

## **Sampling Procedure and construction of sampling weights for the 2015 Zimbabwe Manufacturing firm survey**

This document explains the sampling procedure that was used for the 2015 Zimbabwe manufacturing survey. The survey was implemented in the period July - December 2015.

### *A. Choice of strata: size, sector, and location*

The population for the survey consisted of manufacturing firms with at least 5 employees each.

#### Size strata

Three different size strata were defined for the survey, namely ‘small’ (5-9 employees), ‘medium’ (10-99 employees), and ‘large’ (100+ employees).

#### Industry strata

The survey covered all manufacturing industries and distinguished between the following 6 industry strata based on 2-digit ISIC Rev.2:

- 31 - Manufacture of Food, Beverages and Tobacco
- 32 - Textile, Wearing Apparel and Leather Industries
- 33 - Manufacture of Wood and Wood Products, Including Furniture
- 35 - Manufacture of Chemicals, Petroleum, Coal, Rubber and Plastic Products
- 38 - Manufacture of Fabricated Metal Products, Machinery and Equipment
- 34,36,37,39 - Other manufacturing

#### Location strata

The survey imposed the following location strata:

- (i) Harare and surrounds (towns within 50 km from Harare.)
- (ii) Bulawayo
- (iii) Gweru, Kwekwe and Redcliff (in Midlands)
- (iv) Mutare (in Manicaland)

The surrounding area of Harare includes the following towns: Arcturus, Bindura, Glendale, Shamva, Tafuna, Chitungwiza, Marondera, Ruwa, Norton, Mazowe, Helensvale, Nyabira, Somerby, Epworth.

Therefore the relatively large towns Chegutu, Kadoma, Banket, Chinhoyi in Mashonaland West are not included in the sample. Also the towns in the regions of Matabeleland and Masvingo are not included. According to the 2015 Register, manufacturing firms in these excluded regions make up 5.9% of all manufacturing firms (with 5+ employees).

## B. *Sampling frame*

### Population totals by survey strata

A major challenge was the unavailability of a sampling frame at the time of the survey. ZIMSTAT keeps a business register with firm level names and addresses but this was not made available for the survey. However, ZIMSTAT provided the aggregate number of firms from the 2015 ZIMSTAT Central Business register by size (5-19, 20-99, 100+ employees), sector (ISIC Revision 4, 4-digit, converted to 2-digit ISIC Rev.2)<sup>1</sup> and location (10 regions comprising: Bulawayo, Harare, Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West, Masvingo, Matabeleland North, Matabeleland South, Midlands).

**Table 1: 2015 Register: Firm numbers by region and industry and size strata**

|                      | Strata ISICRev.2   | 5-19       | 20-99      | 100+       | Total       |
|----------------------|--|------------|------------|------------|-------------|
| Bulawayo             | 31 - Food, Beverages and Tobacco                               | 22         | 13         | 4          | 39          |
|                      | 32 - Textile, Wearing Apparel and Leather Industries           | 19         | 17         | 10         | 46          |
|                      | 33 - Wood and Wood Products, Including Furniture               | 9          | 7          | 2          | 18          |
|                      | 34,36-37,39 - Other manufacturing                              | 21         | 13         | 8          | 42          |
|                      | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products s | 18         | 6          | 3          | 27          |
|                      | 38 - Fabricated Metal Products, Machinery and Equipment        | 28         | 11         | 7          | 46          |
| Harare & Mashonaland | 31 - Food, Beverages and Tobacco                               | 58         | 42         | 16         | 116         |
|                      | 32 - Textile, Wearing Apparel and Leather Industries           | 40         | 13         | 11         | 64          |
|                      | 33 - Wood and Wood Products, Including Furniture               | 77         | 29         | 5          | 111         |
|                      | 34,36-37,39 - Other manufacturing                              | 59         | 40         | 17         | 116         |
|                      | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products s | 57         | 27         | 8          | 92          |
|                      | 38 - Fabricated Metal Products, Machinery and Equipment        | 102        | 59         | 14         | 175         |
| Manicaland           | 31 - Food, Beverages and Tobacco                               | 10         | 7          | 2          | 19          |
|                      | 32 - Textile, Wearing Apparel and Leather Industries           | 5          | 0          | 0          | 5           |
|                      | 33 - Wood and Wood Products, Including Furniture               | 17         | 8          | 4          | 29          |
|                      | 34,36-37,39 - Other manufacturing                              | 7          | 3          | 0          | 10          |
|                      | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products s | 4          | 0          | 0          | 4           |
|                      | 38 - Fabricated Metal Products, Machinery and Equipment        | 15         | 1          | 1          | 17          |
| Midlands             | 31 - Food, Beverages and Tobacco                               | 11         | 8          | 4          | 23          |
|                      | 32 - Textile, Wearing Apparel and Leather Industries           | 2          | 2          | 0          | 4           |
|                      | 33 - Wood and Wood Products, Including Furniture               | 4          | 1          | 0          | 5           |
|                      | 34,36-37,39 - Other manufacturing                              | 15         | 12         | 5          | 32          |
|                      | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products s | 0          | 2          | 1          | 3           |
|                      | 38 - Fabricated Metal Products, Machinery and Equipment        | 13         | 5          | 2          | 20          |
| <b>TOTAL</b>         |  | <b>613</b> | <b>326</b> | <b>124</b> | <b>1063</b> |

For the purpose of the 2015 Zimbabwe manufacturing survey, the 2015 register numbers were treated as comprehensive and correct.<sup>2</sup> Table 1 presents the population totals by region, industry and size from the

<sup>1</sup>31 - Manufacture of Food, Beverages and Tobacco

32 - Textile, Wearing Apparel and Leather Industries

33 - Manufacture of Wood and Wood Products, Including Furniture

35 - Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products

38 - Manufacture of Fabricated Metal Products, Machinery and Equipment

34,36-37,39 Other (excluding repair)

<sup>2</sup>There are some concerns about how complete and comprehensive Central Business Register is. The Zimbabwe National Statistics Agency (ZIMSTAT) conducted a 2013/2014 Central Business Register (CBR) Inquiry to collect information necessary for the setting up of a functional Central Business Register. "The inquiry covered all the

2015 business register. Here we present only the 4 regions that include the four locations the survey focuses on - Harare and surrounds (in Harare and Mashonaland), Bulawayo, Gweru/Kwekwe/Redcliff (in Midlands), Mutare (in Manicaland).

One issue is that we do not have firm numbers by town/city. We are therefore unable to directly determine the 2015 population of manufacturing firms at the following town level strata: (i) Harare and surrounds, (ii) Gweru, Kwekwe, Redcliff, and (iii) Mutare.

**Table 2: Estimated sample frame with total number of 2015 firms within each region adjusted to cover towns included in location strata.**

|                                   | <b>Strata ISICRev.2</b>                                      | <b>5-19</b> | <b>20-99</b> | <b>100+</b> | <b>Total</b> |
|-----------------------------------|--|-------------|--------------|-------------|--------------|
| Bulawayo                          | 31 - Food, Beverages and Tobacco                             | 22          | 13           | 4           | 39           |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 19          | 17           | 10          | 46           |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 9           | 7            | 2           | 18           |
|                                   | 34,36-37,39 - Other manufacturing                            | 21          | 13           | 8           | 42           |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 18          | 6            | 3           | 27           |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 28          | 11           | 7           | 46           |
| Harare & Mashonaland              | 31 - Food, Beverages and Tobacco                             | 52          | 38           | 14          | 105          |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 36          | 12           | 10          | 58           |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 69          | 26           | 5           | 100          |
|                                   | 34,36-37,39 - Other manufacturing                            | 53          | 36           | 15          | 105          |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 51          | 24           | 7           | 83           |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 92          | 53           | 13          | 158          |
| Manicaland (Mutare)               | 31 - Food, Beverages and Tobacco                             | 9           | 6            | 2           | 16           |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 4           | 0            | 0           | 4            |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 15          | 7            | 3           | 25           |
|                                   | 34,36-37,39 - Other manufacturing                            | 6           | 3            | 0           | 9            |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 3           | 0            | 0           | 3            |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 13          | 1            | 1           | 15           |
| Midlands (Gweru, Kwekwe/Redcliff) | 31 - Food, Beverages and Tobacco                             | 10          | 7            | 3           | 20           |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 2           | 2            | 0           | 3            |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 3           | 1            | 0           | 4            |
|                                   | 34,36-37,39 - Other manufacturing                            | 13          | 10           | 4           | 28           |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 0           | 2            | 1           | 3            |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 11          | 4            | 2           | 17           |
| <b>TOTAL</b>                      |  | <b>560</b>  | <b>299</b>   | <b>114</b>  | <b>973</b>   |

Consequently, the following approach was followed to calculate the universe of firms by location strata. First the share of the strata towns in each region using the 2011 register was calculated. Next the total

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establishments operating on a fixed location in Zimbabwe which were either registered or licenced or both by any arm of government excluding government ministries.” (Zimstat, 2014: vii). The 2013 Central Business Register Inquiry Report (ZIMSTAT 2014) noted that ZIMSTAT only obtained a 81.2% response rate to questionnaires dropped off at potential firms, but the response rate for Harare was only 43%.

number of firms in each region of the 2015 register was adjusted using these shares.<sup>3</sup> Note that the total number of firms in the region is adjusted. No adjustment for the firms in the industry-size-region substrata categories was made. Table 2 presents the estimated sample frame for the 4 locations in the survey.<sup>4</sup>

#### Construction of sampling frame (list of firms)

Because the 2015 business register itself was unavailable, we used the following three lists to create a list of firms (sampling frame):

- 1) Full 2011 business register with information on size category (5-19, 20-99, 100+ employees), 4-digit ISIC code, name, and town/city (199 cities in the 10 regions)
- 2) The list of RPED firms interviewed in 1993-95
- 3) An 'alternative' list of firms derived from other sources.<sup>5</sup> These lists include:
  - a. Online directories: Yellow Pages and The Directory
  - b. ZIMTRADE 2015 Directory
  - c. Zimbabwe Textile Manufacturers Association list
  - d. Zimbabwean National Chamber of Commerce List
  - e. The Association for Business in Zimbabwe (ABUZ)

The three lists were made mutually exclusive by (i) omitting the RPED firms from the 2011 business register list, and (ii) omitting the RPED and 2011 business register firms from the alternative list. Also duplicate firms were omitted from each of the lists.

#### Correction for attrition

Both the 2011 business register and RPED lists included firms that were no longer active at the time of sampling for the 2015 manufacturing survey. These lists were therefore updated as follows. The 2011 business register was updated by taking random samples of firms from the 2011 business register for each of the four sample locations (Harare and surrounds, Bulawayo, Gweru/Kwekwe/Redcliff, Mutare). The status of each firm in these random samples was verified by direct visits, net searches and consultation with other businesses. Using the information on the current status, the number of firms that was eligible in the sample was determined. Firms were not eligible if they were operating outside the manufacturing

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<sup>3</sup>For example: Firms in location strata category "Harare and surrounds" made up 90% of all manufacturing firms (5+ employees) firms in the region "Harare and Mashonaland" using the 2011 Register. To obtain the total number of manufacturing firms for the sample frame, we multiplied the number of 2015 Register firms in the region "Harare and Mashonaland" 2015 Register by 0.9. The town Mutare makes up 86% of manufacturing firms (5+ employees) in Manicaland, while Gweru/Kwekwe/Redcliff make up 87% of manufacturing firms in the region Midlands).

<sup>4</sup> We note that the row totals do not always equal to what is reported in the 'Total' column because of rounding.

<sup>5</sup> Firms were selected from the Yellow Pages and The Directory using various key words, (Manufacturing, cloth, hats, food, furniture, Engineering ...) as well as given categories provided by the online directories (Agricultural equipment and machinery, Adhesives, Textiles, ...).

sector, closed, or impossible to be found. For each location the share of eligible firms was used to estimate the total number of eligible firms in the 2011 business register.<sup>6</sup>

The RPED list was also updated by contacting all RPED firms. Also in this case firms that were operating outside the manufacturing sector, closed, or impossible to be found were classified as ineligible.<sup>7</sup>

Also the 'alternative' list included firms that were operating outside the manufacturing sector, closed, or could not be found. For each location we estimated the percent of firms that were eligible in the alternative list and used these estimates to estimate the total number of eligible firms in the alternative list.<sup>8</sup>

### Correction for changes in size category

With decline in Zimbabwe economy, many firms in 2015 have been downsizing in the past and therefore were no longer consistent with their categorization according to the 2011 Register and RPED. We therefore compared the original size category ('small', 'medium', 'large') (in 2011 for the 2011 Business Register and 1995 for the RPED firms) with the actual size category in 2015 for the sample of interviewed firms drawn from the 2011 register and RPED list respectively. This information is summarized in size transition matrices for both the 2011 register firms and RPED firms for each location strata (see Table A.1 in appendix A). No transition matrix for the RPED firms in Mutare could be calculated because no RPED firms were interviewed in this strata (1 firm should have been interviewed but was not because of non-response).

Based on these transition matrices we can estimate the number of firms from the 2011 Business Register and RPED in each strata at the time of survey. This information will be needed to calculate the sampling weights (see later).

### *C. Sampling procedure*

A stratified sampling procedure was used with size, industry and location strata. The desired sample size for the survey was set at 240 manufacturing firms.

The sample oversampled firms outside the two location strata Harare and surrounds and Bulawayo, such that at least 20 firms were included in each of the location strata of Manicaland (Gweru / Kwekwe / Redcliff) and Midlands (Mutare).

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<sup>6</sup> The percent of eligible firms for the 2011 business register was estimated to be 49.3, 40.2, 57.7 and 50.0% for Harare and surrounds, Bulawayo, Gweru/Kwekwe/Redcliff, and Mutare respectively.

<sup>7</sup> The percent of eligible RPED firms was estimated to be 52.6, 34.5, 40.0 and 50.0% for Harare and surrounds, Bulawayo, Gweru/Kwekwe/Redcliff, and Mutare respectively.

<sup>8</sup> The percent of eligible firms in the alternative list was estimated to be 41.1, 31.4, 31.8 and 37.5% for Harare and surrounds, Bulawayo, Gweru/Kwekwe/Redcliff, and Mutare respectively.

The sample also was designed to have an equal distribution of 80 firms each across the three size strata (5-19, 20-99, 100+ employees). This results in an oversampling of large firms and undersampling of small firms.

The detailed process of deriving the sample across all strata was as follows:

#### Step 1 – imposing minimum samples sizes for each size strata

Using the estimated sample frame (Table 2), a minimum of 80 firms was set in each size category and allocated proportionately across industry and locations (and then rounded off). An implication was that large firms were oversampled. This gave rise to Table 3 below.

**Table 3: First step**

| RegionSTrata                      | Strata ISICRev.2   | 5-19      | 20-99     | 100+      | Total      |
|-----------------------------------|--|-----------|-----------|-----------|------------|
| Bulawayo                          | 31 - Food, Beverages and Tobacco                             | 3         | 3         | 3         | 9          |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 3         | 5         | 7         | 15         |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 1         | 2         | 1         | 4          |
|                                   | 34,36-37,39 - Other manufacturing                            | 3         | 3         | 6         | 12         |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 3         | 2         | 2         | 7          |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 4         | 3         | 5         | 12         |
| Harare & Mashonaland              | 31 - Food, Beverages and Tobacco                             | 7         | 10        | 10        | 27         |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 5         | 3         | 7         | 15         |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 10        | 7         | 3         | 20         |
|                                   | 34,36-37,39 - Other manufacturing                            | 8         | 10        | 11        | 29         |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 7         | 7         | 5         | 19         |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 13        | 14        | 9         | 36         |
| Manicaland (Mutare)               | 31 - Food, Beverages and Tobacco                             | 1         | 2         | 1         | 4          |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 1         | 0         | 0         | 1          |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 2         | 2         | 2         | 6          |
|                                   | 34,36-37,39 - Other manufacturing                            | 1         | 1         | 0         | 2          |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 0         | 0         | 0         | 0          |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 2         | 0         | 1         | 3          |
| Midlands (Gweru, Kwekwe/Redcliff) | 31 - Food, Beverages and Tobacco                             | 1         | 2         | 2         | 5          |
|                                   | 32 - Textile, Wearing Apparel and Leather Industries         | 0         | 0         | 0         | 0          |
|                                   | 33 - Wood and Wood Products, Including Furniture             | 0         | 0         | 0         | 0          |
|                                   | 34,36-37,39 - Other manufacturing                            | 2         | 3         | 3         | 8          |
|                                   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 0         | 0         | 1         | 1          |
|                                   | 38 - Fabricated Metal Products, Machinery and Equipment      | 2         | 1         | 1         | 4          |
| <b>TOTAL</b>                      |  | <b>79</b> | <b>80</b> | <b>80</b> | <b>239</b> |

Note: Each element is rounded off

Table 3 gives rise to the following total firm numbers by location and size strata (see Total column in Table 4 below).

**Table 4: First step aggregated**

|                                    | 5-19 | 20-99 | 100+ | Total | Minimum   |
|------------------------------------|------|-------|------|-------|-----------|
| Bulawayo                           | 17   | 18    | 24   | 59    | 56        |
| Harare & Surrounds                 | 50   | 51    | 45   | 146   | 137       |
| Manicaland: Mutare                 | 7    | 5     | 4    | 16    | <b>23</b> |
| Midlands: (Gweru, Kwekwe/Redcliff) | 5    | 6     | 7    | 18    | <b>23</b> |
| Total                              | 79   | 80    | 80   | 239   |           |

**Step 2– imposing minimum samples sizes for each location strata**

This process gave rise to too few firms in Mutare (Manicaland) (16) and Gweru/Kwekwe/Redcliff (Midlands) (18). A desired number of 23 firms in each of these town groups was set.

The residual number of firms outside the location strata Gweru/Kwekwe/Redcliff and Mutare ( $239 - 23 - 23 = 193$ ) were allocated to Bulawayo and Harare proportionately (e.g. firms in Bulawayo =  $59/(59+146)*193 = 56$  and for Harare  $146/(59+146)*193 = 137$ , see column Minimum of Table 4).

The sample sizes in each size-industry strata category within the location strata categories were scaled up proportionately and then rounded off. E.g. for Midlands, a total of 18 firms had been selected in the first step above. Values in each size-industry category in Table 5 were scaled upwards by  $23/18$  where 23 was the desired number of firms for Midlands. Because of rounding off issues, the final number of firms only summed to 21.

This gave rise to the desired sample as presented in Table 5. We note that large firms are oversampled and the same holds for firms in Mutare (Manicaland) and Gweru/Kwekwe/Redcliff (Midlands). The total number of firms (242) exceeds the desired sample of 240 due to rounding off.

**Table 5: Desired sample**

| RegionSTrata                            | Strata ISICRev.2   | 5-19 | 20-99 | 100+ | Total |
|---|--|------|-------|------|-------|
| Bulawayo                                | 31 - Food, Beverages and Tobacco                             | 3    | 3     | 3    | 9     |
|   | 32 - Textile, Wearing Apparel and Leather Industries         | 3    | 5     | 7    | 15    |
|   | 33 - Wood and Wood Products, Including Furniture             | 1    | 2     | 1    | 4     |
|   | 34,36-37,39 - Other manufacturing                            | 3    | 3     | 6    | 12    |
|   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 3    | 2     | 2    | 7     |
|   | 38 - Fabricated Metal Products, Machinery and Equipment      | 4    | 3     | 5    | 12    |
| Harare<br>& Mashonaland                 | 31 - Food, Beverages and Tobacco                             | 7    | 9     | 9    | 25    |
|   | 32 - Textile, Wearing Apparel and Leather Industries         | 5    | 3     | 7    | 15    |
|   | 33 - Wood and Wood Products, Including Furniture             | 9    | 7     | 3    | 19    |
|   | 34,36-37,39 - Other manufacturing                            | 8    | 9     | 10   | 27    |
|   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 7    | 7     | 5    | 19    |
|   | 38 - Fabricated Metal Products, Machinery and Equipment      | 12   | 13    | 8    | 33    |
| Manicaland<br>(Mutare)                  | 31 - Food, Beverages and Tobacco                             | 1    | 3     | 1    | 5     |
|   | 32 - Textile, Wearing Apparel and Leather Industries         | 1    | 0     | 0    | 1     |
|   | 33 - Wood and Wood Products, Including Furniture             | 3    | 3     | 3    | 9     |
|   | 34,36-37,39 - Other manufacturing                            | 1    | 1     | 0    | 2     |
|   | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 0    | 0     | 0    | 0     |
|   | 38 - Fabricated Metal Products, Machinery and Equipment      | 3    | 0     | 1    | 4     |
| Midlands<br>(Gweru,<br>Kwekwe/Redcliff) | 31 - Food, Beverages and Tobacco                             | 1    | 3     | 3    | 7     |
|   | 32 - Textile, Wearing Apparel and Leather Industries         | 0    | 0     | 0    | 0     |
|   | 33 - Wood and Wood Products, Including Furniture             | 0    | 0     | 0    | 0     |
|   | 34,36-37,39 - Other manufacturing                            | 3    | 4     | 4    | 11    |

|              |  |           |           |           |            |
|--------------|--|-----------|-----------|-----------|------------|
|              | 35 - Chemicals, Petroleum, Coal, Rubber and Plastic Products | 0         | 0         | 1         | 1          |
|              | 38 - Fabricated Metal Products, Machinery and Equipment      | 3         | 1         | 1         | 5          |
| <b>TOTAL</b> |  | <b>81</b> | <b>81</b> | <b>80</b> | <b>242</b> |

Table 6 aggregates the desired sample to the city/town and size categories. It can be noted that the final number of firms by location strata (see total column of Table 6) do not exactly equal the desired number (see minimum column in Table 4) due to rounding off. For example: in step 2 all elements for Midlands (Gweru/Kwekwe/Redcliff) in Table 3 were raised by a factor of  $23/18 = 1.28$ . However, this led to no change in the desired sample of firms in an industry-size category in cases where there was only one firm in that category, (e.g. there is only 1 small firm in ISIC 31 – Food in Midlands – see Table 3. Raising this by a factor of 1.28 and then rounding off leaves the desired number of small Food firms as 1 – see Table 5).<sup>9</sup>

**Table 6: Step 2 – Desired sample aggregated to location – size level**

|                                    | 5-19 | 20-99 | 100+ | Total | Share sample frame |
|------------------------------------|------|-------|------|-------|--------------------|
| Bulawayo                           | 17   | 18    | 24   | 59    | 27%                |
| Harare & Surrounds                 | 48   | 48    | 42   | 138   | 23%                |
| Manicaland: (Mutare)               | 9    | 7     | 5    | 21    | <b>29%</b>         |
| Midlands: (Gweru, Kwekwe/Redcliff) | 7    | 8     | 9    | 24    | <b>32%</b>         |
| Total                              | 81   | 81    | 80   | 242   |                    |
| Share sample frame                 | 14%  | 27%   | 70%  |       |                    |

#### Selection of sample firms from the lists

Because our sampling frame consists of three different lists, and the RPED firms were prioritized in the sample (to have enough panel firms), the selection of firms was done with the following steps:

- 1) For each eligible RPED firm (i.e. RPED firm that was found, not closed, and still operating in the manufacturing sector) it was determined in which strata it falls. The number of RPED firms to be interviewed in each strata was set at a maximum of  $\frac{3}{4}$  of firms to be sampled within each strata block (if the number of available RPED firms exceeded the maximum, a random sample of RPED firms was selected). This is to deal with problem where the number of surviving RPED firms exceeds the strata quota. This approach allows us to sample new firms that came into existence subsequent to the RPED survey in each strata.
- 2) Of the remaining required sample in each strata,  $\frac{2}{3}$  is randomly drawn from firms that are in the 2011 Business Register.

<sup>9</sup> This also explains why For instance, if I calculate the new number for the strata (Harare,5-19), this would give  $(137/146)*50=47$ . The table reports 48 however. Also, for instance,it looks like that the strata (Manicalands,5-19) is calculated as  $(21/16)*7$  instead of  $(23/16)*7$



- 3) The final 1/3 of the remaining required sample in each strata is randomly drawn from firms in the ‘alternative’ list that are neither in the 2011 Business Register nor the RPED list. Including firms from the alternative list allows us to update the 2011 Enterprise Register in terms of firms that have registered since 2011.

D. *Final sample of interviewed firms*

The following table presents the final sample of interviewed firms by location and size strata. The actual location-size distribution differs from the intended sample distribution (as reported in Table 6) because the targeted number of firms within each location-industry-size strata could not always be interviewed because of non-response (refusal by firms to be interviewed). Also because of the problem of non-response, the number of interviewed firms was 195 instead of 242. We also note that the small size category (5-19 workers) actually also includes three firms with less than 5 employees.

**Table 7: Actual sample aggregated to location – size level**

|                                  | 5-19 | 20-99 | 100+ | Total |
|----------------------------------|------|-------|------|-------|
| Bulawayo                         | 17   | 23    | 11   | 51    |
| Harare & surrounds               | 33   | 50    | 36   | 119   |
| Manicaland (Mutare)              | 2    | 6     | 2    | 10    |
| Midlands (Gweru/Kwekwe/Redcliff) | 9    | 4     | 2    | 15    |
| Total                            | 61   | 83    | 51   | 195   |

E. *Construction of weights*

Weights were constructed for two reasons. First, the desired sample purposively oversampled the larger firms as well as firms in the locations outside Harare and surrounds and Bulawayo. Second, the actual sample differs from the desired sample because of non-response.

The sampling weights were constructed as follows.

Step 1 – corrections for attrition and size transitions

For each of the three lists (RPED, 2011 business register, alternative list), we estimated the number of firms in each strata after correcting for attrition and size transitions.

## Step 2 – correction for total number of firms

Next we adjusted the estimated number of firms in the 2011 business register and alternative list such that the combined number of firms from all lists (RPED, 2011 business register, alternative list) was equal to the corresponding number from 2015 ZIMSTAT in each strata. For a few strata no firms were reported in both the 2011 business register and alternative list, while 2015 ZIMSTAT indicated a larger number of firms than estimated from the RPED list. In these cases, we further adjusted the estimated number of firms from the 2011 business register and alternative list within each location/sector strata (i.e. combining the size strata).

Note that we did not adjust the total number of RPED firms because their estimated number in step 1 is assumed to be relatively reliable, given that much time and effort was undertaken to track these firms in order to construct the largest possible panel.

## Step 2 – calculation of weights for RPED firms

Separate weights were estimated for the RPED firms and for the firms drawn from the (adjusted) 2011 business register and alternative list. This was done because the RPED firms were already active in the first half of the 1990s, and therefore may be different from firms listed in the recent lists.

The RPED weights were calculated for each strata simply as

$$\frac{\# \text{ Interviewed RPED firms in a strata}}{\text{Estimated \# RPED firms in a strata}}$$

## Step 3 – calculation of weights for non-RPED firms

The weights for non-RPED firms drawn from the (adjusted) 2011 business register and alternative list were calculated as

$$\frac{\# \text{ Interviewed non – RPED firms in a strata}}{\text{Estimated \# non – RPED firms in a strata}}$$

## Step 4

In the last step all weights were further adjusted such that the sum of weights equals the number of firms in the sampling frame (i.e. 973, see Table 2). This adjustment is necessary because not all strata were represented in the sample even if there are firms in these strata in the population (the total sum of weights after step 3 is 817).



## Appendix A.

**Table 1. Size transition matrices by location and survey**

2011 Business register

### Transition matrix by size, count of firms, Harare and surrounds

|                     | Final size |       |      |    |             |
|---------------------|------------|-------|------|----|-------------|
| Initial Strata size | 5-19       | 20-99 | 100+ | <5 | Grand Total |
| 5-19                | 8          | 9     |      |    | 17          |
| 20-99               | 9          | 16    | 4    |    | 29          |
| 100+                | 1          | 6     | 11   |    | 18          |
| Total               | 18         | 31    | 15   | 0  | 64          |

### Transition matrix by size, count of firms, Bulawayo

|                     | Final size |       |      |    |             |
|---------------------|------------|-------|------|----|-------------|
| Initial Strata size | 5-19       | 20-99 | 100+ | <5 | Grand Total |
| 5-19                | 7          | 2     |      |    | 9           |
| 20-99               |            | 8     |      |    | 8           |
| 100+                |            | 3     | 3    |    | 6           |
| Total               | 7          | 13    | 3    | 0  | 23          |

### Transition matrix by size, count of firms, Gweru, Kwekwe and Redcliff

|                     | Final size |       |      |    |             |
|---------------------|------------|-------|------|----|-------------|
| Initial Strata size | 5-19       | 20-99 | 100+ | <5 | Grand Total |
| 5-19                | 2          |       |      |    | 2           |
| 20-99               | 1          | 3     |      |    | 4           |
| 100+                |            |       | 1    | 1  | 2           |
| Total               | 3          | 3     | 1    | 1  | 8           |

### Transition matrix by size, count of firms, Mutare

|                     | Final size |       |      |    |             |
|---------------------|------------|-------|------|----|-------------|
| Initial Strata size | 5-19       | 20-99 | 100+ | <5 | Grand Total |
| 5-19                | 1          |       |      |    | 1           |
| 20-99               |            | 2     |      |    | 2           |
| 100+                |            | 1     | 1    |    | 2           |
| Total               | 1          | 3     | 1    | 0  | 5           |

## RPED firms

**Transition matrix by size, count of firms, Harare and surrounds**

| Initial Strata size | Final size |       |      |    | Grand Total |
|---------------------|------------|-------|------|----|-------------|
|                     | 5-19       | 20-99 | 100+ | <5 |             |
| 5-19                | 1          |       |      |    | 1           |
| 20-99               |            | 5     |      |    | 5           |
| 100+                | 2          | 3     | 15   |    | 20          |
| Total               | 3          | 8     | 15   | 0  | 26          |

**Transition matrix by size, count of firms, Bulawayo**

| Initial Strata size | Final size |       |      |    | Grand Total |
|---------------------|------------|-------|------|----|-------------|
|                     | 5-19       | 20-99 | 100+ | <5 |             |
| 5-19                | 2          |       |      |    | 2           |
| 20-99               | 1          | 1     |      |    | 2           |
| 100+                | 4          |       | 4    |    | 8           |
| Total               | 7          | 1     | 4    | 0  | 12          |

**Transition matrix by size, count of firms, , Gweru, Kwekwe and Redcliff**

| Initial Strata size | Final size |       |      |    | Grand Total |
|---------------------|------------|-------|------|----|-------------|
|                     | 5-19       | 20-99 | 100+ | <5 |             |
| 5-19                | 6          |       |      |    | 6           |
| 20-99               | 1          | 4     |      |    | 5           |
| 100+                |            |       | 2    | 2  | 4           |
| Total               | 7          | 4     | 2    | 2  | 15          |

**Transition matrix by size, count of firms, Mutare**

| Initial Strata size | Final size |       |      |    | Grand Total |
|---------------------|------------|-------|------|----|-------------|
|                     | 5-19       | 20-99 | 100+ | <5 |             |
| 5-19                | -          | -     | -    | -  | -           |
| 20-99               | -          | -     | -    | -  | -           |
| 100+                | -          | -     | -    | -  | -           |
| Total               | -          | -     | -    | -  | -           |

## **Sampling procedure for the Informal Manufacturing Sector**

The survey was conducted over the period November – December 2015.

There is no Census of firms in the informal sector in Zimbabwe. Some insights can be obtained from the FinScope 2012 MSME survey as well as the 2014/15 Business Register that includes information on number of small firms by industry (less than 5 workers). Neither of these provide reliable numbers on the current population of informal manufacturing firms by industry. There is therefore no sample frame from which to randomly draw the sample of firms.

The following criteria were followed in deriving the sample:

- Two regions were selected to conduct surveys: Harare and Bulawayo
- The sample was divided into the following set of industries: Textiles, clothing and Leather products, Wood products, including furniture, Metal fabrication and other (including food processing, chemicals, detergents, plastics, non-metal products, etc.)
- Firms were required to have at least one regular worker (apart from the owner)
- Firms were required to be unregistered with the Registrar of Companies

### **Multistage cluster sampling within each strata**

A multi-stage sampling process was then followed in selecting informal manufacturing firms. This process was made easier by a number of characteristics of informal markets in Zimbabwe where manufacturing takes place.

Firstly, informal manufacturing industries are largely clustered in distinct areas.

Secondly, in some markets (e.g. Mbare market in Harare), firms are clustered within specific complexes (e.g. a defined area such as a building, shed, etc.)

Thirdly, firms within informal markets/areas tend to be clustered by industry and geographic location.

Our approach was as follows:

In the first stage, the two main (or main area where informal production is located in a single area) informal areas for each of the industry strata were selected. Where it is possible or sensible these areas were then divided into blocks of roughly equal numbers of firms based on spatial area or building complex. Blocks were then randomly selected. Firms within each these randomly selected blocks were listed, and a random sample of firms were selected for interviewing purposes.

The interviews were done in Harare and Bulawayo.

## **A. Harare Sample**

In Harare, the interviews were contacted were contacted at; Mbare Magaba and Gazaland complex for metal industry, Glenview complex and Mbare Magaba for wood industry, and Highfield and CBD for textile industry. Here is a summary for the sampling procedure ion Harare.

Metal Industry

### **a) Mbare Magaba Complex (metal industry)**

This is the largest informal metal industry complex in Harare. Within Mbare Magaba Complex are three sub complexes namely Vision Complex, Mbare Complex and Mukuvisi home industry. Vision complex is the biggest of all, so for sampling purposes it was divided into two equal parts and these two were named Vision complex 1 and 2. In Mbare and Mukuvisi complexes there are gates (aisles) that enters into these complexes. These gates were used as our sub sampling clusters. In each gate (aisle) was almost equally the same number of firms (about 30-40). These clusters (gates) were then randomly selected for each complex. In Mbare Complex gate 1 was randomly selected and in Mukuvisi gate 3 was selected and Vision complex 2 was also randomly selected. So we had three sampling clusters randomly selected.

In each cluster, a numbered list of firms was created (i.e. from 1-n). A list of firm numbers in each cluster was generated and it was from this list that firms were selected for interviews. In each cluster an average of 5 firms were interviewed. In Mbare complex gate 1 there were total of 33 firms and 4 firms were interviewed, in Mukuvisi complex gate 3 were 37 firms and 6 firms were interviewed, and in Vision complex 2 were 44 firms and 6 firms were selected.

A total of 16 firms were interviewed in Mbare Magaba Complex.

### **b) Gazaland Complex**

This is another complex were informal metal firms operate. For sampling purposes, this complex was divided into 3 clusters with an average of 40 firms in each cluster. In each cluster firms were numbered. Then from a randomly generated list of firms' numbers, firms were then selected for interviews. Five interviews were conducted in each cluster on average. There were 38 in cluster 1 and 4 were interviewed, 43 in cluster 2 and 5 were interviewed and 40 firms in cluster 3 and 5 firms were selected.

A total of 14 firms were interviewed.

## **2. Wood Industry**

### **a). Mbare wood sector**

In Mbare, two places where informal wood firms operate were identified. There is a major place which we name Temporary Structure (Coffman Complex) where much wood working firms operate and the other place is the Mbare Magaba Complex which comprise of Vision, Mukuvisi and Mbare complexes. In Temporary Stucture (Coffman Complex) 46 firms were numbered and 8 were randomly selected from randomly generated firm numbers. There were 10 firms in Mbare complex and 3 were selected, 10 firms in Mukuvisi and 3 were selected, and 8 firms in Vision Complex and 2 were selected. All these firms were randomly selected. A total of 8 firms were interviewed in Mbare Magaba

A total of 16 firms were interviewed in Mbare wood sector

#### **b). Glenview wood industry complex.**

This is the largest informal wood sector complex in Harare. For sampling purposes this complex was strategically divided into three clusters with between 40-50 firms. Firms were then numbered. In cluster 1 there were 47 firms and 4 firms were selected, 54 firms in cluster 2 and 4 were selected, and 56 firms in cluster 3 and 5 were selected. Then from randomly generated list of firm numbers, firms were selected for interviews.

A total of 13 firms were interviewed.

### **3. Textile, Clothing and Leather Industry**

Clothing sector was stratified by 2 major areas, Town and Highfield. In town three buildings were identified 2 in down town and 1 in uptown. The firms in this sector operate in rooms so it was easy for sampling. Rooms were numbered and were selected at random from the list. Firms were then selected from the random list of firms. In down town 9 firms were interviewed from Chinhoyi building which had 8 rooms (and average of 6 firms in each room) and a total of 48 firms. A firm was interviewed in each room.

The Mandela building had 15 rooms and each room had 3 firms on average. 6 rooms were randomly selected, and a firm was interviewed in each room.

In Highfields, a building where tailors operate was also identified. In the building tailors were occupying 1st and 2nd floors. Each floor has an overage of 15 rooms with each room consisting of average of 5 tailors. In each floor, rooms were numbered and 3 rooms were randomly selected in each floor. In each of these 6 randomly rooms, on average a firm was randomly selected from random list. A total of 8 firms were interviewed in Highfield.

Leather firms were somehow challenging to find. However, after intensive scouting we managed to find and interview 8 leather firms in Mbare and in down town.

A total of 30 firms were interviewed in this sector.



## **B. Bulawayo Sample**

The same sampling processes followed in Harare were also followed for Bulawayo informal sector firms.

The following areas were selected for sampling; Renkin (for wood and metal), Kelvin North (wood and metal), CBD (textile) and Nguboyenja (wood). See Appendix for actual samples.

## **Weights**

Weights were calculated for firms to represent the sample population. The weights calculated represents the population sample in areas where the sample frame was drawn. Please note that they do not represent the total population of the informal manufacturing sector firms as some areas were not sampled.

## Appendix

### Sampling Procedure and construction of sampling weights

#### Desired vs Actual sample

| Cluster Location              | Textile |         |             | Wood   |         |             | Metal  |         |             | Other | Total  |         |
|-------------------------------|---------|---------|-------------|--------|---------|-------------|--------|---------|-------------|-------|--------|---------|
|                               | Actual  | Desired | no of firms | Actual | Desired | no of firms | Actual | Desired | no of firms |       | Actual | Desired |
| 1.Vision Complex (metal)      | 0       | 0       | 0           | 0      | 0       | 0           | 6      | 5       | 44          | 0     | 6      | 5       |
| 2.Mukuvisi Complex (metal)    | 0       | 0       | 0           | 0      | 0       | 0           | 6      | 5       | 33          | 0     | 6      | 5       |
| 3.Mbare Home industry (metal) | 0       | 0       | 0           | 0      | 0       | 0           | 4      | 5       | 37          | 0     | 4      | 5       |
| 4.Coffman Complex (wood)      | 0       | 0       | 0           | 8      | 8       | 46          | 0      | 0       | 0           | 0     | 8      | 8       |
| 5.Magaba Complex (wood)       | 0       | 0       | 0           | 8      | 6       | 28          | 0      | 0       | 0           | 0     | 8      | 6       |
| 6.Glenview Complex (wood)     | 0       | 0       | 0           | 13     | 12      | 157         | 0      | 0       | 0           | 0     | 13     | 12      |
| 7.Gazaland (metal)            | 0       | 0       | 0           | 0      | 0       | 0           | 14     | 12      | 120         | 0     | 14     | 12      |
| 8.Chinhoyi Bldng (textile)    | 9       | 8       | 48          | 0      | 0       | 0           | 0      | 0       | 0           | 0     | 9      | 8       |
| 9.Highfield (textile)         | 8       | 8       | 132         | 0      | 0       | 0           | 0      | 0       | 0           | 0     | 8      | 8       |
| 10.Mandela Bldng (textile)    | 6       | 6       | 45          | 0      | 0       | 0           | 0      | 0       | 0           | 0     | 6      | 6       |
| 11. Cameroon Bldng (leather)  | 8       | 8       | 10          | 0      | 0       | 0           | 0      | 0       | 0           | 0     | 8      | 8       |
| 12.Kelvin North (textile)     | 2       | 1       | 3           | 0      | 0       | 0           | 0      | 0       | 0           | 0     | 2      | 1       |
| 13.Kelvin North (wood)        | 0       | 0       | 0           | 12     | 13      | 48          | 0      | 0       | 0           | 0     | 12     | 13      |
| 14.Kelvin North (metal)       | 0       | 0       | 0           | 0      | 0       | 0           | 5      | 4       | 10          | 0     | 5      | 4       |
| 15. Renkin (wood)             | 0       | 0       | 0           | 1      | 1       | 3           | 0      | 0       | 0           | 0     | 1      | 1       |
| 16. Renkin (metal)            | 0       | 0       | 0           | 0      | 0       | 0           | 6      | 6       | 25          | 0     | 6      | 6       |
| 17.CBD (textile)              | 9       | 9       | 81          | 0      | 0       | 0           | 0      | 0       | 0           | 0     | 9      | 9       |
| 18.Nguboyenja (wood)          | 0       | 0       | 0           | 3      | 3       | 5           | 0      | 0       | 0           | 0     | 3      | 3       |
| 19.Others                     | 0       | 0       | 0           | 1      | 0       | 0           | 0      | 0       | 0           | 2     | 3      | 0       |
| Total                         | 42      | 40      |             | 46     | 43      |             | 41     | 37      |             | 2     | 131    | 120     |

## Sample Frame Constructed

| Location | Cluster Location              | Textile     | Wood        | Metal       |
|----------|-------------------------------|-------------|-------------|-------------|
|          |                               | no of firms | no of firms | no of firms |
| Harare   | 1.Vision Complex (metal)      | 0           | 0           | 88          |
| Harare   | 2.Mukuvisi Complex (metal)    | 0           | 0           | 212         |
| Harare   | 3.Mbare Home industry (metal) | 0           | 0           | 103         |
| Harare   | 4.Coffman Complex (wood)      | 0           | 46          | 0           |
| Harare   | 5.Magaba Complex (wood)       | 0           | 28          | 0           |
| Harare   | 6.Glenview Complex (wood)     | 0           | 157         | 0           |
| Harare   | 7.Gazaland (metal)            | 0           | 0           | 120         |
| Harare   | 8.Chinhoyi Bldng (textile)    | 48          | 0           | 0           |
| Harare   | 9.Highfield (textile)         | 150         | 0           | 0           |
| Harare   | 10.Mandela Bldng (textile)    | 45          | 0           | 0           |
| Harare   | 11. Cameroon Bldng (leather)  | 10          | 0           | 0           |
| Bulawayo | 12.Kelvin North (textile)     | 3           | 0           | 0           |
| Bulawayo | 13.Kelvin North (wood)        | 0           | 48          | 0           |
| Bulawayo | 14.Kelvin North (metal)       | 0           | 0           | 10          |
| Bulawayo | 15. Renkin (wood)             | 0           | 3           | 0           |
| Bulawayo | 16. Renkin (metal)            | 0           | 0           | 25          |
| Bulawayo | 17.CBD (textile)              | 81          | 0           | 0           |
| Bulawayo | 18.Nguboyenja (wood)          | 0           | 5           | 0           |
| Bulawayo | 19.Others                     | 0           | 0           | 0           |
| Total    |                               | 337         | 287         | 558         |

## Weights calculation

| Location | Cluster Location              | Strata | Sampled<br>Strata | total number<br>of firms in a<br>complex | number of firms in<br>selected cluster (s) | Selected<br>Firms |
|----------|-------------------------------|--------|-------------------|--|--|-------------------|
| Harare   | 1.Vision Complex (metal)      | 2      | 1                 | 88                                       | 44   | 6                 |
| Harare   | 2.Mukuvisi Complex (metal)    | 6      | 1                 | 212                                      | 37   | 6                 |
| Harare   | 3.Mbare Home industry (metal) | 3      | 1                 | 103                                      | 33   | 4                 |
| Harare   | 4.Coffman Complex (wood)      | 1      | 1                 | 46                                       | 46   | 8                 |
| Harare   | 5.Magaba Complex (wood)       | 3      | 3                 | 28                                       | 28   | 8                 |
| Harare   | 6.Glenview Complex (wood)     | 3      | 3                 | 157                                      | 157  | 13                |
| Harare   | 7.Gazaland (metal)            | 3      | 3                 | 120                                      | 120  | 14                |
| Harare   | 8.Chinhoyi Bldng (textile)    | 8      | 8                 | 48                                       | 48   | 9                 |
| Harare   | 9.Highfield (textile)         | 30     | 6                 | 150                                      | 30   | 8                 |
| Harare   | 10.Mandela Bldng (textile)    | 15     | 6                 | 45                                       | 18   | 6                 |
| Harare   | 11. Cameroon Bldng (leather)  | 1      | 1                 | 10                                       | 10   | 8                 |
| Bulawayo | 12.Kelvin North (textile)     | 1      | 1                 | 3  | 3  | 2                 |
| Bulawayo | 13.Kelvin North (wood)        | 2      | 2                 | 48                                       | 48   | 12                |
| Bulawayo | 14.Kelvin North (metal)       | 2      | 2                 | 10                                       | 10   | 5                 |
| Bulawayo | 15. Renkin (wood)             | 1      | 1                 | 3  | 3  | 1                 |
| Bulawayo | 16. Renkin (metal)            | 1      | 1                 | 25                                       | 25   | 6                 |
| Bulawayo | 17.CBD (textile)              | 3      | 3                 | 81                                       | 81   | 9                 |
| Bulawayo | 18.Nguboyenja (wood)          | 1      | 1                 | 5  | 5  | 3                 |
| Bulawayo | 19.Others                     | 1      | 1                 | 3  | 3  | 3                 |
| Total    |                               |        |                   | 1185                                     | 749  | 131               |

## Calculation of weights

- **1<sup>st</sup> stage: Probability of strata selected for sampling: strata weight**

$$Pi1 = \frac{\text{number of strata selected for sampling}}{\text{total number of strata in a location}}$$

**Weight in stage 1**

- $Wi1 = \frac{1}{Pi1}$

•

- **2<sup>nd</sup> stage: Probability of selecting a firm in each selected strata: firm weight**

$$Pi2 = \frac{\text{number of firms sampled in a strata}}{\text{total number of firms in strata}}$$

- $Wi2 = \frac{1}{Pi2}$

**Overall weight: weight**

$$\text{weight} = Wi1 * Wi2$$