Deriving traditional reproductive regimes to explain subnational fertility differentials in Zambia

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Abstract

To assess ethnic fertility variations in Zambia, multivariate cluster analysis, multivariate analysis of variance and discriminant analysis are applied to Zambian anthropological and demographic data. First, using 35 anthropological dimensions (as presented in the Murdock Atlas), cluster analysis is applied to twenty Zambian societies to derive four Zambian traditional reproductive regimes. Results suggest that low fertility was associated with societies that had a weak control of reproduction at community level. This suggests that these societies controlled fertility at family level therefore supporting a crucial element of the intergenerational wealth-flows theory (family nucleation). Second, using census and DHS data, fertility trends (1981-2000) for the derived traditional reproductive regimes are computed. Results confirm existence and changing patterns of Zambian ethnic fertility differentials. Lastly, multivariate analysis of variance and descriptive discriminant analysis results show that fertility levels of Zambian traditional reproductive regimes have been converging because of differences in exposure and response to urbanisation between different ethnic societies. This suggests that modernisation and ideational theories provide eminent explanations of fertility declines in some Zambian ethnic societies.

1 Introduction

Official reports on Zambian fertility have observed notable regional fertility variations. These reports have argued—but not convincingly—that regional fertility differentials are long-term reflections of ethnic reproductive behaviours (Central Statistical Office [Zambia] 1975, 2003). Mitchell's (1965) study focusing on fertility differentials of urban inhabitants infers that fertility variations exist between women of different ethnic origin. Ohadike and Tesfaghiorghis (1975) reach the same conclusion when they study fertility of Lusaka (the capital city of Zambia) women speaking different Zambian languages. Hill (1985: 59) observes that "the basis for these geographical differentials is variation in fertility by ethnic groupings which appear to persist to some extent even in the urban areas".

However, the extent of ethnic demographic differences, if any, is unknown or undocumented because—as Weinreb (2001) observes—analysis of subnational demographic differentials in Africa hardly goes beyond the term "regional", "provincial" or "district" differentials. Studies that have assessed ethnic fertility differentials in Zambia have suffered from three fundamental limitations. First, they have described ethnicity normatively (name or language of a traditional society). This approach does not provide an avenue for identifying features underlying fertility in pre-industrial societies. Second, they have relied on kinship lineage organisation only to explain ethnic fertility differentials. However, as argued by Lesthaeghe (1989), monocausal explanations are inadequate for this task because they leave out some important traditional features. Third, prior studies have applied inadequate research procedures and inappropriate statistical tools to untangle such a complex problem.

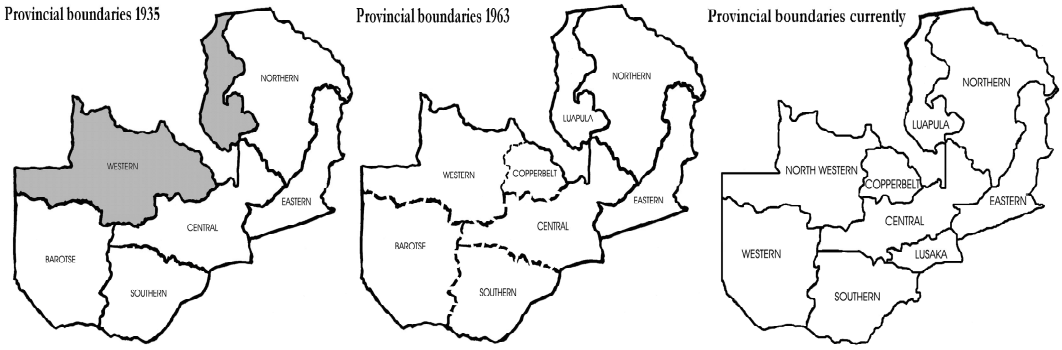
This paper aims to explore and account for subnational fertility differentials in Zambia—a research problem that has remained unanswered for forty years. First, the paper applies multivariate cluster analysis to derive clusters of ethnic societies in Zambia that share similar cultural norms that govern fertility in traditional societies. Second, we use the derived traditional reproductive clusters or regimes as units of analysis to assess ethnic fertility differentials. Third, we apply descriptive discriminant analysis to account for modern features that underlie current Zambian ethnic fertility differentials.

2 Background: Zambia and its ethnic inhabitants

Figure 1 shows the provincial demarcations of Zambia before and after independence. In 1935, the British Colonial Administration Office divided Zambia into six provinces:

Barotse, Central, Eastern, Northern, Southern and Western Provinces. Western Province included the present-day Copperbelt, Luapula and North-western Provinces (shaded portion) while Lusaka was part of Central Province. In 1963, the number of provinces increased to eight after declaring Luapula and Copperbelt as autonomous from the rest of Western Province. After independence, the Zambian government renamed Western Province as North-western Province and Barotse as Western Province. Since 1973, Zambia has had nine administrative regions, after splitting Lusaka Province from Central Province. The nine provinces are Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, North-western, Southern and Western.

Figure 1 Provincial demarcation of Zambia before and after independence



Source: Provincial maps scanned from Sheikh (1975) and CSO (2003)

Apart from provincial demarcations, Zambia is divided into urban and rural areas. Copperbelt (1.6 million in the 2000 Census[1]) and Lusaka (1.4 million) are the most urbanised provinces in Zambia. Central (one million) and Southern (1.2 million) Provinces are also fairly urbanised because of their proximity to Copperbelt and Lusaka Provinces. The "traditional line-of-rail" passes through these four provinces. The "traditional line-of-rail" refers to the railway line that runs through major urban towns in Zambia from Chililabombwe in the Copperbelt Province through mining towns and Lusaka (the capital city) to Livingstone in Southern Province (Mitchell 1956).

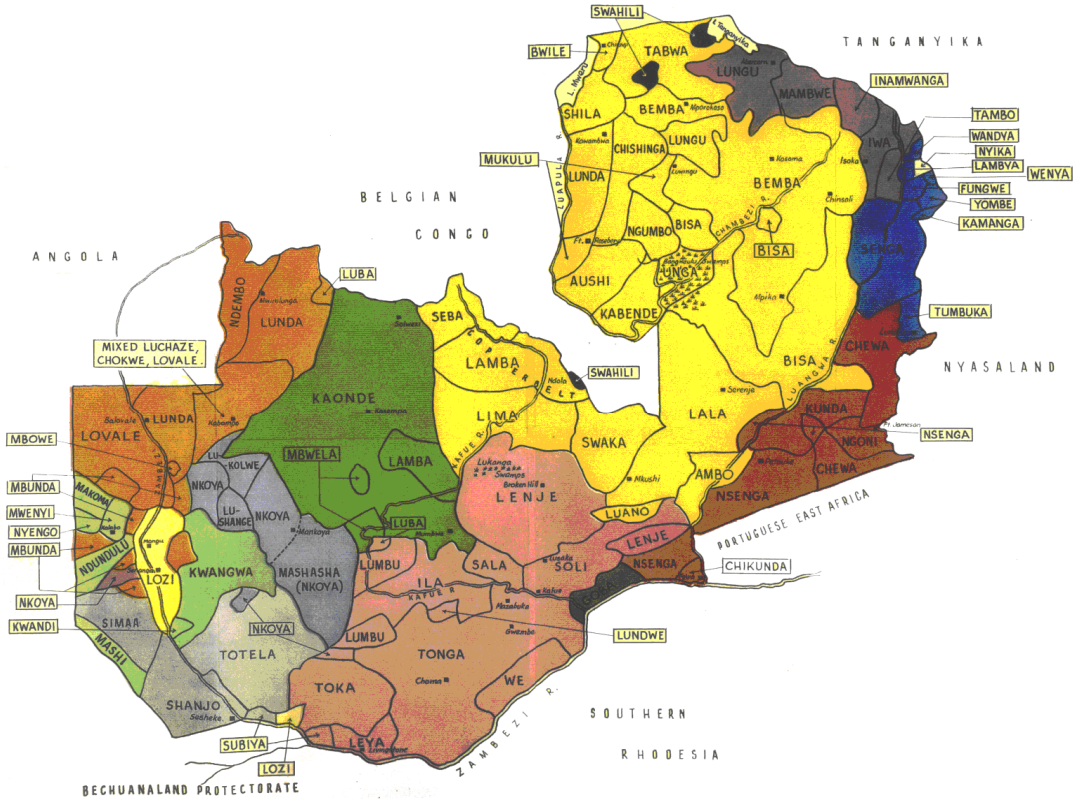
There are nearly 80 ethnic societies in Zambia (Brelsford 1956). Figure 2[2] shows the ethnic societies found in Zambia mapped according to geographical location of their

[1] Central Statistical Office [Zambia] (2003)

[2] There is similar version of this map featuring post-independence country names but the ethnic societies and their geographic locations are the same. However, the author failed to establish the source of this new version therefore making provenance difficult to establish.

ethnic villages (ethno-geographical location) in the 1950s[3]. Historical and archaeological evidence indicates that inhabitants of the present-day Zambia are Bantu descendants from the Great Lakes Region in East Africa (Brelsford 1956). Brelsford (1956) argues that ancestors of ethnic societies transformed the cultural customs and norms (the interest of this research) during the migration from the Great Lakes region. Therefore, it is important to distinguish ethnic societies according to the timing of their arrival in Zambia and the regions passed through before settling in Zambia (secondary origin).

Figure 2 Tribal and linguistic societies in Zambia



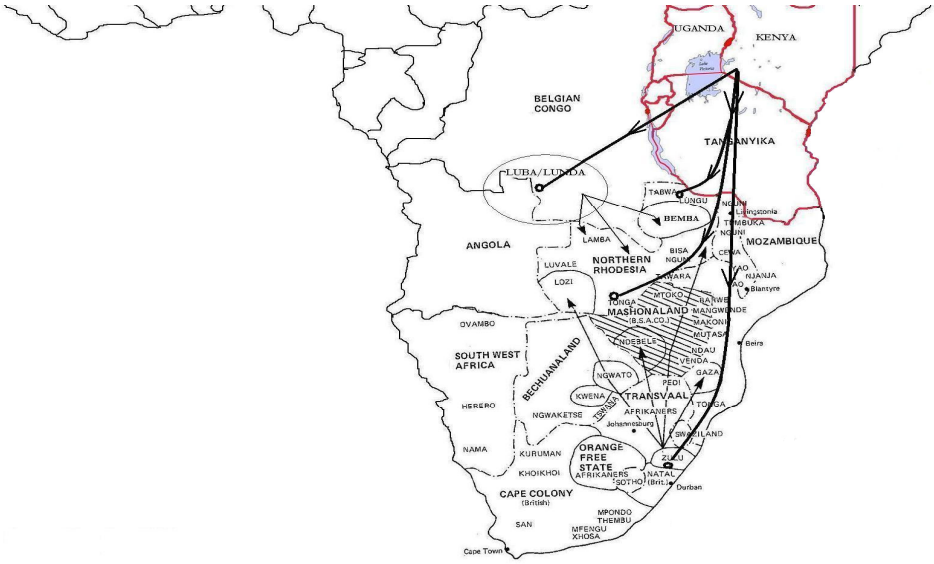
Source: Brelsford (1956)

Figure 3 shows migration routes of Zambian ethnic societies showing their region of origin and the regions they passed through before settling in Zambia. Table 1 shows various ethnic societies grouped according to period of arrival in Zambia and their secondary region of origin before migrating to Zambia—classified using information in Brelsford (1956), Mainga (1966) and Roberts (1966). The earliest group (first cluster) migrated straight into Zambia from the Great Lakes region. This cluster comprises of two groups: the south-central group and the north-eastern group. The second cluster settled in the southern part of the present-day Democratic Republic of Congo (and stretching into

[3] The different colour shades represent Brelsford's 1956 tribal and linguistic groupings. The key was too small to include in the figure

eastern Angola) as part of the Luba or Lunda Kingdoms before migrating to Zambia. The third cluster comprises of Zambian societies that migrated from South Africa (the Ngoni) and Zambian societies (the Barotse tribes: the Lozi and the surrounding tribes) whose customs and norms have been influenced by South African ethnic societies. The South African societies also initially migrated from the Great Lakes region (Poole 1949).

Figure 3 Zambian major ethnic societies according region of origin and migration route



Modified by the author from Chanaiwa (1985)

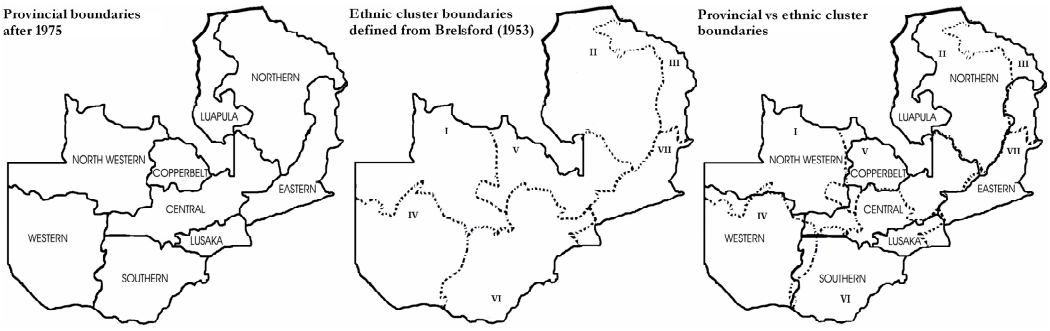
Table 1 Ethnic societies according to secondary origin and period of arrival in Zambia

Great Lakes Region (up to 16th Century)		Luba/ Lunda Kingdoms (17th - 18th Century)		South African influenced (19th Century)
1 Fungwe	19 Toka	1 Ambo	19 Luchazi	1 Kwandi
2 Goba/Gowa	20 Tonga	2 Aushi	20 Lunda - Lua.	2 Kwangwa
3 Ila	21 Wandya	3 Batwa*	21 Lunda - NW	3 Lozi
4 Inamwanga	22 We	4 Bemba	22 Luvale	4 Lukolwe
5 Iwa	23 Wenya	5 Bisa	23 Lwena*	5 Lushange
6 Kamanga	24 Yombe	6 Bwile	24 Mbunda	6 Makoma
7 Lambya		7 Chewa	25 Mbwela	7 Mashasha
8 Lenje		8 Chikunda	26 Mukulu	8 Mashi
9 Leya		9 Chishinga	27 Ndembu	9 Mbowe
10 Lumbu		10 Chokwe	28 Ngumbo	10 Mwenyi
11 Lungu		11 Kabende	29 Ngwela*	11 Ndundulu
12 Mambwe		12 Kaonde	30 Nsenga	12 Ngoni
13 Nyika		13 Kunda	31 Seba	13 Nkoya
14 Sala		14 Lala	32 Senga	14 Nyengo
15 Soli		15 Lamba	33 Shila	15 Shanjo
16 Sukwa*		16 Lima	34 Swaka	16 Simaa
17 Tabwa		17 Luano	35 Tumbuka	17 Subiya
18 Tambo		18 Luba	36 Unga	18 Totela

Notes: Classification based on Brelsford (1956); Mainga (1966); Roberts (1966)
*Not on the Tribal and Linguistic Map but discussed by Brelsford
Lua. Is Luapula province
NW is North-western province

Table 2 presents ethnic societies found in Zambia according to location of ancestral villages and kinship lineage. The ethno-regional demarcations roughly match the provincial administrative boundaries presented in Figure 1. Figure 4 shows that, of the nine administrative provinces in Zambia, only seven ethno-geographical location boundaries almost match provincial boundaries. This is because, before 1950, Copperbelt and Lusaka Provinces did not exist.

Figure 4 Regional clusters of ethnic societies according to location of ethnic settlement and kinship systems relative to provincial boundaries



Provincial map scanned from CSO (2003)

The layout of Table 2 broadly reflects geographical locations in Zambia—for example, Region I is North-western and Region VI is South-central. Ethno-regional demarcations representing regional cultural differentials in Zambia are justified. Corinaldi (1966) states that climatic and environmental conditions in a particular region could have had an impact on determining the means of subsistence—the main preoccupation of ethnic societies. In turn, means of subsistence and technological knowledge and skills tailor decision making, overall traditional customs and norms including reproduction choices (Brelsford 1956; Lesthaeghe 1989). Later we observe that the differences between two societies—the Ngoni and the Kololo—both originally cattle-herding societies from South Africa, support Corinaldi's observation.

We use kinship lineage to group correctly societies whose ethno-geographical category is not obvious (borderline cases). Kinship lineage is selected because it provides an important basis for understanding African societies (Radcliffe-Brown 1950; Hull 1980). Brelsford (1956) and to a lesser extent Roberts (1976) describe the kinship lineages of ethnic societies found in Zambia. Regions I, II, V and VII comprises of tribes described as full corporate matrilineal kinship societies. Region III (north-eastern) comprises of societies that trace their relations through patrilineal kinship. Region IV (south-western) comprises of societies that trace their relations through cognatic kin relations—that is,

they lack a unilineal kinship lineage. Region VI (south-central) societies have a dual kinship lineage. These societies trace relations through the matrilineal kinship but place a strong emphasis on patrilineal inheritance.

Table 2 Ethnic societies according to region of settlement and kinship lineage system

Region I			Region II			Region III		
Society	Population in 1953		Society	Population in 1953		Society	Population in 1953	
	Number	Per cent		Number	Per cent		Number	Per cent
1 Luvale	49,097	24.4	1 Bemba	144,511	32.5	1 Ngoni	66,589	30.1
2 Kaonde	42,354	21.1	2 Lunda	82,050	18.4	2 Lungu	38,073	17.2
3 Lunda	40,131	20.0	3 Bisa	50,804	11.4	3 Senga	25,811	11.7
4 Ndembu	33,216	16.5	4 Aushi	43,163	9.7	4 Tumbuka	25,300	11.4
5 Luchazi	21,442	10.7	5 Chishinga	28,735	6.5	5 Mambwe	21,388	9.7
6 Chokwe	11,355	5.7	6 Ngumbo	28,047	6.3	6 Inamwanga	12,400	5.6
7 Mbowe	2,941	1.5	7 Mukulu	20,882	4.7	7 Iwa	12,249	5.5
8 Mbwela	280	0.1	8 Tabwa	15,320	3.4	8 Tambo	5,340	2.4
9 Luba	N/S		9 Kabende	9,355	2.1	9 Yombe	4,234	1.9
10 Lwena*			10 Unga	9,204	2.1	10 Fungwe	2,849	1.3
			11 Shila	7,300	1.6	11 Nyika	2,630	1.2
			12 Bwile	5,899	1.3	12 Lambya	1,953	0.9
			13 Batwa*			13 Wenya	900	0.4
			14 Ngwela*			14 Wandya	800	0.4
						15 Kamanga	500	0.2
						Sukwa*		
Total	200,816	100.0	**Total**	445,270	100.0	**Total**	221,016	100.0

Region IV			Region V			Region VII		
Society	Population in 1953		Society	Population in 1953		Society	Population in 1953	
	Number	Per cent		Number	Per cent		Number	Per cent
1 Lozi	54,605	22.9	1 Lala	55,936	41.5	1 Chewa	127,824	54.0
2 Kwangwa	34,866	14.6	2 Lamba	35,175	26.1	2 Nsenga	73,568	31.1
3 Mbunda	32,111	13.5	3 Swaka	17,647	13.1	3 Kunda	19,447	8.2
4 Nkoya	28,785	12.1	4 Lima	15,210	11.3	4 Ambo	11,657	4.9
5 Kwandi	13,841	5.8	5 Seba	6,000	4.5	5 Chikunda	4,383	1.9
6 Totela	13,765	5.8	6 Luano	4,808	3.6			
7 Subiya	9,705	4.1	**Total**	134,776	100.0	**Total**	236,879	100
8 Ndundulu	7,649	3.2						
9 Lushange	7,000	2.9	**Region VI**					
10 Makoma	6,557	2.7	Society	Population in 1953				
11 Mashasha	5,876	2.5		Number	Per cent			
12 Nyengo	5,833	2.4	1 Tonga	164,829	58.8			
13 Simaa	5,440	2.3	2 Lenje	42,723	15.2			
14 Mwenyi	4,804	2.0	3 Soli	19,208	6.8			
15 Shanjo	3,385	1.4	4 Ila	17,737	6.3			
16 Mashi	3,377	1.4	5 Toka	16,257	5.8			
17 Lukolwe	892	0.4	6 Goba/Gowa	7,436	2.7			
			7 Leya	6,256	2.2			
			8 Sala	4,034	1.4			
			9 Lumbu	2,063	0.7			
			10 We	N/S				
Total	238,491	100.0	**Total**	280,543	100.0			

Notes: Grouping based on Brelsford's (1956) Tribal and Linguistic map
The layout of the table broadly reflects geographical location in Zambia - for example Region I is North-western and Region VI is South-central
*Not in the Tribal and Linguistic Map but discussed by Brelsford
NS means the population figure of the specific society is not stated probably because it is included in a larger society which is however not specified by Brelsford.

To identify the largest Zambian societies, Table 2 presents the 1953 population estimates provided by the Zambian colonial government (Brelsford 1956). They coincide with the reference period of most of the materials discussing these societies. Of the nearly 1.7 million inhabitants in 1953, Region II had the largest population (about 25 per cent of the national total) while Region V had the smallest (below 10 per cent of the national total).

Lesthaeghe and Eelens (1989: 95) state that "admittedly, nothing is more difficult than forming ethnic clusters, and choices are always to some extent arbitrary…" However, regardless of differences in objectives, the groupings in Table 2 are similar to those reported by Mitchell (1965) arising from his 1961 study, Murdock's (1967a) ethnic clusters, Kashoki and Mann's (1978) linguistic groups, Gordon's (2005) Ethnologue Maps and Maho's (2007) and linguistic groups. This suggests that the seven clusters (Table 2) are a good representation of the ethnic clusters found in Zambia. The exercise suggests that Zambian ethnic societies have diverse histories. There is a possibility that histories of origin, migrations and region of settlement have shaped cultural customs and norms of Zambian ethnic societies. In turn, these cultural differences may be underlying regional or ethnic fertility differentials.

3 Deriving traditional reproductive regimes in Zambia using multivariate cluster analysis

Deriving traditional reproductive regimes in Zambia using multivariate cluster analysis attains three ancillary objectives. First, the approach re-expresses ethnicity (in the context of reproduction) using several features that influence reproduction in pre-industrial societies. This way, we avoid limitations associated with defining ethnicity normatively or proxies based on single features. Second, the approach groups Zambian ethnic societies that have similar overall (not single) features underlying reproduction in pre-industrial societies. Reducing these traditional societies to a manageable number allows for easier comparative analysis. Third, the method spells out similarities and differences between Zambian traditional reproductive regimes.

Multivariate cluster analysis—detailed in Everitt, Landau and Leese (2001)—measures the average of all attributes (underlying fertility in pre-industrial societies) and then groups similar objects—in this case Zambian traditional societies—based on average multivariate properties thereby minimising within-cluster variation and maximising between-cluster variation. To achieve this, multivariate cluster analysis first computes multivariate distances (also known as proximity measures). The procedure then applies

these distances to divide a set of observations into groups. Then a single point, the multivariate mean, replaces the grouped observations. The procedure also exposes the overall pattern of the various attributes defining the groups (Smith 2002).

The first step in application of multivariate cluster analysis is determining the dimensions that distinguish groupings (Maxwell, Pryor and Smith 2002). These dimensions should comprise only the attributes that define the phenomena under investigation. In our research, there are no standard cultural attributes underlying fertility outcomes in traditional societies. Therefore, we identified these features from studies undertaken by Whiting (1964), Murdock (1967b), Saucer (1972), and Goody (1976). These studies show that apart from the obvious—governance of courtship and sexual relations—there are two broad groups of features capable of influencing reproductive outcomes in traditional societies. The first group consists of economic and political features while the second group comprises of social and community features.

Our next challenge was identifying sources of information on features underlying reproduction in traditional societies that is suitable for comparative or cross-cultural research. This information is available in the Yale Human Relation Area Files, Murdock's Ethnographic Atlas and Standard Cross-Cultural Sample for several countries. Sometimes researchers—for example Schoenmaeckers, Shah, Lesthaeghe *et al.* (1981) as well as Pryor (2005)—have coded their own data based on the Yale Human Relation Area Files and other historical and anthropological reports.

However, the Yale Human Relation Area Files and Standard Cross-Cultural Sample are inadequate for our research for two reasons. First, we require cultural information for as many Zambian societies as possible. However, the Standard Cross-Cultural Sample has information on only two Zambian traditional societies (the Bemba and the Lozi). Second, to apply multivariate cluster analysis, we need quantitative data and yet information in the Yale Human Relation Area Files is not readily available in a statistical database format. Coding our own data was beyond the scope of this research because comparing features underlying reproduction in Zambian ethnic societies is not an end in itself. As Goodenough (1964) points out, coding ethnographic data requires special skills that take a long-time to acquire.

Therefore, this study uses the data from Murdock's Ethnographic Atlas because it contains quantitative information on 21 traditional societies found in Zambia (Table 3). The information in Murdock's Ethnographic Atlas accounts for 57 per cent of the Zambian population presented in Table 2 and at least one society represents each of the

seven regions in Table 2. This facilitates assessing a wide range of cultural attributes for several Zambian societies at minimal cost. Another advantage, as implied by Levinson and Malone (1980), is that this information may be objective because persons not involved in its collection compiled it.

Table 3 Zambian societies whose pre-industrial information is included in the Murdock Ethnographic Atlas

Society name	Geographical location		Year of information collection	*Ethno-geo. region in Zambia
	Latitude	Longitude		
Luvale	12°S	22°E	1930	Region I
Kaonde	13°S	26°E	1920	Region I
Ndembu	11°S	26°E	1930	Region I
Luchazi	13°S	23°E	1930	Region I
Chokwe	10°S	21°E	1920	Region I
Luba	08°S	26°E	1930	Region I
Bemba	11°S	31°E	1900	Region II
Lunda-Luapula (Luapula)	10°S	29°E	1940	Region II
Shila	10°S	28°E	1900	Region II
Ngoni (Mpezeni Ngoni)	12°S	33°E	1940	Region III
Tumbuka	12°S	34°E	1920	Region III
Mambwe	09°S	32°E	1910	Region III
Iwa	10°S	32°E	1900	Region III
Lozi	15°S	23°E	1890	Region IV
Lala	15°S	31°E	1940	Region V
Lamba	13°S	28°E	1920	Region V
Tonga (Pleateau Tonga)	18°S	28°E	1940	Region VI
Ila	16°S	27°E	1920	Region VI
Chewa	14°S	33°E	1920	Region VII
Kunda	15°S	32°E	1950	Region VII
Nyanja	16°S	36°E	1910	Region VII

Sources: Murdock (1967)

Names is parenthesis are as they appear in Murdock's Ethnographic Atlas (Murdock 1967a: 8-10)

*The ethno-geographic location in Zambia is based origin, region of traditional settlement and lineage group according to the data in Table 2

However, Murdock's Ethnographic Atlas has its own share of flaws. One major issue—also noted by Pryor (2003; 2005) when he applies cluster analysis to derive economic regimes—is that the data in Murdock's Ethnographic Atlas were collected at different times by different anthropologists each focusing on different issues and societies. Column four of Table 3 presents the estimated publication date[4] of some materials used to derive the Murdock (1967a) Ethnographic Atlas codes on each Zambian society. The earliest record (for the Lozi) was published in 1890 while the latest (for the Kunda traditional society) in 1950. This means that information on Zambian traditional societies in Murdock's Ethnographic Atlas refers to ethnologies collected or published over 60

[4] This is usually the year of publishing the first detailed observational report on a traditional society (Goodenough 1964).

years. Cultural features practiced in one particular society may have changed when the data were collected in another society. Societies whose ethnographic information was collected much later are affected by what Murdock and White (1969: 340) term as "culturative effects because of increasing contact with the Europeans". Against this, Murdock and White (1969) argue that any newly introduced cultural norms and customs tend to take a long-time to be integrated into the mainstream of any culture.

Another, more important, issue affecting data in the Murdock's Ethnographic Atlas is the accuracy of coding of anthropological attributes, especially those that required quantification—for example, the duration of the postpartum taboo (Schoenmaeckers, Shah, Lesthaeghe *et al.* 1981). Some authors have argued that the sources of information that Murdock (1967a) used to code cultural attributes in his Atlas are questionable because non-professionals collected them. Others—for example, Pryor (2003)—question the methods Murdock (1967a) used to arrive at some of his codes. For example, to code per cent subsistence coming from animal husbandry, Murdock based his estimates on bulk or weight of the food not nutritional content.

In all, anthropological features are not easy to classify and there is no single method of coding ethnologies (Georgiadis 2007). Therefore, as recommended by Coast (2003), additional information should supplement ethnologies in Murdock's (1967a) Atlas. This evaluates ethnologies against other anthropological accounts and provides support for anthropological arguments (Coast, Hampshire and Randall 2007). Information on the origin and migration histories of Zambian ethnic societies is a form of supplementation. As observed by Johnson-Hanks (2007: 8), "…there is no use in thinking about intentions, goals, or choices without considering the social processes through which the categories of intentions and choice are formed".

We use the material presented in Whiting (1964), Murdock (1967b), Saucer (1972), and Goody (1976) to identify attributes representing traditional economic and political organisation, social and community arrangements and governors of courtship and sexual relations in Murdock's (1967a) Ethnographic Atlas[5]. Other literature—for example, Goodenough (1964)—supplement these materials especially when identifying political attributes. Gray (1999b) provides the codes of the revised Murdock Ethnographic Atlas. The meaning of terminologies that describe the codes are in discussions presented by Evans-Pritchard (1940) and Radcliffe-Brown (1940; 1950). To interpret the results, the

[5] The analysis here is based on the updated electronic database of the Murdock's Ethnographic Atlas made available by Professor Douglas White (University of California at Irvine). Gray (1999a) as well as Khaltourina, Korotayev and Divale (2002) have published details of the corrections made to this version.

original codes have been reordered to assign distance manually between different "fertility states" so that high scores on each attribute are associated with low fertility while low scores with high fertility. The code for missing data is -9999 being the requirement of the cluster analysis software.

Table 4 presents a summary of the 24 dimensions underlying reproduction in traditional societies. Nine dimensions describe various aspects of traditional economic and political organisation. Eight attributes present various forms of traditional social and community arrangements. Finally, seven indicators specify the different features governing courtship and sexual relationships in traditional societies. Some attributes have more than one variable—for example, subsistence economy has five variables. In total, there are 55 variables relating to the 24 attributes.

Table 4 Features underlying reproduction in traditional societies obtained from the Murdock's Ethnographic Atlas

	Group and description of dimension	Number of variables					
		Selected	Eliminated				Retained
			Scanty[1]	Duplicative[2]	Invariant[3]	Conflicting[4]	
	Traditional economic and political factors						
1	Subsistence economy	5	-	-	-	-	5
2	Type and intensity of agriculture	2	-	-	-	-	2
3	Type of animal husbandry	3	-	-	1	-	2
4	Mean size of local communities	1	1	-	-	-	0
5	Pattern of settlement	1	-	-	-	-	1
6	Jurisdictional hierarchy	2	-	-	-	-	2
7	Succession to the office of local headman	2	-	1	-	-	1
8	Class stratification	4	-	-	3	-	1
9	Presence of slavery	2	-	-	-	-	2
	Total	*22*	*1*	*1*	*4*	*0*	*16*
	Social and community factors						
1.a	Patrilineal kin groups and exogamy	2	-	-	1	-	1
1.b	Matrilineal kin groups and exogamy	2	-	-	-	-	2
2	Cognatic kin groups	2	-	-	-	-	2
3	Community organisation	1	-	-	-	-	1
4	Marital residence	5	-	-	-	2	3
5	Inheritance of real property	2	1				1
6	Sex delineated participation in provision of subsistenc	5	3	-	1	-	1
7	Kinship terminology for cousins	1	-	-	-	-	1
8	Recognition of high Gods	1	-	-	-	-	1
	Total	*21*	*4*	*0*	*2*	*2*	*13*
	Factors governing courtship and sexual relationships						
1	Norms of premarital sex behaviour	1	1	-	-	-	0
2	Male genital mutilations	1	-	-	-	-	1
3	Segregation of adolescent boys	1	1	-	-	-	0
4	Cousin marriage	4	-	2	-	-	2
5	Mode of marriage	2	-	-	-	-	2
6	Family organisation	2	-	1	-	-	1
7	Postpartum sex taboo	1	1	-	-	-	0
	Total	*12*	*3*	*3*	*0*	*0*	*6*
	Overall total	55	8	4	6	2	35

Notes: 1. Variable with more than 6 societies with missing data
2. Two variables - primary and alternate dimensions which have the same have the same distribution - one is eliminated
3. Variables with all the 21 societies reporting in the same category - apart from missing information
4. Two variables - primary and alternate dimensions but providing information that is inconsistent

Twenty variables are removed because they provide information that is either scanty (eight variables), exactly duplicative (four variables), invariant across all societies (6 variables) or inconsistent with another similar variable (2 variables). Only four of the

seven attributes used to govern courtship and sexual relationships in traditional societies are retained while almost all attributes for the other two groups are represented. The variables dropped—especially norms of premarital sex behaviour for young women and postpartum sex taboo—are important determinants of fertility in traditional societies. Since these cannot be evaluated for Zambian traditional societies, this is a serious limitation. Lastly, the Shila society is dropped from the database because it is missing information on 13 of the 35 remaining variables.

Multivariate cluster analysis is then applied to the 35 ordinal coded attributes underlying reproduction in pre-industrial societies to derive Zambian traditional reproductive regimes using LOICZView,[6] a web-based clustering analysis software. This is a "data-driven expert-guided program" for clustering objects using heterogeneous data sets (Maxwell and Buddemeier 2002: 77). The program is robust in handling of missing data because it uses the average scaled Euclidean (ASE) distance between two points. Maxwell, Pryor and Smith (2002) provide guidance on how to apply this program for purposes of cross-cultural research. We obtain identical results when operation of this program is checked by analysing identical subsets of the data using SPSS (2005) version 14 modules.

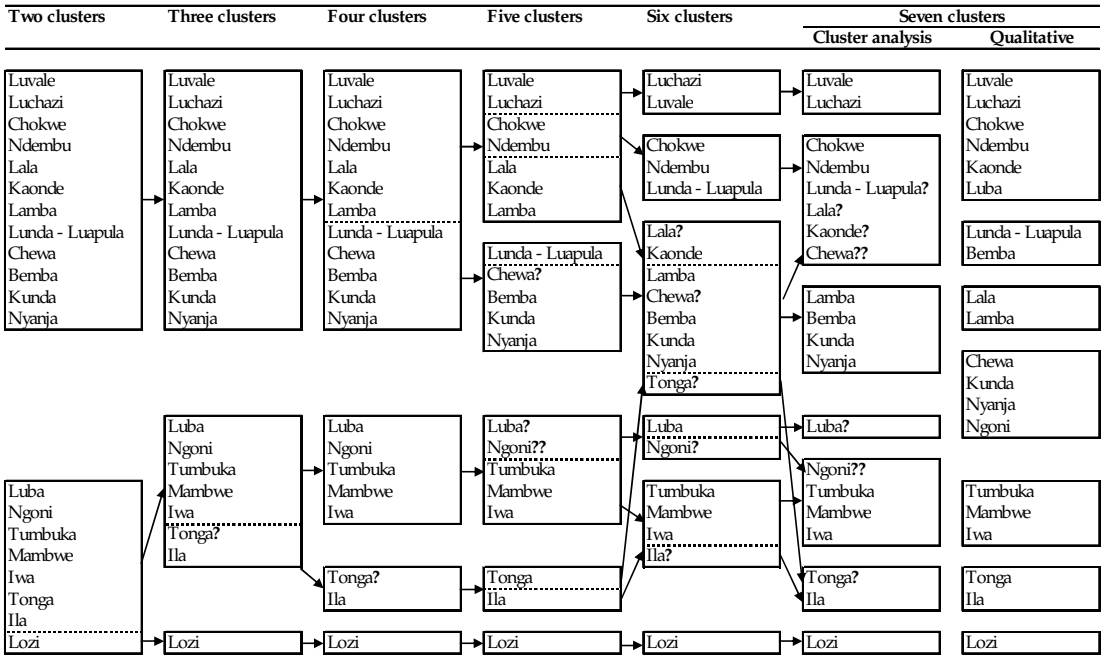
The 'minimum description length' algorithm of LOICZView program suggests that the suitable number of clusters in Murdock's Ethnographic data on Zambian societies is between two and six with four being the ideal number. The scaled k-means multivariate classification algorithm of cluster analysis is applied to derive compositions of traditional reproductive clusters. To get a good set of clusters from a 20 x 35 matrix (Murdock's data set on traditional societies in Zambia), the clustering procedure was set at 50 runs at 100 iterations for each run and repeated five times—in total 250 runs or 25,000 iterations for each number of clusters. Apart from the ideal number of clusters (four), the described clustering procedure was applied to different numbers of clusters to examine how societies change cluster memberships when the number of clusters is changed.

Figure 5 presents the cluster composition of Zambian societies derived from applying the scaled k-means classification algorithm to all ordinal coded attributes underlying traditional reproduction. For purposes of comparison, the last column shows the cluster composition derived using qualitative information (Table 2). At two clusters, the composition indicates that societies that came from the Great Lakes Region and those that are South African influenced are similar but different from those that came from the

[6] This programme is available online at www.palantir.swarthmore.edu/loicz/

Luba/Lunda Kingdoms. However, the Luba society (of the Luba/Lunda Kingdoms) is among societies that came from the Great Lakes Region and those that are South African influenced.

Figure 5 Cluster composition of traditional societies in Zambia based on all ordinal coded attributes



Notes **?** indicates that of the five clustering procedures performed, this society only appears in this group three times
?? indicates that of the five clustering procedures performed, this society only appears in this group less than three times

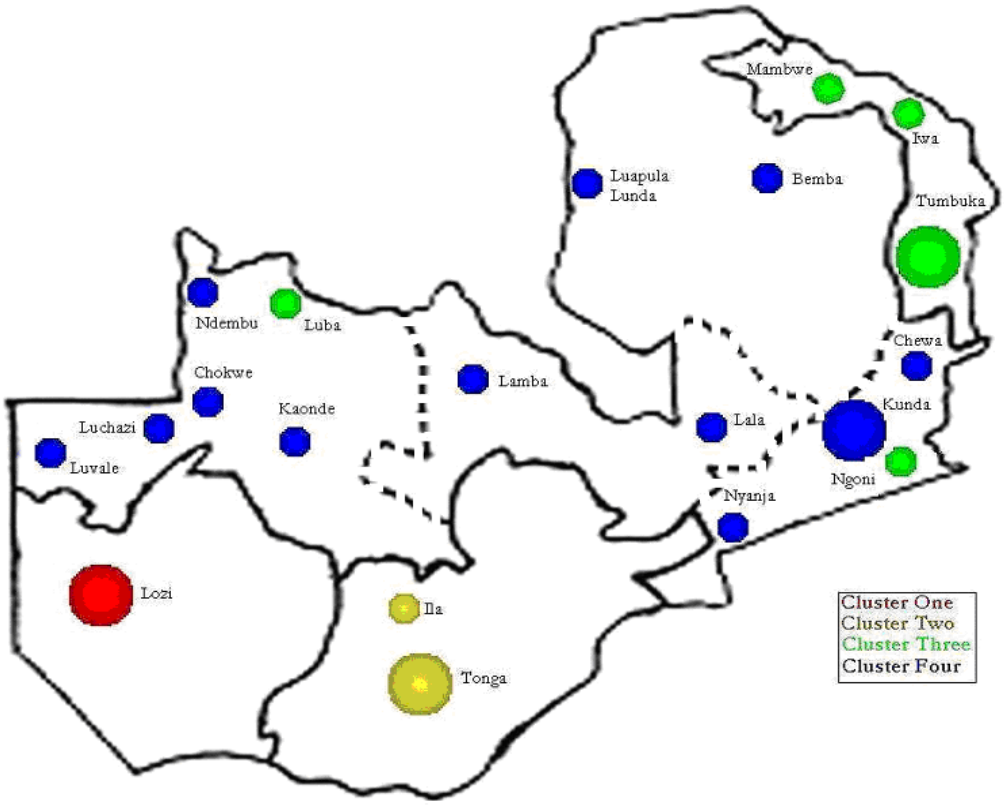
At three and four clusters, the group that migrated directly from the Great Lakes Region splits up into those that settled in the North-eastern and South-central regions, respectively. At five clusters, the societies that came from the Luba/Lunda Kingdom also split up according to region of settlement. One group comprises of societies that settled in the North-western and Central regions of Zambia while the other comprises those that settled in the North-central and Eastern regions.

Beyond five clusters, the group compositions are difficult to explain—implying there are no more than five reproductive clusters in Zambia. In any clustering this is the point at which "…the additional information gained by increasing the number of clusters is more than offset by the additional theoretical complexity of the resulting representation of reality" (Pryor 2005: 257). Despite this, at seven clusters, the membership compares well with those clusters derived using qualitative information—especially for the non-Luba/Lunda societies.

Figure 6 provides a geographical positioning of societies belonging to the four reproductive clusters found in Zambia mapped according to their ethno-geographical

location. The figure presents the **average-type society** of each cluster (suggested by the LOICZView program) using a big bubble—these are the Lozi, Tonga, Tumbuka and Kunda. The boundaries are ethno-geographical regional boundaries of clusters derived qualitatively in Table 2. The dotted lines show ethno-geographical clusters that have formed one traditional reproductive regime.

Figure 6 Traditional reproductive clusters in Zambia as described through application of cluster analysis to Murdock's Ethnographic Atlas data



Note: The lines inside the map represent ethno-geographical regional boundaries

The Lozi form a one-society cluster (red), because as discussed in the next section their traditional reproductive characteristics—adopted mainly from South African traditional societies—are distinctly different from any other Zambian society in Murdock's sample. The Ila and Tonga (from the Great Lakes region) form one group—Cluster 2 (yellow). Societies that also migrated direct from the Great Lakes region but settled in north-eastern Zambia form the third cluster (green). Cluster 4 (blue)—comprising mostly societies whose descendants migrated from the Luba/Lunda—has the largest number of societies spanning across a wide geographical area of Zambia from the North-western region to South-eastern.

Even though two societies—the Luba and Ngoni from the Luba Kingdom and South Africa—have settled among and near the societies in the fourth cluster, they display

reproductive traits of the traditional societies in the third cluster. This is because although most traditional arrangements of the Luba and Ngoni are similar to their matrilineal neighbours, they have upheld most of their patrilineal characteristics (Brelsford 1956; Barnes 1967).

4 Describing the Zambian traditional reproductive regimes

Table 5 presents the defining characteristics of the four traditional reproductive regimes in Zambia according to the three sets of attributes underlying reproduction in traditional societies. The figures in the table are weighted scores (total of one) derived from the mean scores produced by the multivariate cluster analysis procedure. Principal components analysis results (not presented) and statistical significance tests (t-test values[7]) show the variables that distinguish between the clusters.

Overall, Cluster 1 has the highest average score[8] (64 per cent) a suggestion that compared with other clusters, this group has characteristics that are favourable to low fertility in traditional societies. Cluster 2 has the next highest score (58 per cent) and the last two clusters have the lowest scores (55 and 53 per cent). Multidimensional distance indices computed in LOICZView show the same relationships. For instance, Cluster 1 is the furthest from Cluster 4 followed by Cluster 2 while the closest is Cluster 3. Using these scores, Cluster 1 and 2 are designated as the "low and medium traditional fertility regimes" respectively. Clusters 3 and 4 are both high traditional fertility regimes but for purposes of identification, they are designated as "high traditional fertility patrilineal regime" and "high traditional fertility matrilineal regime", respectively.

Figure 7 illustrates the profiles of the four regimes on the three sets of attributes underlying fertility in traditional societies. Cluster one (low traditional fertility regime) has advanced traditional economic and political arrangements conducive to lower fertility while cluster four (high traditional fertility matrilineal regime) is less organised. Compared with Cluster 1, the other clusters have social and community arrangements that encourage higher fertility. Governance of courtship and sexual relations is more restrictive in Clusters one and two (low and medium traditional fertility regimes).

Therefore, patterns of traditional economic and political organisation as well as courtship and sexual governance are the features that separate low and medium traditional fertility regimes from the high fertility regimes. Further, social and community

[7] Because equal variance cannot be assumed, the degrees of freedom are calculated using the formula proposed by Satterthwaite (1946), as suggested by Pryor (2003)

[8] We recoded data to associate high scores on these variable to low fertility and vice versa

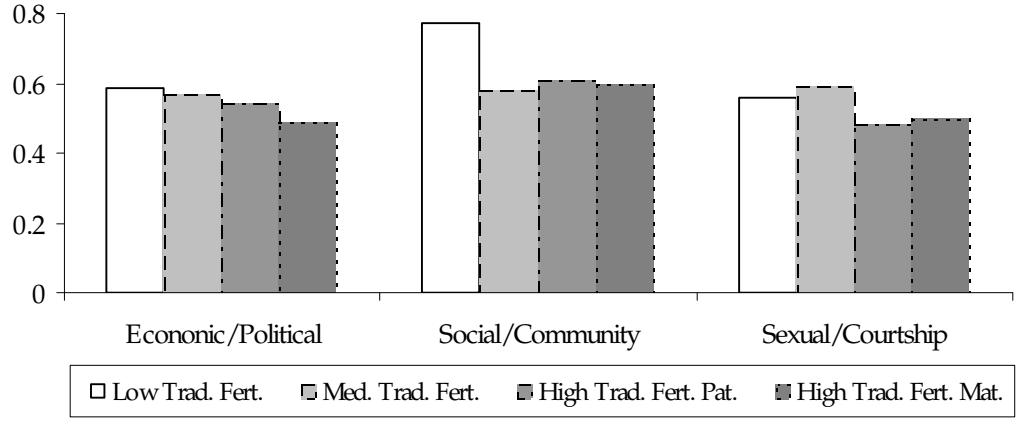
organisation in Zambian traditional societies is what separates the low from the medium traditional fertility regime. Lastly, the only distinction between the two high fertility regimes is traditional economic and political organisation—although as discussed later, kinship lineage also casts an important distinction.

Table 5 Defining characteristics of traditional reproductive regimes in Zambia derived using data from the Murdock's Ethnographic Atlas

Traditional feature	Cluster				
	First	Second	Third	Fourth	All
Name of archetype society in each cluster	Lozi	Tonga	Tumbuka	Kunda	All
Number of societies in each cluster	1	2	5	12	20
Traditional economic and political organisation					
Dependence on gathering (0-1, low = 0)	0.20	0.15	0.12	0.13	0.13
Dependence on hunting (0-1, low = 0)	0.30	0.15	0.24	0.26	0.25
Dependence on fishing (0-1, low = 0)	0.20	0.15	0.18	*0.27	0.23
+Dependence on animal husbandry (0-1, low = 0)	0.30	0.35	0.22	*0.16	0.20
+Dependence on agriculture (0-1, low = 0	0.50	0.70	0.74	0.68	0.69
Intensity of agriculture (0-1, none = 0)	0.83	0.50	0.50	0.50	0.52
Major crop type (0-1, none = 0)	0.83	0.83	0.77	0.78	0.78
+Predominant type of animal husbandry (0-1, none = 0)	1.00	**1.00	0.57	**0.33	0.49
Milking of domestic animals (0-1, none/little = 0)	1.00	*1.00	0.70	0.54	0.65
Settlement patterns (0-1, nomadic = 0)	0.38	0.56	**0.88	0.76	0.75
Jurisdictional hierarchy within local community (0-1, four levels = 0)	0.67	0.33	0.53	0.44	0.47
+Jurisdictional hierarchy beyond the local community (0-1, none = 0)	0.80	0.30	0.64	0.52	0.54
+Type of hereditary succession (0-1, none = 0)	0.50	0.75	**0.38	**0.72	0.66
Class stratification (0-1, none = 0)	0.40	0.50	0.40	0.27	0.33
Type of slavery (0-1, absent = 0)	1.00	0.88	0.81	0.68	0.75
+Former presence of slavery (0-1, absent = 0)	0.50	1.00	1.00	0.80	0.85
Average - economic and political organisation	**0.59**	**0.57**	**0.54**	**0.49**	**0.52**
Traditional social and community organisation					
+Largest patrilineal kin group (0-1, advanced/complex = 0)	1.00	0.83	**0.43	**1.00	0.84
+Largest matrilineal kin group (0-1, advanced/complex = 0)	1.00	*0.17	**1.00	**0.17	0.42
Largest matrilineal exogamous group (0-1, advanced/complex = 0)	1.50	1.50	1.50	1.36	1.42
Largest cognatic kin group_primary (0-1, none/na = 0)	0.71	0.14	0.29	0.21	0.25
Largest cognatic kin group_secondary (0-1, none/na = 0)	1.00	0.00	0.00	0.00	0.05
+Community marriage organisation_primary (0-1, simple = 0)	1.00	*1.00	0.79	0.71	0.77
Marital residence with kin: first years (0-1, husband's kin = 0)	0.60	0.70	0.76	0.67	0.69
+Transfer of residence at marriage: after first years (0-1, husband's kin = 0)	0.20	0.30	**0.20	**0.60	0.45
+Marital residence with kin: after first years (0-1, none = 0)	0.30	0.35	**0.14	0.33	0.28
Inheritance rule for land (0-1, none = 0)	0.71	0.29	0.50	0.46	0.46
Sex differences: agriculture (0-1, males only = 0)	0.88	0.88	0.81	0.78	0.80
Kin terms for cousins (0-1, mixed = 1)	0.38	0.75	0.75	0.75	0.73
Perception of High Gods (0-1, supportive of human morality = 0)	0.75	0.63	0.75	0.71	0.72
Average - social and community organisation	**0.77**	**0.58**	**0.61**	**0.60**	**0.61**
Traditional courtship and sexual relationship governance					
+Male genital mutilations (0-1, absent = 0)	0.10	0.10	**0.10	*0.27	0.19
+Type of cousin marriages allowed (0-1, any first cousin = 0)	1.00	0.58	0.60	*0.55	0.59
+Type of cousin marriages preferred (0-1, symmetrical = 0)	1.00	0.87	0.73	**0.59	0.67
+Primary mode of marriage (0-1, bride price/wealth = 0)	0.38	*0.13	0.18	*0.30	0.26
+Secondary mode of marriage (0-1, bride price/wealth = 0)	0.25	*1.00	0.70	0.73	0.73
+Domestic org.: type of marriage (0-1, independ. polyandrous families = 0)	0.63	**0.88	0.60	0.55	0.60
Average - courtship and sexual governance	**0.56**	**0.59**	**0.48**	**0.50**	**0.51**
Overall	**0.64**	**0.58**	**0.55**	**0.53**	**0.54**

Note: ** Indicates that the cluster average is significantly different at the 0.01 level of confidence from the sample average excluding the reference cluster
* Indicates that the cluster average is significantly different at the 0.05 level of confidence from the sample average excluding the reference cluster
+ Indicates variables identified, using principal components analysis, as key attributes of the traditional reproductive regimes
- The boxed values are those in the extreme end of the range values or equal to a significant value in another cluster. This is because it is not possible to compute degrees of freedom for cluster 1 because its sample size is one

Figure 7 Profiles of the four clusters on the three sets of attributes that underlying fertility in traditional societies



Low traditional fertility regime

Murdock's Ethnographic Atlas has only one traditional society—the Lozi—with features conducive to low fertility. Therefore, it is not possible to test statistical significance of this regime's estimates. As a result, this discussion uses the exceptional scores (those boxed in Table 5) to highlight the outstanding traditional features.

The Lozi has several characteristics of a low traditional fertility society. These are advanced traditional political and economic arrangements, less rigid social and community features, and strict governance of courtship and sexual relations. Additional anthropological accounts of the Lozi provide support for these features. Gluckman (1950: 168) describes their mixed traditional economy as follows: "they have to send their cattle to … grazing … when they are gardening and fishing on the Zambezi plain…". Similarly, Roberts (1976) describes the Lozi traditional society as politically well-organised.

The Lozi may have had less need for communal living for purposes of survival because they had an economically advanced traditional society. This quality promoted family nucleation and therefore less rigid social and community arrangements. For instance, inheritance circulated within the immediate rather than the extended family (Gluckman 1968). Family nucleation may have accounted for the high social status of women in this traditional regime. Gluckman (1968) notes that the Lozi hold their women, including wives, in high esteem; they have notable authority and their opinion is important. Even upon marriage, Lozi women remained members their kin-groups and did not produce children for the husband's kin. By placing less emphasis on bridal price, the Lozi may have been upheld the social status of their women (Gluckman 1968).

The Lozi exercised strict governance of courtship and sexual relations by limiting sexual outlets (Gluckman 1968). They did not sanction sex or marriage between individuals related through a traceable genealogy and hence, cousin marriage was strictly taboo (Gluckman 1968). Widespread cognate relations made these controls even more repressive. Gluckman (1968) observes that in the third generation all siblings, half-siblings and cousins, however related, are called brother and sister. The Lozi also encouraged sex abstinence until marriage and discouraged adultery. Definition of adultery among the Lozi is not limited to sleeping with someone's wife but any intent to do so by walking with her or aiding her in any form or offering her anything especially alcohol (Gluckman 1968). Higher proportions of polygyny and frequent divorces in the Lozi society may have reduced exposure to sexual intercourse. Although average age is not stated, Gluckman (1968) reports that age at first marriage in this society was high.

Less rigid social and community arrangements and strict governance of courtship and sexual relations among the Lozi society had support from an advanced traditional economic base. Boserup (1985) as well as Caldwell and Caldwell (1987) have argued that these features account for low fertility in sub-Saharan traditional societies.

Medium traditional fertility regime

The Tonga and Ila are the only medium traditional fertility regime societies in Murdock's Ethnographic Atlas. Seven of the 35 attributes are significantly different from the sample average of the other three regimes (Table 5). This regime had traditional features that supported both high and low fertility and therefore ending as a medium traditional fertility regime. Their courtship and sexual relations arrangements supported low fertility. Compared with the two high traditional fertility regimes, this regime had an advanced traditional political and economic base.

They score highly on their traditional economic features because they settled in an environment that was favourable to animal and crop farming (Roberts 1976). Jaspan (1953) and Colson (1968) observe that the Ila and Tonga societies are mainly pastoralists who take pride in owning as many cattle as possible—hardly for sale—but as a source of dairy products. Colson (1968) observes that apart from cattle rearing, the Tonga produced cereal grain. Their rather well-organised traditional economy could have supported low fertility.

However, the Tonga and Ila had rigid social and community arrangements centred on complex matrilineal kinship and patri-line inheritance that could have supported high fertility. Women and their children (regardless of whom the father was)

belonged to the husband's lineage (Smith and Dale 1920). Further, "when a wife dies, it was the duty of her matrilineal kin to provide the surviving husband with a substitute—even if this woman is married" (Jaspan 1953: 39). Patrilocal marital home arrangements could have also compromised women's social status in these societies. This could have resulted in relatively higher fertility because—as suggested by Setel (1995)—they lacked the capacity to negotiate their fertility. Colson (1960: 96) notes that marital residence was with the husband's family, on marriage "…the bride moves to her husband's home wherever this happens to be even if it is in another neighbourhood". Women kept the earnings from selling their surplus produce only after consulting the husband (Colson 1968).

The significance placed on expensive bridal wealth by these societies could have also compromised their woman's social status. Bridal wealth involved a transfer of cattle from the groom's family to the family of the intended bride (Jaspan 1953; Colson 1968). The woman's family recognised a man as a husband after his family paid the full amount of the bridal price (Colson 1958). Traditional societies interpreted payment of bridal wealth as a transfer of reproductive rights from a woman's kinship to her husband's.

On the other hand, prohibitive bridal wealth could have discouraged marriages and probably resulting in low fertility. Exposure to sexual intercourse was also limited due to marital interruptions. Smith and Dale (1920) as well as Colson (1958; 1968) observe these societies were polygamous and divorces were common.

High traditional fertility patrilineal regime

In Murdock's Ethnographic Atlas, five patrilineal Zambian societies make up the high traditional fertility patrilineal regime. Table 5 shows that seven out of the 35 attributes underlying fertility in traditional societies distinguish this regime from the sample average of the other three regimes. With a less advanced traditional economic base, a rigid social and community organisation, and flexible governance of courtship and sexual relations, this regime displays the assumed characteristics of a high traditional fertility society. Multivariate cluster analysis has selected the Tumbuka as the society with the average features in this regime. However, the discussion in the next paragraphs uses literature on the Mambwe and Ngoni as well because more information on these societies is available.

Phiri (2000) notes that the Tumbuka practiced extensive agriculture—largely shifting cultivation—producing cereal grain such as finger millet, sorghum and maize. Large animal farming was not as pronounced amongst these societies because the environment in their villages was not that conducive to animal husbandry (Corinaldi

1966). Without an advanced traditional economic base, societies in this regime had a need to expand and coexist in large communities. That is why multivariate cluster analysis results show that societies in this regime had advanced settlement patterns, that is, compact and permanent. Radcliffe-Brown (1940) links this feature to the need for coexistence among individuals.

The need to coexist explains the rigid community and social arrangements. The kinship lineage of societies in this regime was strictly unilineal: patrilineal without any traces of matril-lineage. Their marital home arrangement was patrilocal and the extended family was involved in marital unions of individuals. Barnes (1967) reports that the Ngoni lineages were exogamous and marital residence was patrilocal. These male-centred features point to a consistency that status of women in this cluster was low and therefore they could not negotiate their fertility. For example, among the Mambwe, women and their children belonged to the husband's lineage and they practiced the levirate (Watson 1958).

Significance of bridal wealth that transferred their productive and reproductive rights further worsened and upheld the low social status of women in these societies. Watson (1958: 113) notes that "when a Mambwe marries, he pays out a considerable sum…the essential item in their marriage contract is an exchange of cattle and money, and the wife comes to live in her husband's village". This meant that on marriage, women's productive and reproductive rights belonged to the husband's lineage a feature that supports high fertility. The Ngoni rarely paid bride-wealth "…until after several children have been born" (Barnes 1968: 226).

Governance of courtship and sexual relations among these societies also promoted high fertility. Age at marriage was low because narrow cognatic kinship relations made finding a partner easy. Absence of circumcision meant there was no barrier to early marriage. Further, although in principle, societies in this regime did not allow marriage between close genealogical relatives—apart from cross-cousins and siblings-in-law—tracing these relations was of little interest to individuals. Therefore, "distant relationships between the couple to be were conveniently forgotten by the parties concerned" (Barnes 1968: 226).

High traditional fertility matrilineal regime

Societies belonging to the high traditional fertility matrilineal regime make up 60 per cent of the Zambian sample in Murdock's Ethnographic Atlas. Cluster analysis results show that in this regime the Kunda has the average characteristics. However, additional

anthropological literature on the Kunda is not available. Therefore, the discussion in the next paragraphs uses information on other societies in this cluster. Eleven attributes significantly distinguish this regime from the other Zambian traditional fertility regimes. Like the high traditional fertility patrilineal regime, it displays the assumed characteristics of a high traditional fertility regime. Nevertheless, the literature shows that status of women in this regime was better than their patrilineal counterparts.

Turner (1979) reports that the Ndembu society (North-western) placed a high value on hunting. Fishing was the main source of subsistence for the traditional societies in the North-central region (Cunnison 1959). There is also little evidence of animal farming in these traditional societies. Richards (1968: 166) reports that the Bemba "are not a pastoral people…and have no tradition or knowledge of handling cattle…" Most traditional societies in this regime cultivated extensively and produced only tuber crops and cereal grain (Roberts 1976). Similarly, Richards (1968) and Roberts (1973) observe that the Bemba traditional society practised extensive agriculture—largely shifting cultivation and produced only cereal grain.

Therefore, with a less advanced traditional economy, individuals belonging to societies in this regime needed to coexist to survive. Their well-organised military was for survival purposes. For instance, the Bemba used their well-organised military to attack their neighbours—for instance, the Iwa and the Mambwe—for food needs (Roberts 1976). Like their patrilineal counterparts, the need to coexist explains their uni-lineage: the full corporate matrilineal kinship. Further, their community organisation was exogamous rather than agamous—an arrangement that rules out the possibility of strong immediate family bonds.

Women belonging to societies in this regime had a much greater say in decision-making because of the matrilocal living arrangements. As a result, their status was higher than the patrilineal group. High women's status coupled with matrilocal marital home might have placed women in a position of negotiating their fertility (Boserup 1985). Richards (1968) states that marital home among the Bemba-speaking people is matrilocal. This is the only regime in which polygamy was rare because of resistance from women (Richards 1968). Modest needs for a man to marry could have further upheld the status of women. According to Richards (1968), although requirements of marriage were important among the Bemba, they were in form of a token or service to the bride's family.

However, governance of courtship and sexual relations in these societies supported high fertility. Compared with other Zambian traditional reproductive regimes,

Table 5 shows that societies in this regime were significant more likely to allow and prefer marriages among relations. Richards (1968) notes that the Bemba preferred marriage between relatives such as cross-cousins, granddaughters and sons, to daughters of his own sons (but not among commoners) and to his brothers' sons. In addition, individuals passed on their marriages to the next generations. For instance, "…a woman has definite rights over her brother's daughter, and may demand this girl as an additional wife for her husband or a substitute wife if she herself is tired of married life" (Richards 1968: 181).

The Bemba (North-central region) encouraged early marriage subtly because "rather than the number of cattle and possessions…the Bemba father counts his assets in terms of the number of sons-in-law whose services he can command, such a system being correlated with the institution of matrilocal marriage" (Richards 1968: 180). The Luvale (North-western region) "…regard the attainment of puberty by a girl and the time for marriage as normally coincident occasions" and this is mostly below the age of 12 years old (White 1962: 1). Besides, White (1962: 1, 8) observes that "premarital virginity is not expected of Luvale girls, and many therefore have sexual relations…as young girls today have commonly had considerable sexual experience before puberty."

These societies also encouraged long exposure to sexual intercourse. They achieved this by using initiation ceremonies to teach young women how to keep a marriage (Richards 1968). The Luvale marriage ritual "…includes a very strong sexual element in the instruction…with elements regarded as sexually exciting to men" (White 1962: 7). "The girl is enjoined to live harmoniously, and to avoid jealousy in respect of her husband or co-wives in a polygamous marriage; she is warned to get on well with the relatives of her husband; in particular she is advised that if the father-in-law makes sexual advances to her she must conceal the fact from her husband" (White 1962: 8).

From the discussion, we expect that societies belonging to the low traditional fertility regime would have the lowest fertility followed by those belonging to the medium traditional fertility regime. The patrilineal high traditional fertility regime should have the highest.

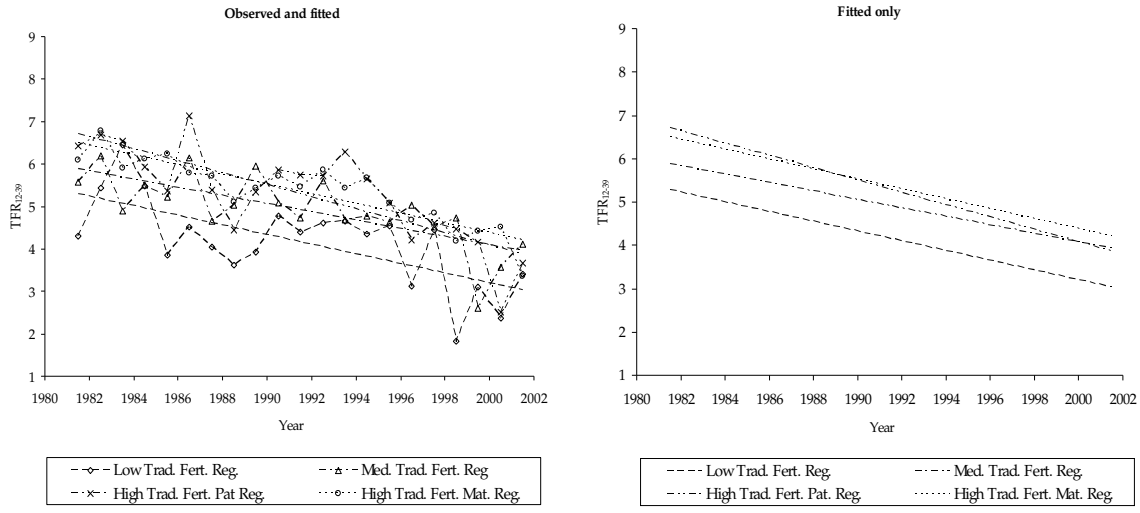
5 Assessing fertility differentials between Zambian traditional reproductive regimes

Appendix 1 presents traditional reproductive regimes in Zambia shown in Figure 6 after mapping other societies that do not appear in Murdock's Ethnographic Atlas clusters using the information in Table 2. Doing so allows for larger sample sizes when estimating

fertility for assessing differentials between traditional reproductive regimes. Section 2 justifies this generalisation by showing that traditional societies not in the Ethnographic Atlas are either similar to, or represented by, those left out. Multivariate cluster analysis results also show that clusters of societies are similar to those presented in Table 2 with an exception of the Luba society. Thereafter, we assign women of reproductive age to traditional reproductive regimes using the ethnicity variable found in present-day data sources. We exclude the non-Zambians because the research question does not cover this group.

Figure 8 shows overall trends in cumulated fertility up to age 40 for each traditional reproductive regime derived from birth histories using the approach described in Garenne and Joseph (2002). Figure 9 presents the same trends by residence classification: urban and rural. Table 6 shows the statistical description of trends in Figure 8 and Figure 9.

Figure 8 Cumulated fertility up to age 40 according to traditional reproductive regime: Zambia, 1992, 1996 and 2001-02 DHS



In the early 1980s, women belonging to the high traditional fertility patrilineal regime had the highest fertility while the low traditional fertility regime women had the lowest. Those belonging to the medium traditional fertility regime and high traditional fertility matrilineal regime had the same fertility. However, the differences in the pace of fertility transition between these two regimes suggest that before 1980, fertility among women belonging to the high traditional fertility matrilineal regime was higher than that for women belonging to the medium traditional fertility regime.

Figure 9 Cumulated fertility up to age 40 by urban/ rural residence classification according to traditional reproductive regime: Zambia, 1992, 1996 and 2001-02 DHS

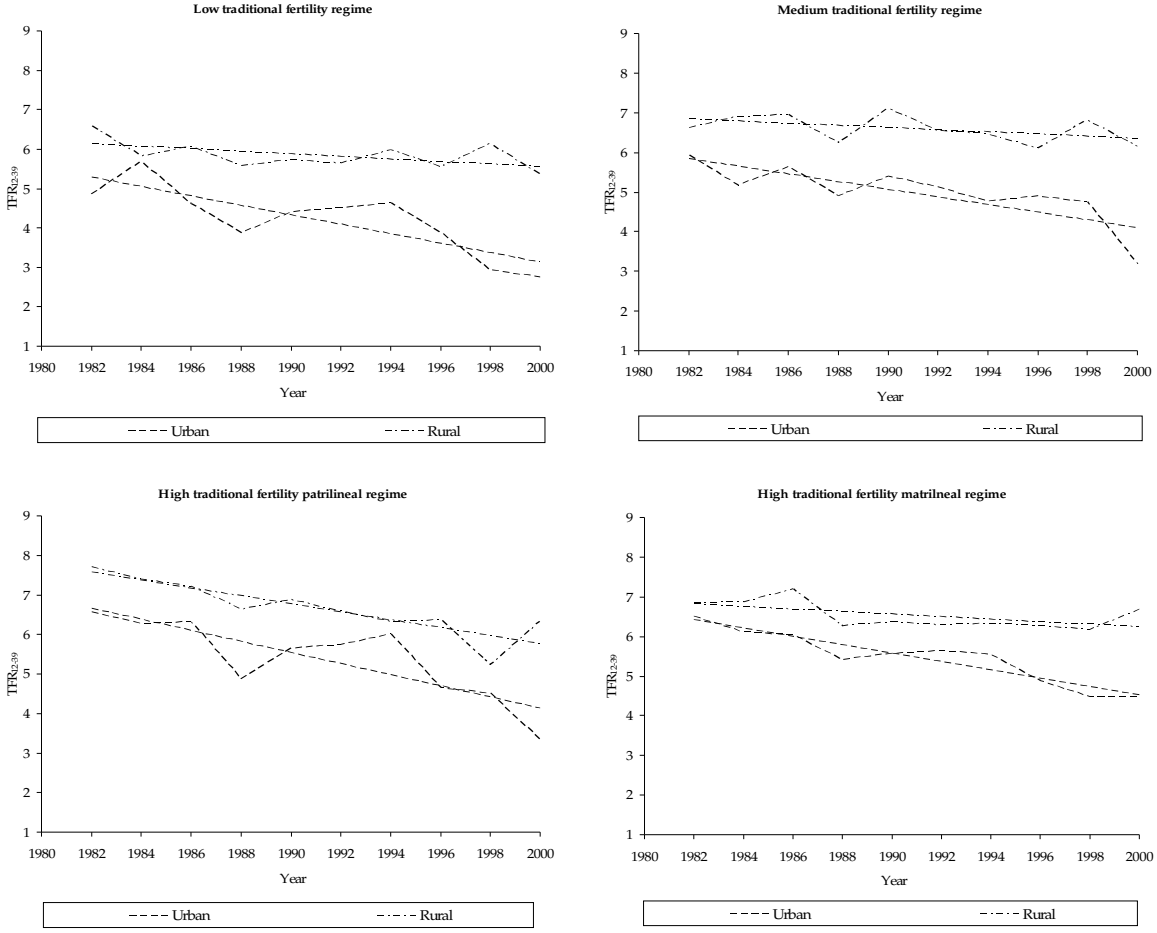


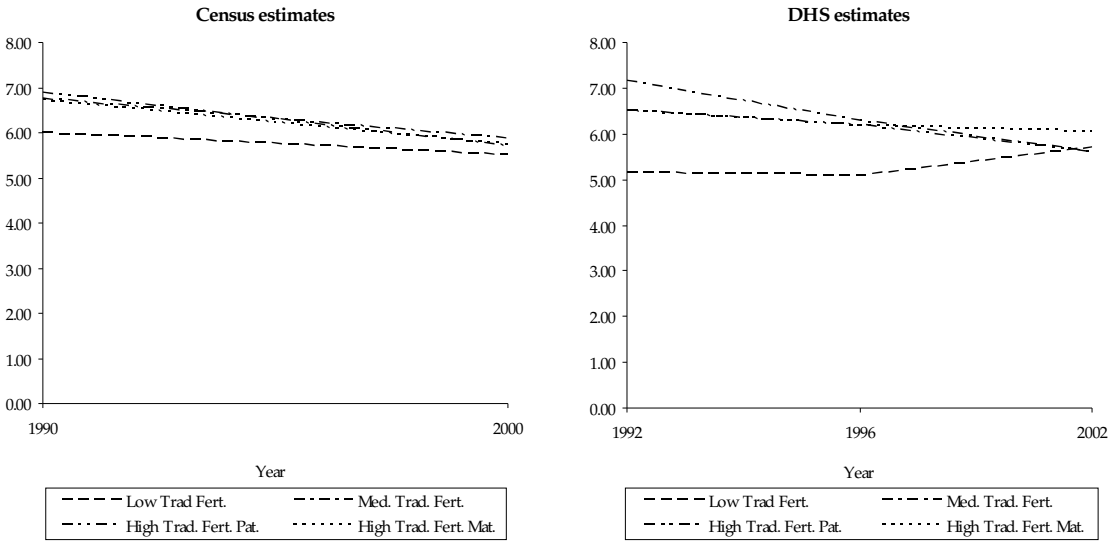
Table 6 Statistics describing fertility trends for each Zambian traditional reproductive regime

	Low trad. Fert.	Medium trad. Fert.	High trad. Fert. Pat.	High trad. Fert. Mat.
Urban/ rural				
Number of births	4,204	8,109	7,627	28,284
Per cent annual decline	-1.663	-1.107	-1.967	-0.864
Slope (exponential)	-0.011	-0.008	-0.019	-0.010
P-value	0.009	0.019	0.003	0.008
Significance	**	*	**	**
Urban				
Number of births	1,054	2,092	3,513	12,203
Per cent annual decline	-3.179	-3.470	-3.764	-2.077
Slope (exponential)	-0.031	-0.213	-0.028	-0.020
P-value	0.004	0.011	0.004	0.001
Significance	**	*	**	**
Rural				
Number of births	3,150	6,017	4,115	16,081
Per cent annual decline	-1.146	-0.406	-1.102	-0.125
Slope (exponential)	-0.005	-0.004	-0.015	-0.005
P-value	0.116	0.174	0.002	0.082
Significance	ns	ns	**	ns

Notes: ** Indicates that the slope is significantly different from 0 at 0.01 level of confidence
* Indicates that the slope is significantly different from 0 at 0.05 level of confidence
ns Indicates that the slope is not significantly different from 0

Twenty years later, the fertility of high traditional fertility patrilineal regime women had declined rapidly and was approaching that for the low traditional fertility regime women. Significant and simultaneous fertility declines for both rural and urban women belonging to the former regime (Figure 8 and Table 6) explain the rapid fertility decline among women belonging to this regime. In 2000, fertility of the medium traditional fertility regime women was the highest because their fertility decline, even in urban areas, was the slowest. Even total fertility estimates (Figure 10) derived from both the census and the DHS show that fertility declines between the four regimes have been different.

Figure 10 Total fertility estimates by year tabulated according to traditional reproductive regime: Zambia, 1990, 2000 Census, 1992, 1996, and 2001-02 DHS



The converging fertility levels signal that importance of traditional fertility governing arrangements are eroding at varying paces in different ethnic societies. This raises some important questions. First, what present-day features have taken over fertility governance? Second, how different are these attributes between the four Zambian traditional reproductive regimes? Third, is fertility decline among women belonging to the high traditional fertility patrilineal regime the fastest because they have embraced present-day features underlying fertility the most, if so why?

6 Explaining converging fertility between traditional reproductive regimes

Features of modernisation such as industrialisation, urbanisation and education are responsible for the erosion and transformation of traditional governors of fertility (Hayes 1994). The erosion and transformation of traditional governors of fertility can explain

fertility change. Data to evaluate if erosion and transformation of traditional governors of fertility are different between the four regimes are not available. Doing so would require the impossible task of collecting both recent and historical data on traditional societies and then evaluating the changes in the ethnographies. However, it is possible to evaluate differences in exposure to modern determinants of fertility between the four traditional reproductive regimes. Doing so, would explain the disparities in fertility trends between women belonging to the four Zambian traditional reproductive regimes.

Bongaarts' (1978) proximate determinants framework is not applied because 'regime' specific data needs are not available. Instead, multivariate analysis of variance (MANOVA) and descriptive discriminant analysis (DDA)—detailed in Huberty and Olejnik (2006) as well as Hair, Black, Babin *et al.*(2006a)—are applied to evaluate and compare present-day features underlying fertility between traditional reproductive regimes in Zambia.

To perform MANOVA and DDA procedures, a research design must have at least one grouping variable and more than one response variable (Hair, Black, Babin *et al.* 2006a, 2006b). The grouping variable (traditional reproductive regimes) shows the group to which each observation belongs. Response variables (present-day determinants of fertility) describe the characteristics of each observation. These comprise of both proximate and background determinants of fertility available in the census and DHS data. The analysis evaluates six census and ten DHS response variables. The census has fewer variables because it does not collect information on some present-day determinants of fertility such as contraceptive use. Ages at marriage and at birth are excluded from the analysis because of missing information for respondents who were still single and those non-parous at enumeration.

The information in Appendix 2 describes the values for the codes used in the analysis with low scores corresponding to high fertility. SPSS (2005) version 14 software was used for these assessments. As recommended by Huberty and Mohamed (2003), the data had to be certified suitable for multivariate assessments using a battery of tests.

The multivariate analysis of variance (MANOVA) Bartlett-Pillai and Wilks lambda test statistics for assessing multivariate differences also showed that the centroids for the four Zambian traditional fertility regimes differ significantly. This implies that our results are generalisable to the populations that these samples represent.

Table 7 presents descriptive discriminant analysis statistical test results assessing significance of each of the three linear discriminant functions for each data source. The

results (fifth column) show that all three linear discriminant functions are significant. However, for both censuses, the third linear discriminant function (last column) accounts for less than two per cent of the variability in the data. Therefore, we exclude these latent variables from the analysis.

Table 7 Tests for dimensionality for the four traditional reproductive regimes: Zambia 1990 and 2000 Census; 1992, 1996 and 2001-02 Zambia DHS

The three linear discriminant functions according to data source	Statistical description				
	Λ	X^2	df	*P*	Variance (%)
1990 Census					
1st linear discriminant function	0.864	59,167.60	18	0.000	85.4
2nd linear discriminant function	0.978	9,043.90	10	0.000	13.8
3rd linear discriminant function	0.999	533.62	4	0.000	0.9
2000 Census					
1st linear discriminant function	0.894	59,517.30	18	0.000	79.3
2nd linear discriminant function	0.976	12,661.35	10	0.000	19.1
3rd linear discriminant function	0.998	998.71	4	0.000	1.6
1992 DHS					
1st linear discriminant function	0.788	1,632.02	30	0.000	63.5
2nd linear discriminant function	0.914	612.45	18	0.000	29.7
3rd linear discriminant function	0.983	115.88	8	0.000	6.7
1996 DHS					
1st linear discriminant function	0.778	1,947.46	30	0.000	78.3
2nd linear discriminant function	0.944	449.93	18	0.000	16.7
3rd linear discriminant function	0.987	104.72	8	0.000	5.0
2001-02 DHS					
1st linear discriminant function	0.809	1,569.83	30	0.000	70.4
2nd linear discriminant function	0.937	481.33	18	0.000	24.7
3rd linear discriminant function	0.989	81.44	8	0.000	4.9

As a follow-up to Table 7, Table 8 and Table 9 show that location and classification (rural/urban) of residence accounts for the most variation in present-day features underlying reproduction between the Zambian traditional reproductive regimes. An examination of frequency distributions reveals that most women belonging to societies that make up the low traditional fertility regime live in rural regions that are not easily accessible by road and rail. However, although most medium traditional regime women live in rural areas, these regions are easily accessible by road and rail (Southern and Central Provinces). Meanwhile, almost equal proportions of women belonging to the high traditional fertility regimes live in both rural and urban areas (Copperbelt and Lusaka Provinces). This suggests that compared with the low and medium traditional reproductive regimes, fertility could be declining more rapidly in the two high traditional fertility regimes because larger proportions live in the most urbanised areas of Zambia.

Table 8 Structure *r's* for the four traditional reproductive regimes: Zambia 1990 and 2000 Census

Variable	Linear discrimnant function			
	1990 Census		2000 Census	
	First	Second	First	Second
Location	**0.59**	**0.71**	**0.72**	**0.53**
Residence	-0.22	**0.81**	-0.26	**0.77**
Marital status	-0.02	-0.29	-0.09	-0.41
Economic activity	-0.01	0.07	0.06	0.13
Head of the household	-0.09	-0.01	-0.10	-0.07
Education	0.06	-0.10	0.07	-0.04

Note: The values in boldface point out the important variables because their coefficients are relatively higher (≥50 per cent) than those for other variables

Table 9 Structure *r's* for the four traditional reproductive regimes: Zambia 1992, 1996 and 2001-02 Zambia DHS

Variable	Linear discrimnant function								
	1992 DHS			1996 DHS			2001-02 DHS		
	First	Second	Third	First	Second	Third	First	Second	Third
Location	**0.36**	**0.71**	**-0.38**	**-0.57**	**0.53**	-0.28	**-0.64**	**0.40**	**0.41**
Residence	-0.32	**0.60**	**-0.50**	0.19	**0.45**	**-0.56**	0.13	0.16	**0.73**
Religion	0.31	**-0.58**	**-0.39**	-0.26	**-0.60**	**-0.41**	-0.29	**-0.73**	0.05
Marital status	-0.03	-0.12	0.10	0.03	**-0.41**	0.24	0.03	-0.13	**-0.39**
Type of marriage	0.04	-0.22	-0.06	-0.03	**-0.43**	0.09	-0.02	-0.16	-0.34
Economic activity	-0.14	-0.18	-0.11	0.15	0.03	0.20	0.21	**0.43**	-0.27
Head of the household	-0.12	-0.22	0.16	0.13	-0.11	0.12	0.04	-0.04	-0.29
Ever used contraception	-0.21	0.02	**-0.61**	-0.04	-0.01	**-0.54**	-0.06	0.06	0.26
Education	0.05	0.08	**-0.35**	-0.09	-0.06	-0.14	-0.11	-0.10	**0.38**
Currently using contraception	-0.05	0.05	-0.25	0.01	0.07	-0.33	-0.06	0.06	0.23

Note: The values in boldface point out the important variables because their coefficients are relatively higher (≥35 per cent) than those for other variables

Further examination of the results also show that classification of residence, education and contraceptive use are the features that distinguish women belonging to the high traditional fertility patrilineal regime from those belonging to other regimes. Most high traditional fertility patrilineal regime women are educated, live in urban areas, Protestants, and report having used contraception before. This probably explains why fertility is declining the most among women belonging to this regime. It also seems that contraceptive use is what sets them apart from their matrilineal counterparts. Compared with their matrilineal counterparts, this suggests that fertility is declining rapidly among women belonging to the patrilineal regime women because they are more urbanised, educated and likely to be using contraception.

7 Discussion

Overall, multivariate cluster analysis results and migration histories of Zambian societies provide some proof that regional fertility variations are a reflection of ethnic fertility

differentials in Zambia. The results suggest that social and community features are important arrangements for controlling sexual and marital relations—hence reproduction—in pre-industrial societies. However, the impact of these features on reproduction in traditional societies is inversely related to traditional economic and political arrangements. Economically and politically granted traditional societies are able to impose strict courtship and sexual relations controls that result in low fertility. The research shows that traditional societies with low observed fertility are those with a weak control of reproduction at community level. This suggests that control of fertility at family level is associated with low fertility therefore, supporting family nucleation preposition of the intergenerational wealth-flows theory.

The results showed that exposure to and embracing of modernisation features is different between the four traditional reproductive regimes. Large proportions of women belonging to the two high traditional fertility regimes now live in the most urbanised regions of Zambia. Therefore, compared with women belonging to the other regimes, it is most likely that fertility is declining rapidly among these women because the majority live in the most urbanised Zambian regions. This finding supports the urbanisation proposition of the modernisation theories.

Descriptive discriminant analysis results showed that fertility has been declining more rapidly among women belonging to the patrilineal societies because larger proportions of these women are using contraception. Compared with their matrilineal counterparts, it is difficult to explain why this is so, especially that anthropological accounts show that women belonging to matrilineal societies have a say in their reproduction. We therefore suggest that women with the highest fertility who belong to traditional societies in which their status is low respond more positively to present-day suppressants of fertility. This is because they are quick to emancipate themselves from traditional norms that promote high fertility once an opportunity to do so arises.

There is also a possibility that ideational features have played a role in the rapid fertility decline of women belonging to the patrilineal societies. Information that child survival had increased probably because of decreasing mortality could have spread among these women. Higher child survival could have placed larger economic strain on these societies because they had the highest fertility before the 1980s.

The results suggest that different traditional societies have different resilience to modernisation that affects demographic outcomes with varying degrees. This observation is in line with Caldwell, Caldwell and Orubuloye's (1975) argument that historical and pre-

industrial traditions have present-day demographic implications in sub-Saharan Africa. It also shows that modernisation in Zambia has not reached a level that breaks resilience of traditional reproductive behaviours for most Zambian ethnic societies. Ohadike and Tesfaghiorghis (1975) had also reached a similar conclusion and observe that:

> "Fundamentally, valued institutions and behaviour patterns persist with the people unless new social, economic and ideological super-structures are created to transform the foundations of the old ways…variations strongly suggest the occurrence of social, economic and demographic changes to which people have been reacting with varying degrees of success and accommodation" (Ohadike and Tesfaghiorghis 1975: 52).

However, the results do not explain the observed low fertility among traditional societies found in North-western province. According to this research, societies in this region fall under the high traditional fertility matrilineal regime and therefore, fertility among societies in this region should be higher. There is a possibility that sterility and infertility affects societies in this region (Hill 1985). This research cannot examine this issue in detail—as well as ethnic and regional differentials in HIV prevalence and its links to fertility—because of lack of data. There is also a need to examine if mortality, especially infant and child mortality, is different between traditional reproductive regimes. If mortality differences exist, are they similar to fertility variations and could fertility decline in some regimes be a lagged response to mortality decline.

Overall, the paper also shows that it is possible to get meaningful results from integrating anthropology into quantitative analysis using a multivariate approach and combining both qualitative and quantitative analyses. This approach suppresses limitations due to poor ethnographic data coding. Correct coding of some variables offsets inaccurate coding of other variables. This may also apply to agency within a structured society. Whilst individuals can decide to act outside group norms, it is unlikely that they will shed off all group norms. They will uphold some norms while adjusting and abandoning others. Therefore, a multivariate evaluation of group norms recognises interdependence of structure and agency.

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Appendix 1: Traditional reproductive regime in Zambia according to region

High fertility - matrilineal

Region I

Society	Population in 1953	
	Number	Per cent
1 **Luvale**	**49,097**	**24.4**
2 **Kaonde**	**42,354**	**21.1**
3 **Ndembu**	**33,216**	**16.5**
4 **Luchazi**	**21,442**	**10.7**
5 **Chokwe**	**11,355**	**5.7**
6 Lunda	40,131	20.0
7 Mbowe	2,941	1.5
8 Mbwela	280	0.1
9 Lwena*		
Total	200,816	100.0

Region II

Society	Population in 1953	
	Number	Per cent
1 **Bemba**	**144,511**	**32.5**
2 **Lunda**	**82,050**	**18.4**
3 **Shila****	**7,300**	**1.6**
4 Bisa	50,804	11.4
5 Aushi	43,163	9.7
6 Chishinga	28,735	6.5
7 Ngumbo	28,047	6.3
8 Mukulu	20,882	4.7
9 Tabwa	15,320	3.4
10 Kabende	9,355	2.1
11 Unga	9,204	2.1
12 Bwile	5,899	1.3
13 Batwa*		
14 Ngwela*		
Total	445,270	100.0

High fertility - patrilineal

Region III

Society	Population in 1953	
	Number	Per cent
1 **Ngoni**	**66,589**	**30.1**
2 **Tumbuka**	**25,300**	**11.4**
3 **Mambwe**	**21,388**	**9.7**
4 **Iwa**	**12,249**	**5.5**
5 **Luba**	**N/ S**	
6 Lungu	38,073	17.2
7 Senga	25,811	11.7
8 Inamwanga	12,400	5.6
9 Tambo	5,340	2.4
10 Yombe	4,234	1.9
11 Fungwe	2,849	1.3
12 Nyika	2,630	1.2
13 Lambya	1,953	0.9
14 Wenya	900	0.4
15 Wandya	800	0.4
16 Kamanga	500	0.2
17 Sukwa*		
Total	221,016	69.9

Low fertility

Region IV

Society	Population in 1953	
	Number	Per cent
1 **Lozi**	**54,605**	**22.9**
2 Kwangwa	34,866	14.6
3 Mbunda	32,111	13.5
4 Nkoya	28,785	12.1
5 Kwandi	13,841	5.8
6 Totela	13,765	5.8
7 Subiya	9,705	4.1
8 Ndundulu	7,649	3.2
9 Lushange	7,000	2.9
10 Makoma	6,557	2.7
11 Mashasha	5,876	2.5
12 Nyengo	5,833	2.4
13 Simaa	5,440	2.3
14 Mwenyi	4,804	2.0
15 Shanjo	3,385	1.4
16 Mashi	3,377	1.4
17 Lukolwe	892	0.4
Total	238,491	100.0

Region V

Society	Population in 1953	
	Number	Per cent
1 **Lala**	**55,936**	**41.5**
2 **Lamba**	**35,175**	**26.1**
3 Swaka	17,647	13.1
4 Lima	15,210	11.3
5 Seba	6,000	4.5
6 Luano	4,808	3.6
Total	134,776	100.0

Region VII

Society	Population in 1953	
	Number	Per cent
1 **Chewa**	**127,824**	**54.0**
2 **Kunda**	**19,447**	**8.2**
3 **Nyanja*****	**N/ S**	
4 Nsenga	73,568	31.1
5 Ambo	11,657	4.9
6 Chikunda	4,383	1.9
Total	236,879	100.0

Medium fertility

Region VI

Society	Population in 1953	
	Number	Per cent
1 **Tonga**	**164,829**	**58.8**
2 **Ila**	**17,737**	**6.3**
3 Lenje	42,723	15.2
4 Soli	19,208	6.8
5 Toka	16,257	5.8
6 Goba/Gowa	7,436	2.7
7 Leya	6,256	2.2
8 Sala	4,034	1.4
9 Lumbu	2,063	0.7
10 We	N/S	
Total	280,543	100.0

Notes: Regional grouping based on Brelsford's (1956) Tribal and Linguistic map

The layout of the table broadly reflects geographical location in Zambia - for example Region I is North-western and Region VI is South-central

Traditional societies used to derive the clusters - i.e. those whose data are available in the Murdock's Ethnographic Atlas - are in boldface

* Not in the Tribal and Linguistic Map but discussed by Brelsford

** Dropped from the cluster analysis because most information on this society is missing

***Not in the Tribal and Linguistic Map presented/discussed by Brelsford but recognised in contemporary data sources

NS - the population figure of the specific society not stated but included in other larger societies which however are not stated by Brelsford.

Appendix 2: Variable description and codes

Variable		Code	Label
Name	Description		
v104_reh	Head of the household	1	No
		2	Yes
v131_pro	Location	1	Non Traditional line-of-rail
		2	Traditional line-of-rail Rural
		3	Traditional line-of-rail Urban
v141_res	Residence	1	Rural
		2	Urban
v152_edu	Education	1	None
		2	Primary
		3	Secondary and higher education
v192_eco	Economic activity	1	Not working outside the home
		2	Working outside the home for pay or profit
v161_rel	Religion	1	Catholic
		2	Non-Catholic
v172_mst	Marital status	1	Married
		2	Marriage disrupted
		3	Single
v173_mst	Type of marriage		
		1	Monogamous
		2	Polygamous
		3	Single
v231_con	Ever used contraception	1	No
		2	Yes
v232_con	Currently using contraception	1	No
		2	Yes