

Impact investing summary

A. Summary

The main contribution made by this article is to justify assumption made by previous article which is investors are willing to pay for impact holds (i.e give up excess return)?

1. Methodology

- Model : logit regression model
- Measurement of fund performance :
Base on data availability
 - IRR
 - VM (value multiple)
- Calculation of willingness to pay :
 - i. $WTP = \frac{\beta_{expected\ return}}{\beta_{impact}}$
 - ii. map WTP to IRR according to table in appendix (in terms of IRR)
- Caution :
Performance data were transformed into percentage ranking

2. Definition of Fund/Investor Type

Observe the heterogeneity of WTP among different investor and fund type

- Investor Type
 - Development organizations
 - Financial institutions
 - Corporation & government portfolios
 - state-owned corporations
 - Wealth managers
 - Private pensions
 - Foundations, Endowments
 - Public pensions
 - Institutional asset managers
- Investor Attributes
The following chart shows the mapping of **Investor Type** and **Investor Attributes**

Table 7

Limited partner (LP) types and attributes related to impact motives.

The table summarizes investor attributes by LP type (column (1)) and region. Column (2) indicates whether the primary constituents of the capital are households (versus organization). Column (3) indicates whether the constituent capital is intermediated as opposed to directly invested by the constituent or an administrator (e.g., foundations and pensions). Column (4) indicates whether impact is a primary goal of the constituent. Column (5) identifies legal and political pressure to invest with impact. The last two columns identify laws (e.g., ERISA) and charters (e.g., corporate charters) that restrict impact investment.

| Limited Partner | Household | Intermediated | Mission | Pressure toward impact | Laws restricting impact | Charters restricting impact |
|-----------------------------------|-----------|---------------|---------|---|------------------------------|-----------------------------|
| Development organizations | - | - | yes | - | - | - |
| Foundations | - | - | yes | - | yes UPMIFA and PRI (US) | - |
| Financial institutions | - | - | - | yes Community Reinvestment Act & state regulation modeled after CRA (US) | - | yes |
| Endowments | - | - | - | - | yes UPMIFA (US) | - |
| Corporate & government portfolios | - | - | - | - | - | yes |
| Institutional asset managers | - | yes | - | - | - | yes |
| Wealth managers | yes | yes | - | - | - | - |
| Private pensions | yes | - | - | - | yes ERISA (US) | yes (non-US) |
| Public pensions | yes | - | - | yes Political pressure | yes State & national laws | - |

3. Empirical Result

3.1 Impact funds under-perform traditional VC funds

- Result:

Impact funds under-perform traditional VC funds [Appendix.Fig1](#)

- Issue to be solved:

ex-post performance estimations do not necessarily reveal ex-ante decisions to invest as a function of expected returns

(i.e Investors can't observe the future return of the fund)

- Solving the issue:

- Using discrete choice hedonic model model (Originated from economics) of ex-ante choice, which builds on the hedonic pricing and resource choice literatures.
- Construct the expected return by asset pricing model, besides using shrinkage result of the regression model as a correction for attenuation bias

- Model 1

$$r_j = a_0 + a_1 r_j^{prior} + a_2 Miss_j^{prior} + a_3 First_j + a_4 IMPACT_j + a_5 (Miss_j^{prior} * IMPACT_j) + a_6 (First_j * IMPACT_j) + \varepsilon_j.$$

- Model 2

regressing the actual return on the estimated return, obtaining the shrinking result parameter

$$r_j = \gamma_0 + \gamma_1 \hat{E}[r_j] + e_j.$$

$$\hat{E}_{shrink}[r_j] = 0.25 + 0.50 \hat{E}[r_j].$$

- proof of correction of attenuation bias

Note that $\gamma_1 = 0.5 < 1$ in previous regression result, thus this method is valid theoretically

classic errors-in-variable analysis is

$$\text{plim}(\hat{b}) = \frac{b\sigma_{\mathbb{E}[r_j]}^2}{\sigma_{\mathbb{E}[r_j]}^2 + \sigma_u^2} = \lambda b, \quad (13)$$

where $\lambda < 1$ is the attenuation bias. Note that the slope parameter (γ_1) of the shrinkage regression of Eq. (10) yields an estimate of this attenuation bias:

$$\begin{aligned} \gamma_1 &= \frac{\text{cov}(\mathbb{E}[r_j], r_j)}{\sigma_{\mathbb{E}[r_j]}^2} = \frac{\text{cov}(\mathbb{E}[r_j] + u, \mathbb{E}[r_j] + \xi)}{\sigma_{\mathbb{E}[r_j]}^2 + \sigma_u^2} \\ &= \frac{\sigma_{\mathbb{E}[r_j]}^2}{\sigma_{\mathbb{E}[r_j]}^2 + \sigma_u^2} = \lambda. \end{aligned} \quad (14)$$

3.2 Result of WTP method (discrete choice hedonic model model)

- Result [Appendix.Fig2](#):
 - Suppose homogeneous expected return from investors (PanelA)
Investors are willing to give up 3.7 ppts in IRR (calculate the WTP first, than map it to IRR)
 - Suppose heterogeneous expected return from investors (PanelB)
Investors are 3.5 ppts in IRR (PanelB)
- Note:
Col3~Col6 is for robustness test

3.3 Difference of WTP among LP types

- Result [Appendix.Fig3](#):
development organizations, financial institutions, and public pensions have large positive WTP for impact with estimates ranging from 13 to 27 percentile ranks (2.5–6.2 ppts in excess IRR)
- Note:
Col1 : Homogenous
Col2 : Heterogenous
Col3~Col4 : robustness check

3.4 Difference of WTP among LP attributes

- Result [Appendix.Fig4](#):

| Investor Attribute | Result |
|--------------------------|-----------------|
| Mission Objective | 3.4 ~ 6.2 IRR |
| Investor facing pressure | 2.3 ~ 3.3 IRR |
| Laws of fiduciary duty | -4.2 ~ -6.7 IRR |

B. Appendix

Fig1

Table 3

The performance of impact funds, vintage years 1995–2012.

Fund performance (Panel A, IRR; Panel B, VM; Panel C, percentile rank) is regressed on a dummy variable for impact funds and controls. Controls include vintage year, log of fund size, log of fund sequence number, fund geography, and fund industry. Models (1) to (3) step in controls without interactions using 5 geographies and 12 industries. Model (4) creates fund group dummy variables based on 6 three-year vintage groups (1995–97 through 2010–12) and 5 fund geographies in place of vintage year and geography FEs of Model (3). Model (5) creates fund group dummy variables based on 6 three-year vintage groups and 12 fund industries in place of vintage year and industry FEs of Model (3). Model (6) creates fund group dummy variables based on 6 three-year vintage groups, 5 fund industries, and North America/Europe v. other funds. The 5 fund industries include (1) information technology and business services, (2) diversified and consumer discretionary, (3) health care, (4) media and communications, and (5) others (energy, industrials, infrastructure, food and ag., materials, real estate). Models that include fund size in the regression lose observations of traditional VC funds with missing fund size. Robust standard errors (in brackets) are calculated by clustering on vintage years and fund geography. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|-----------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|
| <i>Panel A: IRR</i> | | | | | | |
| Impact | -7.890*** [2.548] | -9.937*** [2.386] | -4.701** [2.282] | -4.898** [2.440] | -4.652* [2.555] | -5.359** [2.520] |
| Observations | 1283 | 1252 | 1252 | 1252 | 1252 | 1252 |
| R-squared | 0.004 | 0.146 | 0.166 | 0.288 | 0.19 | 0.274 |
| <i>Panel B: Value multiple</i> | | | | | | |
| Impact | -0.403*** [0.124] | -0.465*** [0.107] | -0.361*** [0.137] | -0.265* [0.141] | -0.228* [0.122] | -0.194* [0.103] |
| Observations | 1456 | 1417 | 1417 | 1417 | 1417 | 1417 |
| R-squared | 0.002 | 0.117 | 0.125 | 0.184 | 0.122 | 0.204 |
| <i>Panel C: Percentile rank</i> | | | | | | |
| Impact | -0.149*** [0.037] | -0.158*** [0.037] | -0.089** [0.040] | -0.093** [0.045] | -0.083** [0.040] | -0.078* [0.040] |
| Observations | 1505 | 1465 | 1465 | 1465 | 1465 | 1465 |
| R-squared | 0.014 | 0.027 | 0.068 | 0.17 | 0.121 | 0.164 |
| <i>Controls for all panels in column</i> | | | | | | |
| Vintage year FE | NO | YES | YES | NO | NO | NO |
| Log(fund size) | NO | YES | YES | YES | YES | YES |
| Log(fund sequence) | NO | YES | YES | YES | YES | YES |
| Fund geography FE | NO | NO | YES | NO | YES | NO |
| Fund industry FE | NO | NO | YES | YES | NO | NO |
| Vintage group*Geography | NO | NO | NO | YES | NO | NO |
| Vintage group*Industry | NO | NO | NO | NO | YES | NO |
| Vintage grp.*Industry*Geography | NO | NO | NO | NO | NO | YES |

Fig2

Table 5

The willingness to pay for impact.

The dependent variable is a dummy variable that equals one if an LP invests in a fund. Observations are determined by crossing all vintage year funds with LPs that make an investment in that year. All columns except column (2) are a logit model with LP investment group controls. LPs are dynamically placed in one of 368 groups according to how many prior three-year investments they make in VC by LP type. Column (2) is a conditional logit model (LP fixed effects). Columns (3) and (4) drop ex-ante top-quartile VC funds and top 15 VCs, respectively, investment opportunities for LPs that have no prior relation with the VC fund families. Column (5) creates an opportunity set assuming that a GP was fundraising in year t (and thus is included in the fund opportunity set for LPs investing in year t) if it closed a fund in year $t+1$ and its predecessor fund was raised in $t-5$ or older. Column (5) creates an opportunity set assuming that an LP considers investments in year t but does not realize investments until $t+1$. *Impact* equals one for impact funds. *Expected returns* are expressed as percentile ranks relative to vintage year cohort funds and are modeled based on known fund characteristics at the time of investment and are adjusted for shrinkage. In Panel A, a fund's expected return forecast is homogenous across all investors. Panel B allows heterogeneous forecast for each fund by LP type. The WTP estimate is the ratio of the *Impact* coefficient divided by the *Expected returns* coefficient. Standard controls included in all columns are LP experience (log of years since first fund investment plus one), LP-GP relationship (we analyze five regions rather than eight by combining Emerging Europe, Africa, and Central and South America into "Rest of the World" and Emerging Asia-Pacific and Middle East into "Emerging Asia-Pacific"; however, to establish an LP-fund geography match, we continue to employ the eight-region code first and then combine the eight home bias dummies into five), fund-LP geography match (five dummy variables for five regions that equal one if the fund and LP are in the same region), expected fund size, and fixed effects for fund geography (five regions), industry (12 industries), and vintage year. Standard errors in brackets are clustered at the LP level, except for the conditional logit. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| <i>Panel A: Homogeneous expected returns forecast</i> | | | | | | |
| Expected returns | 3.354*** [0.276] | 3.426*** [0.210] | 3.248*** [0.363] | 2.833*** [0.354] | 3.146*** [0.270] | 3.307*** [0.275] |
| Impact | 0.591*** [0.0599] | 0.585*** [0.0443] | 0.599*** [0.0645] | 0.567*** [0.0643] | 0.590*** [0.0599] | 0.580*** [0.0595] |
| WTP estimate | 0.176 | 0.171 | 0.184 | 0.200 | 0.188 | 0.175 |
| Pseudo R-squared | 0.261 | 0.237 | 0.264 | 0.269 | 0.258 | 0.263 |
| Observations | 3047,430 | 3047,430 | 2780,390 | 2944,643 | 3301,101 | 3873,720 |
| <i>Panel B: Heterogeneous expected returns forecast</i> | | | | | | |
| Expected Returns | 4.655*** [0.225] | 4.725*** [0.140] | 5.072*** [0.253] | 5.022*** [0.262] | 4.622*** [0.227] | 4.655*** [0.225] |
| Impact | 0.613*** [0.0577] | 0.602*** [0.0422] | 0.650*** [0.0589] | 0.645*** [0.0588] | 0.618*** [0.0579] | 0.613*** [0.0577] |
| WTP Estimate | 0.132 | 0.127 | 0.128 | 0.128 | 0.134 | 0.132 |
| Pseudo R-squared | 0.263 | 0.240 | 0.267 | 0.272 | 0.259 | 0.263 |
| Observations | 3047,430 | 3047,430 | 2780,390 | 2704,939 | 3159,087 | 3047,430 |
| <i>Model:</i> | | | | | | |
| Logit with dynamic LP invest. groups | Yes | – | Yes | Yes | Yes | Yes |
| Conditional logit model | – | Yes | – | – | – | – |
| # F.E. (LP or dynamic LP groups) | 368 | 3460 | 368 | 368 | 368 | 368 |
| <i>Sample restrictions:</i> | | | | | | |
| Drop top quartile unless prior relation | – | – | Yes | – | – | – |
| Drop top 15 VCs unless prior relation | – | – | – | Yes | – | – |
| Expanded fundraising years | – | – | – | – | Yes | – |
| Expanded LP investor set | – | – | – | – | – | Yes |

Fig3

Table 6

Willingness to pay for impact by investor type.

Presented are coefficients and willingness-to-pay estimates from investment choice logit models. The columns vary in their estimation or use of the expected return forecast. Column (1) implements a homogenous model to forecast expected returns, where we estimate a single estimate of the forecast expected returns by fund using all funds in the dataset. Columns (2) and (3) use LP-type specific expected return forecasts but forecast with a smaller set of information (only funds invested by the investor type). Column (3) uses the same forecast as column (2) and also interacts these forecasts with fund characteristics (industry, geography, and size). Column (4) drops the expected return forecast variable altogether. Note that WTP is reported only for columns (1)-(3). Standard errors clustered at the LP level are in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

| | (1) | | (2) | | (3) | | (4) |
|--|------------------------|---------|-------------------------------------|---------|---------------------|---------|--|
| <i>Expected returns forecast:</i> | Homogenous ER forecast | | Heterogenous ER forecast by LP type | | | | No forecast |
| <i>Reported from logit:</i> | Estimates | WTP | Estimates | WTP | Estimates | WTP | Estimates |
| Expected return | 3.364*** [0.275] | | 4.591*** [0.223] | | 5.568*** [1.584] | | Note: Not comparable to columns (1) and (2). |
| Impact estimates by LP type: | | | | | | | |
| Development org. | 0.906*** [0.180] | 0.27*** | 0.738*** [0.183] | 0.16*** | 0.980*** [0.155] | 0.14*** | 0.595*** [0.180] |
| Foundation | 0.267 [0.179] | – | 0.299* [0.179] | 0.06* | 0.469*** [0.178] | 0.07*** | 0.00261 [0.178] |
| Financial institution | 0.765*** [0.144] | 0.23*** | 0.710*** [0.144] | 0.15*** | 0.852*** [0.122] | 0.13*** | 0.483*** [0.141] |
| Endowment | –0.518 [0.346] | – | –0.443 [0.346] | – | –0.300 [0.360] | – | –0.802** [0.343] |
| Corporation | –0.0188 [0.233] | – | 0.0655 [0.224] | – | 0.238 [0.194] | – | –0.316 [0.232] |
| Institutional | 0.0872 [0.182] | – | 0.233 [0.182] | – | 0.501*** [0.157] | 0.08*** | –0.187 [0.181] |
| Wealth manager | 0.121 [0.329] | – | 0.23 [0.332] | – | 0.449 [0.335] | – | –0.142 [0.325] |
| Private pension | –0.153 [0.168] | – | –0.0746 [0.168] | – | 0.0834 [0.174] | – | –0.440*** [0.165] |
| Public pension | 0.730*** [0.121] | 0.22*** | 0.832*** [0.119] | 0.18*** | 1.028*** [0.107] | 0.16*** | 0.430*** [0.121] |
| Region*Impact F.E. | YES | | YES | | YES | | YES |
| ER interacts with portfolio choice variables | NO | | NO | | YES | | NO |
| Standard controls | YES | | YES | | YES | | YES |
| Pseudo R-squared | 0.261 | | 0.264 | | 0.276 | | 0.260 |
| Observations | 3047,430 | | 3047,430 | | 3047,430 | | 3047,430 |

Fig4

Table 8

The willingness to pay for impact by investor attribute.

This table presents logit model estimates (Panel A) and willingness-to-pay estimates (Panel B) including variables to test the incremental willingness to pay for investor attributes. In columns (1) to (3), a fund's expected return forecast is homogenous across all investors. Columns (4) to (6) allows heterogeneous forecast for each fund by LP type. All columns include the interaction of the impact variable with the six LP attribute dummies, a UNPRI signatory dummy variable (that is one for LPs that signed the UNPRI), and a UNPRI post-signing dummy variable. Columns (2) and (5) add in the interaction of the impact variable with the LP geography. Columns (3) and (6) further add the ten LP types and impact interactions. All models include standard controls (see text and Table 5 for details). Standard errors clustered at the LP level are in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|------------------------|----------------------|----------------------|--------------------------|---------------------|----------------------|
| | Homogenous ER forecast | | | Heterogenous ER forecast | | |
| <i>Panel A: Model estimates</i> | | | | | | |
| Expected returns | 3.393*** [0.276] | 3.381*** [0.276] | 3.386*** [0.276] | 4.609*** [0.223] | 4.607*** [0.223] | 4.608*** [0.222] |
| Impact estimates by investor attribute | | | | | | |
| UNPRI signatory | 0.411*** [0.132] | 0.317** [0.140] | 0.357*** [0.134] | 0.377*** [0.135] | 0.284** [0.142] | 0.328** [0.136] |
| UNPRI post-signing | 0.737*** [0.211] | 0.702*** [0.211] | 0.754*** [0.211] | 0.791*** [0.219] | 0.764*** [0.219] | 0.802*** [0.218] |
| Mission | 0.916*** [0.322] | 0.884*** [0.313] | | 0.866*** [0.332] | 0.764** [0.318] | |
| Household | 0.370 [0.234] | 0.319 [0.219] | | 0.422* [0.240] | 0.277 [0.228] | |
| Intermediated | -0.206 [0.178] | -0.224 [0.178] | | -0.0528 [0.180] | -0.052 [0.179] | |
| Pressure | 0.987*** [0.138] | 1.005*** [0.145] | 0.553** [0.229] | 0.957*** [0.139] | 0.996*** [0.147] | 0.569** [0.234] |
| Charter | 0.14 [0.305] | 0.196 [0.293] | 0.404 [0.515] | 0.238 [0.315] | 0.203 [0.305] | 0.382 [0.517] |
| Laws | -0.835*** [0.211] | -0.711*** [0.222] | -0.942*** [0.353] | -0.652*** [0.216] | -0.526** [0.226] | -0.935*** [0.353] |
| Impact | 0.0668 [0.336] | n/a | n/a | -0.0472 [0.347] | n/a | n/a |
| <i>Panel B: Incremental willingness to pay (WTP)</i> | | | | | | |
| UNPRI signatory | 0.12*** | 0.09** | 0.11*** | 0.08*** | 0.06** | 0.07** |
| UNPRI post-signing | 0.22*** | 0.21*** | 0.22*** | 0.17*** | 0.17*** | 0.17*** |
| Mission | 0.27*** | 0.26*** | | 0.19*** | 0.17** | |
| Household | - | - | | 0.09* | - | |
| Intermediated | - | - | | - | - | |
| Pressure | 0.29*** | 0.30*** | 0.16** | 0.21*** | 0.22*** | 0.12** |
| Restrictions by charter | - | - | - | - | - | - |
| Restrictions by laws | -0.24*** | -0.21*** | -0.28*** | -0.14*** | -0.11** | -0.2 *** |
| Standard controls | YES | YES | YES | YES | YES | YES |
| LP attributes | YES | YES | YES | YES | YES | YES |
| Impact*LP geo | NO | YES | NO | NO | YES | NO |
| Impact*LP type | NO | NO | YES | NO | NO | YES |
| Pseudo R-squared | 0.262 | 0.262 | 0.262 | 0.264 | 0.264 | 0.264 |
| Observations | 3047,430 | 3047,430 | 3047,430 | 3047,430 | 3047,430 | 3047,430 |