Fei (1981) for the proof that this method maximizes reduction in Gini.

<sup>2</sup> See Fellman, Jäntti, and Lambert (1999).

MC to inequality (that is, taxes and transfers that cause an *increase* in inequality), assume tax A causes the same increase in inequality as tax B but tax A is larger. This would mean that, while A and B both do harm, tax A at least collects more revenue while doing the same harm.<sup>3</sup> In other words, if tax B were scaled up to collect the same revenue as tax A, its negative effect on inequality would be higher (its MC would be more negative). Thus, tax A is preferred to B, and this is indeed the information given by the Impact Effectiveness indicator because  $MC_{T \text{ (and/or B)}}^{\text{End income}^*}$  is in the denominator and is increasing in the size of  $T$  (note that here  $MC_{T \text{ (and/or B)}}^{\text{End income}} < 0$ ). Note that while the indicator is bounded from above (i.e., one is the maximum possible value for this indicator), it is not bounded from below if MC is negative.

For poverty, one can calculate the impact effectiveness indicator (using the formula above) for benefits or combined tax-benefit systems. For taxes, which can only increase poverty, the denominator will always be zero (so the optimal effect of a tax on poverty is zero). Therefore, the denominator is modified in the following expression to reflect the most harmful way of taxing (taxing the poorest until her income equals zero, then the second poorest until her income equals zero, and so on). We denote this harmful taxation as  $MC_{T \text{ (or B)}}^{\text{End income}^H}$  and calculate

$$\text{Poverty Impact Effectiveness}_{T \text{ (or B)}}^{\text{End income}} = - \frac{MC_T^{\text{End income}}}{MC_T^{\text{End income}^H}},$$

where the negative sign is included to ensure that the higher the value of the indicator, the less harmful the tax is relative to its potential to do harm.<sup>4</sup>

### 2.2.2 Spending Effectiveness

The spending effectiveness (SE) indicator is defined as the ratio of the minimum amount of a tax (transfer) required to be collected (spent) in order to create the observed MC of the tax (transfer), if the tax (transfer) is instead redistributed optimally. The following equation shows how this indicator is calculated:

$$\text{Spending Effectiveness}_{T \text{ (and/or B)}}^{\text{End income}} = \frac{T^* \text{ (and/or B}^*)}{T \text{ (and/or B)}},$$

where  $T^*$  (and/or  $B^*$ ) is the minimum amount of  $T$  (or  $B$ ) that is needed to create the same  $MC_{T \text{ (or B)}}^{\text{End income}}$  using the same redistribution procedure that was discussed previously to find the maximum MC.

<sup>3</sup>This is not exactly a mathematical property because the MC of taxes A and B is calculated with respect to different reference points, so having different potentials does not necessarily correspond to collecting more revenue.

<sup>4</sup>Note that both numerator and denominator have a negative sign by definition, which will cancel each other, and that therefore, we add a negative sign in front of the ratio to make it a negative value.

This indicator shows how much less tax (transfer) is required to achieve the same observed outcome (in terms of inequality reduction) if the tax (transfer) is collected (spent) in a way that maximizes the reduction in inequality. For example, a value of 70 percent for spending effectiveness of a transfer means that the same MC could be achieved by spending only 70 percent of the current resources if those resources were spent optimally (if the objective function is to maximize equality).

A higher value of the SE indicator implies that a program is more effective. The following example clarifies this point. Assume two alternative worlds in which we spend \$100 in transfers and reduce inequality by 0.1 Gini points. In world A, we can achieve the same level of inequality reduction by spending just \$30 but allocating it in the most inequality-reducing way, while in world B we would have to spend \$90. In other words, in world A we could achieve just as much inequality reduction by only spending 30 percent as much as we are now; in world B we are already fairly close to the most effective spending. That is because even if we redistribute in the most inequality-reducing way, we would still have to spend 90 percent of what we are currently spending to get the same inequality reduction we observe. Clearly, spending in world B is more effective for inequality reduction.

The spending effectiveness indicator can only be calculated for the taxes and transfers with a positive MC (and as a result, the spending effectiveness of taxes on poverty reduction is undefined). Moreover, and in the context of inequality indices, in order to calculate this indicator for the whole fiscal system (which is a combination of taxes and transfers), one needs to make a normative choice first. There are various inequality-minimizing taxes and transfers that could achieve the same level of reduction in inequality, and a researcher needs to decide between them using a normative criterion. For example, one may choose an optimal fiscal system with the least budget deficit (or surplus), while others may choose an optimal system that keeps the ratio of total taxes to transfers constant (that is, one that scales the current system). For this reason, here we refrain from calculating this indicator for the whole fiscal system.

Spending effectiveness has an important interpretation as a measure of efficiency as well. Because the value of the normative index of interest<sup>5</sup> (for example, the Gini index) is kept constant, spending effectiveness shows how the fiscal intervention could have reached the same social goal with less distortion through a smaller size of tax or transfer. Therefore, this indicator not only ranks the effectiveness of different taxes and transfers in reducing inequality and poverty but can also be used to rank alternative taxes and transfers from the view of economic efficiency.

---

<sup>5</sup> Here we assume that the choice of an index of inequality (e.g., Gini) implies a normative choice in the sense that the society uses this index to evaluate various programs with regard to its social goals. So, for example, the society is indifferent between two alternative taxes as long as they reduce the value of Gini identically. Note that, this is only from the perspective of the social goal stated here, which is reduction in inequality measured by Gini.

## 2.3 Fiscal Impoverishment and Gains Effectiveness Indicators

This section reviews the effectiveness indicators introduced by Enami and others.<sup>6</sup> These indicators are specific to the effect of taxes and transfers on fiscal impoverishment (FI) and fiscal gains to the poor (FGP). Axiomatic indicators for FI and FGP are derived by Higgins and Lustig (2016) and described in chapter 4 of this Handbook. Consider a set of policies that may include both benefits and taxes. We measure the effectiveness of these policies at reducing poverty without making many of the poor poorer as:

$$Effectiveness_{FI/FGP} = \left[ \left( \frac{B}{T+B} \right) \left( \frac{FGP\_MC_{T\ and\ B}^{End\ income}}{B} \right) \right] + \left[ \left( \frac{T}{T+B} \right) \left( 1 - \frac{FI\_MC_{T\ and\ B}^{End\ income}}{T} \right) \right]$$

where  $T$  and  $B$  are the size of total taxes and transfers (both positive values),  $FGP\_MC_{T\ and\ B}^{End\ income}$  is the marginal contribution of the net system (i.e.,  $T$  and  $B$ ) to FGP (always a non-negative value), and  $FI\_MC_{T\ and\ B}^{End\ income}$  is the marginal contribution of the net system (i.e.,  $T$  and  $B$ ) to FI (always a non-negative value).<sup>7</sup>

Note that  $T$  and  $B$  are maximum possible reduction or increase in the FGP and FI indicators. In other words, if all taxes are paid by the poor and no benefits reach the poor,  $FI\_MC_{T\ and\ B}^{End\ income}$  becomes equal to  $T$ . Similarly, if all transfers go to the poor (only up to the point that brings them out of poverty) and the poor pay no taxes, the value of  $FGP\_MC_{T\ and\ B}^{End\ income}$  becomes equal to  $B$ . As a result, both  $\left( \frac{FGP\_MC_{T\ and\ B}^{End\ income}}{B} \right)$  and  $\left( 1 - \frac{FI\_MC_{T\ and\ B}^{End\ income}}{T} \right)$  are bounded between zero and 1. Moreover, the higher the value of each of these two components, the more effective the bundle of taxes and transfer is from the poverty reduction perspective. The weights (i.e.,  $\left( \frac{B}{T+B} \right)$  and  $\left( \frac{T}{T+B} \right)$ ) also add up to one. Therefore, the whole indicator is bounded between zero and one, and the higher the value of the indicator, the more effective the bundle of taxes and transfers is in reducing poverty. For analyzing bundles that include only taxes, including a single tax, the indicator reduces to

$$Tax\ Effectiveness_{FI} = 1 - \left( \frac{FI\_MC_T^{End\ income}}{T} \right).$$

<sup>6</sup> See Enami, Higgins, and Younger (2018), box 1-3 in this Handbook.

<sup>7</sup> FGP and FI are in Higgins and Lustig (2016), chapter 4 in this Handbook. A brief description can be found in chapter 1 by Lustig and Higgins (2018) and the instructions on how to calculate them with the *CEQ Stata Package* are in chapter 8 of this Handbook by Higgins (2018).

For policies that include only benefits, it reduces to

$$\text{Transfer Effectiveness}_{FGP} = \frac{FGP - MC_B^{\text{End income}}}{B}.$$

These indicators vary between zero and one and the higher the value of the indicator, the better a tax or transfer is in terms of its effectiveness in reducing poverty. Note that taxes can only hurt and transfers can only help the poor, and even though both of the preceding indicators have positive values, one should not compare the effectiveness of a tax to a transfer in reducing poverty.

### 3 Conclusion

This chapter introduced two new CEQ effectiveness indicators for evaluating the performance of taxes and transfers in reducing inequality and poverty. The first indicator is the impact effectiveness indicator, which takes the size of a tax or transfer as given and compares the realized reduction in inequality (or poverty) to the maximum possible reduction. The second indicator, spending effectiveness, takes the reduction in inequality (or poverty) as given and compares the actual size of a tax or transfer to the minimum required tax or transfer to create the same reduction in inequality (or poverty). The spending effectiveness index has an interpretation as a measure of efficiency as well because it determines how much unnecessary tax (or transfer) is collected (distributed), which if avoided would have resulted in less distortion. This chapter also reviewed a sub-family of impact effectiveness indicators that is specific to the effectiveness of taxes and transfers in reducing poverty.<sup>8</sup> These indicators are based on the indexes of fiscal impoverishment and fiscal gain to the poor introduced in Higgins and Lustig (2016), chapter 4 in this Handbook.

### Acknowledgments

I am very grateful to Sean Higgins, Nora Lustig, and Stephen D. Younger for their insightful comments on the previous drafts of this chapter.

### References

Enami, Ali. 2018. "Iran: An Application of the CEQ Effectiveness Indicators," chap. 17 in *Commitment to Equity Handbook: Estimating the Impact of Fiscal Policy on Inequality and Poverty*, edited by Nora Lustig (Brookings Institution Press and CEQ Institute, Tulane University). Free online version available at [www.commitmenttoequity.org](http://www.commitmenttoequity.org).

<sup>8</sup> Enami, Higgins, and Younger (2018), box 1-3 in this Handbook.

- Enami, Ali, Sean Higgins, and Stephen D. Younger. 2018. "Box 1-3. Fiscal Impoverishment and Gains Effectiveness Indicators," in *Commitment to Equity Handbook: Estimating the Impact of Fiscal Policy on Inequality and Poverty*, edited by Nora Lustig (Brookings Institution Press and CEQ Institute, Tulane University). Free online version available at [www.commitmentoequity.org](http://www.commitmentoequity.org).
- Fei, John C. H. 1981. "Equity Oriented Fiscal Programs." *Econometrica: Journal of the Econometric Society* 49, no. 4, pp. 869–81.
- Fellman, Johan, Markus Jäntti, and Peter J. Lambert. 1999. "Optimal Tax-Transfer Systems and Redistributive Policy." *Scandinavian Journal of Economics* 101, no. 1, pp. 114–26.
- Higgins, Sean. 2018. "Producing Indicators and Results, and Completing Sections D and E of the CEQ Master Workbook Using the CEQ Stata Package," chap. 8 in *Commitment to Equity Handbook: Estimating the Impact of Fiscal Policy on Inequality and Poverty*, edited by Nora Lustig (Brookings Institution Press and CEQ Institute, Tulane University). Free online version available at [www.commitmentoequity.org](http://www.commitmentoequity.org).
- Higgins, Sean, and Nora Lustig. 2016. "Can a Poverty-Reducing and Progressive Tax and Transfer System Hurt the Poor?" *Journal of Development Economics* 122, pp. 63–75.
- Lustig, Nora, and Sean Higgins. 2018. "The CEQ Assessment: Measuring the Impact of Fiscal Policy on Inequality and Poverty," chap. 1 in *Commitment to Equity Handbook. Estimating the Impact of Fiscal Policy on Inequality and Poverty*, edited by Nora Lustig (Brookings Institution Press and CEQ Institute, Tulane University). Free online version available at [www.commitmentoequity.org](http://www.commitmentoequity.org).